UNIVERSITY OF CALGARY

Problem Gambling Risk Factors in Internet and Non-Internet Gamblers

by

Terri-Lynn MacKay

A THESIS

SUBMITTED TO THE FACULTY OF GRADUATE STUDIES

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE

DEGREE OF DOCTOR OF PHILOSOPHY

PROGRAM OF CLINICAL PSYCHOLOGY

CALGARY, ALBERTA

SEPTEMBER, 2012

© Terri-Lynn MacKay 2012
Abstract

The purpose of this research was to explore differences between online and land-based gamblers to determine whether differences in problem gambling risk factors could account for the higher rates of pathological gambling observed in online gamblers. The primary focus of study 1 was to investigate factors known to be associated with problem gambling severity to determine whether these variables are associated with Internet gambling. An additional focus was to investigate whether online gamblers initiate and maintain their gambling through the Internet or whether they are land-based gamblers seeking a new forum. Three hundred and seventy four undergraduates completed an online questionnaire looking at demographic, cognitive, psychological, dispositional and medium related factors. The results of a logistic regression analysis revealed that online gamblers were less likely to be Caucasian, were more likely to engage in range of gambling activities and have more gambling-related cognitive distortions. The results of a hierarchical multiple regression analysis showed that frequency of play and distorted gambling cognitions were independent predictors of problem gambling severity among Internet gamblers. The majority of online gamblers also wagered in land-based formats, with less than 3% reporting that their first gambling experience occurred online. The purpose of study 2 was to investigate the role of cognitions to determine whether online gamblers were distorting aspects of play. Two hundred and seventy eight poker players completed 75 hands of Texas Hold’em against an automated computer opponent. The results of study 2 revealed that Internet gamblers perceived themselves to be more skilled and exhibited higher levels of gambling-related cognitive distortions when compared to non-Internet gamblers, despite showing no superiority in actual ability. Based on the findings, consideration should be given to the influence of the Internet on heavily involved gamblers. This study has implications for understanding how
the Internet influences gambling behaviour in order to effectively create appropriate prevention and treatment initiatives. This study also has implications for substantiating a psychosocial approach to online gambling to inform public policy decisions in the future.
Acknowledgements

Foremost, I would like to acknowledge the support of my research supervisor Dr. David Hodgins. His guidance and encouragement have consistently facilitated navigating the obstacles to completing this dissertation. David’s passion and commitment towards mentoring students has substantially contributed to a positive graduate school experience.

I would like to thank Dr. Tavis Campbell and Dr. Shawn Currie from the Department of Psychology for their input throughout the process of completing this research. Their feedback was an important component in advancing my ideas. I also appreciate the involvement of external committee members, Dr. Cynthia Beck and Dr. Jeremiah Weinstock who provided feedback on the final draft.

Finally, I would like to acknowledge the financial support of the Social Sciences and Humanities Research Council of Canada, the Alberta Gaming Research Institute and the Alberta Heritage Foundation for Medical Research. Additional funding was provided by a research grant from the Alberta Gaming Research Institute. The assistance provided by these agencies is very much appreciated.
Dedication

For my dad, who would have enjoyed a nap while reading this, but whose unconditional love and vicarious impartation of curiosity, empathy and acceptance provided the foundation for becoming a psychologist.

For my grandmother, who was perfectly content to have a 30-year-old graduate student living in her basement.
Table of Contents

Abstract .......................................................................................................................... ii
Acknowledgments ........................................................................................................ iv
Dedication ....................................................................................................................... v
Table of Contents .......................................................................................................... vi
List of Tables ................................................................................................................ viii
List of Figures ............................................................................................................... ix
List of Abbreviations .................................................................................................... x
Introduction ................................................................................................................... 1
  Gambling on the Internet ............................................................................................. 3
  Gambling Expansion and Problem Gambling ............................................................. 5
  Problem Gambling Risk Factors ................................................................................ 6
  Risk Factors and Internet Gambling ......................................................................... 8
    Risk Factors Associated with the Medium ............................................................... 9
    Comorbid Risk Factors ........................................................................................... 12
    Cognitive Risk Factors ........................................................................................... 14
Study 1 ............................................................................................................................ 17
  Objective 1 .................................................................................................................. 17
  Objective 2 .................................................................................................................. 18
Method ............................................................................................................................ 19
  Participants .................................................................................................................. 19
  Procedure and Measures ......................................................................................... 20
    Table 1: Instruments Measuring Risk Factors in the Questionnaire ...................... 22
Data Manipulation ......................................................................................................... 26
Data Analysis ............................................................................................................... 27
Results ............................................................................................................................ 28
  Univariate Analysis of Variables Contributing to Online Gambling ....................... 28
    Table 2: Mean Scores (SD) for Internet and non-Internet Gamblers on Risk Factors for Problem Gambling ................................................................. 30
  Logistic Regression Analysis to Predict Online Gambling ........................................ 31
    Table 3: Logistic Regression Analysis for Predicting Internet Gamblers from non-Internet Gamblers .......................................................... 32
  Multiple Regression Analysis to Predict Problem Gambling Severity .................... 33
    Table 4: Hierarchical Multiple Regression Analysis for Variables Predicting Problem Gambling Severity Among Internet Gamblers .................. 34
Post-Hoc Analysis ......................................................................................................... 35
  Table 5: Multiple Regression Analysis for Variables Predicting Problem Gambling Severity Among Gamblers ............................................................. 37
Figure 1. Interaction Effect of Internet Gambling on the Relationship Between Expenditures and Problem Gambling .................................................. 39
Figure 2. Interaction Effect of Internet Gambling on the Relationship Between Gambling Fallacies and Problem Gambling ............................................. 40
Online Gambling Initiation .......................................................................................... 40
Discussion ...................................................................................................................... 41
Study 2 ............................................................................................................................ 49
Why Poker? .................................................................................................................... 50
Method .................................................................................................................54
Procedure .............................................................................................................54
Computer Poker Program .....................................................................................56
Excluded Participants and Data Manipulation .....................................................58
Data Analysis ........................................................................................................59
Validity of Empirical Skill .....................................................................................60
Results ..................................................................................................................60
Table 6: Mean Scores (SD) for Internet and non-Internet Gamblers on Measures of
Empirical Skill, Perceived Skill and Cognitive Distortions ...............................63
Logistic Regression Analysis to Predict Online Poker Play ...............................63
   Table 7: Logistic Regression Analysis for Predicting Internet Poker Players from non-
Internet Poker Players .......................................................................................65
Empirical Skill vs. Perceived Skill among Internet Gamblers ............................65
   Table 8: Multiple Regression Analysis for Variables Predicting Empirical Skill ....67
   Table 9: Multiple Regression Analysis for Variables Predicting Perceived Skill ....68
Post-Hoc Analysis ..................................................................................................68
   Table 10: Hierarchical Multiple Regression Analysis for Variables Predicting Problem
Gambling Severity Among Poker Players ..........................................................70
Discussion .............................................................................................................71
General Discussion ...............................................................................................76
   Limitations ..........................................................................................................80
   Implications .........................................................................................................81
References .............................................................................................................84
Appendix A: Consent form study 1 .....................................................................99
Appendix B: Demographics .................................................................................101
Appendix C: Problem Gambling Severity Index .................................................104
Appendix D: Gamblers’ Beliefs Questionnaire ....................................................106
Appendix E: Gambling Fallacies Scale .................................................................110
Appendix F: Alcohol Use Disorders Identification Test .......................................112
Appendix G: Drug Abuse Screening Test .............................................................114
Appendix H: Liebowitz Social Anxiety Scale .......................................................115
Appendix I: Barratt Impulsiveness Scale .............................................................117
Appendix J: Debriefing form study 1 ...................................................................118
Appendix K: Post poker play questions .................................................................119
Appendix L: Gambling Cognitions Inventory .......................................................121
Appendix M: Consent form study 2 .....................................................................123
Appendix N: Debriefing form study 2 .................................................................126
Appendix O: Intercorrelations between variables in study 2 ...............................127
List of Tables

TABLE 1. Instruments Measuring Risk Factors in the Questionnaire
TABLE 2. Mean Scores (SD) for Internet and non-Internet Gamblers on Risk Factors for Problem Gambling
TABLE 3. Logistic Regression Analysis for Predicting Internet Gamblers from non-Internet Gamblers
TABLE 4. Hierarchical Multiple Regression Analysis for Variables Predicting Problem Gambling Severity Among Internet Gamblers
TABLE 5. Multiple Regression Analysis for Variables Predicting Problem Gambling Severity Among Gamblers
TABLE 6. Mean Scores (SD) for Internet and non-Internet gamblers on measures of empirical skill, perceived skill and cognitive distortions
TABLE 7. Logistic Regression Analysis for Predicting Internet Poker Players from non-Internet Poker Players
TABLE 8. Multiple Regression Analysis for Variables Predicting Empirical Skill
TABLE 9. Multiple Regression Analysis for Variables Predicting Perceived Skill
TABLE 10. Hierarchical Multiple Regression Analysis for Variables Predicting Problem Gambling Severity Among Poker Players
List of Figures

Figure 1. Interaction Effect of Internet Gambling on the Relationship Between Expenditures and Problem Gambling

Figure 2. Interaction Effect of Internet Gambling on the Relationship Between Gambling Fallacies and Problem Gambling
List of Abbreviations

VLT- Video Lottery Terminal
EGM- Electronic Gaming Machine
SOGS- South Oaks Gambling Screen
CPGI- Canadian Problem Gambling Index
PGSI- Problem Gambling Severity Index
GBQ- Gamblers’ Beliefs Questionnaire
GFS- Gambling Fallacies Scale
AUDIT- Alcohol Use Disorders Identification Test
DAST- Drug Abuse Screening Test
LSAS- Liebowitz Social Anxiety Scale
BIS- Barratt Impulsiveness Scale
BDI- Beck’s Depression Inventory
GCI- Gambling Cognitions Inventory
CPRG- Computer Poker Research Group
Problem Gambling Risk Factors in Internet and Non-Internet Gamblers

Over the past 20 years, gambling availability has increased dramatically and the level of commercial global growth is qualitatively different from what has been seen in the past. Like many countries, Canada has witnessed the expansion of gambling into new formats such as video lottery terminals (VLTs) and electronic slot machines. The omnipresence of contemporary legalized gambling is being influenced by technology and the most recent advancement is for gamblers to access games via the Internet. As gambling technologies change and evolve it is incumbent upon us as researchers to examine the potential consequences of new forms of gambling on society.

Empirical studies into the sequelae of Internet gambling have not been able to advance with the same accelerated pace as the industry but one finding that has been consistently replicated is that online gamblers are more likely to report disordered gambling behaviour (Griffiths & Barnes, 2008; Griffiths, Parke, Wood, & Rigby, 2009; Griffiths, Wardle, Orford, Sproston, & Erens, 2009; Ladd & Petry, 2002; McBride & Derevensky, 2009; Petry, 2006; Petry & Weinstock, 2007a; Wood & Williams, 2007a, Wood & Williams, 2009). A primary concern is that the Internet as a conduit for gambling is a causal factor in players developing problems. While this may be valid, evidence to support such assertions is lacking. Our current understanding of online gambling primarily comes from general population prevalence studies or from samples of Internet users recruited from gambling sites. In a recent review into the literature on Internet gambling, Shaffer, Peller, LaPlante, Nelson, and LaBrie (2010) identified that there were a mere nine published articles that employed empirical testing to research online gambling. The authors argued that there is a substantial need for empirical scientific research in the area.
The theoretical perspective taken mediates the degree to which contemporary gambling formats are thought to influence behaviour. Over the years numerous theories have been developed to explain the acquisition and maintenance of gambling. Some of these theories focus on gambling from a sociological standpoint and assert that it is increased accessibility and availability of opportunities that causes or perpetuates problems (Korn & Shaffer, 1999). Other theories suggest that psychological, biological or personality factors contribute more of an influence than environmental contingencies (Blaszczynski & Nower, 2002). It is generally acknowledged that gambling problems do not arise because of a unitary causal influence and recent etiological theories acknowledge multifarious contributors.

Research has shown that there are specific demographic, psychological (personality characteristics and comorbid conditions), physiological and cognitive risk factors for pathological gambling. In order to determine what influence the Internet has on gambling behaviour, we must also consider that online gamblers may differ from land-based gamblers on pathological gambling risk factors. It may be the case that problem gambling rates are higher among Internet gamblers because they differ in significant ways from individuals who would opt to gamble in land-based establishments. For example, based on prevalence research, we know that online gamblers are more likely to have certain demographic characteristics (e.g., being male and younger) that have been identified as general risk factors (Griffiths & Barnes, 2008; Griffiths, Wardle, et al., 2009; Petry, 2006; Wood & Williams, 2009). To date, few studies have been conducted to determine how Internet gamblers differ from land-based gamblers on various other problem gambling risk factors. Therefore, the overall purpose of this research project was to investigate differences
in risk factors between gamblers that wager money on the Internet and those that solely gamble in land-based establishments.

Gambling on the Internet

The first Internet gambling sites opened in 1995 and with 18 casino games, Internet Casinos Inc. began what is now a flourishing enterprise. The advent of online gambling software coupled with the development of encrypted communication protocols for online money transfers meant that gambling was expanding into a new foray. According to Christiansen Capital Advisors (CCA), in 2005 online gambling revenue worldwide was approximately $12 billion (US), with 23 million people gambling on the Internet. From 2002 to 2003, the CCA Gross Annual Wager reported a 42% increase in consumer spending for online gambling in the United States; more than double that of any other form of gambling activity (CCA, 2005). The current value of the Internet gambling sector is $29.95 billion (US), with 2,400 Internet gambling sites owned by 650 different operators (H2 Gambling Capital, 2011). Canadian citizens can bet on (in approximate order of descending popularity) online casinos, poker rooms, sports books, bingo, skill games, lotteries, betting exchanges and backgammon.

Countries throughout the world have taken very disparate stances when it comes to Internet gambling. Some countries have opted for a primary stance of legalization (e.g., Antigua, Gibraltar), prohibition (e.g., United States, Greece), and others have less definitive guidelines such as restricting access to residents (e.g., Finland) or non-residents (e.g., Australia). Some countries permit certain forms of gambling (e.g., lotteries, pari-mutual betting) and restrict such activities as online poker and casino games (for a complete
overview of jurisdictional regulatory frameworks see Williams & Wood, 2007a). Unlike many countries, Canada has a unique policy organization where gambling is under the jurisdiction of the individual provincial and territorial governments. Essentially this means that provinces can provide gambling opportunities to their residents. There are certain exceptions such as pari-mutual betting, which falls under the jurisdiction of the federal government and is regulated by the The Canadian Pari-Mutual Agency, a division of Agriculture and Agri-Food Canada. Currently British Columbia provides government run online casinos and poker rooms, and Ontario plans to legalize online casino gambling for its residents in 2012. Of particular interest and debate is the legality of Aboriginal groups to license online casinos. The Kahnawake Gaming Commission operating out of Quebec currently licences 177 sites. The Kahnawakes, like many other Aboriginal groups in Canada, claim the status of a sovereign nation and thus, arguably, have the right to deviate from Canadian law under self-government.

When general population surveys started to include Internet gambling as a variable of interest, participation rates were low at 0.5%, 1% and 4% in Canada, the UK and US respectively (American Gaming Association, 2006; Azmier, 2000; Griffiths, 2001). In a national Canadian survey the rates were found to be between 2.1% and 3.5% (higher rate includes stocks and day trading; Williams & Wood, 2007a). In Great Britain where data has been collected quarterly, the online participation rate was 10.5% in 2010 (Gambling Commission, 2010) and the prevalence rate of past year adult online gambling in the most recent British national survey was 14% (Wardle, 2011). Studies of specific populations have shown higher rates than general population samples. For guests entering a US casino, the rate was found to be 37% (Woodruff & Gregory, 2005). In an undergraduate US
sample, the rate of online gambling was 23% (Petry & Weinstock, 2007a) and for an undergraduate sample from the UK it was 22% (Griffiths & Barnes, 2008).

**Gambling Expansion and Problem Gambling**

Increased expenditures at the population and individual level are fairly well established as a product of the introduction of new gambling opportunities (for an overview see Abbott, 2007). Conclusions are more complex when it comes to the relationship between gambling availability and problem gambling. Some researchers assert that the prevalence of pathological gambling increases with the addition of legalized gambling formats. A study conducted with Quebec residents examined gambling patterns both before and after the legalization of VLTs and the introduction of three new casinos. In the 7-year replication design, the researchers found that significantly more people reported gambling and the number of pathological gamblers increased by 75%. The gamblers appreciably increased the amount of money they lost in a day (from $108 to $360; Ladouceur, Jacques, Ferland, & Giroux, 1999). Others argue that the relationship is not direct and point to vulnerability factors as determinants (Hodgins, 2005) or contend that despite initial increases in problem gambling rates, individuals will habituate or adapt to the novelty of additional forms over time (Shaffer, LaBrie, & LaPlante, 2004).

Despite the lack of a definitive causal link between gambling availability and problem gambling, there exists evidence that Internet gambling potentiates risk. In an early empirical study, Ladd and Petry (2002) found that, in sample of university-based medical and dental clinic patients who had gambled online, 74% were a level 2 (3 or 4 out of 20) or level 3 (5 or more out of 20) on the South Oaks Gambling Screen (SOGS). Similarly, Petry
(2006) found that 70% of regular Internet gamblers were probable pathological gamblers. Among undergraduate students, Petry and Weinstock (2007a) found that 62% of regular (weekly) online gamblers were pathological gamblers and Griffiths and Barnes (2008) found that 77% of problem gamblers in their university-based sample had gambled online. Wood and Williams (2007a) found that in a sample of 1,920 online gamblers, 23% had moderate problems on the Canadian Problem Gambling Index (CPGI) and 20% were classified as problem gamblers. Given these results, the researchers suggested that problem gambling rates among Internet gamblers could be 10 times higher than general population rates. They also suggested that future research examine characteristic differences between online and land-based gamblers.

**Problem Gambling Risk Factors**

Researchers have investigated many different factors that could potentially contribute to the development of gambling problems. These include demographic factors (e.g., age, sex, minority status, education, socioeconomic status, marital status), medium factors (e.g., availability, accessibility, exposure, sensory characteristics), cognitive factors (e.g., illusion of control, attributional bias, gambler’s fallacy), personality factors (e.g., sensation seeking, impulsivity, arousal), physiological/biological factors (e.g., genetics, heart rate and arousal, transmitter activity), and comorbid disorders (e.g., substance use, mood disorders, anxiety disorders). Making sense of the considerable amount and variety of different risk factors is a difficult task. Over the years, a number of literature reviews have been conducted to compile evidence for various risk factor categories. For example, Raylu and Oei (2002) reviewed a variety of familial/genetic, sociological and individual factors (e.g., personality, sensations-seeking, impulsivity). Toneatto and Nguyen (2007)
reviewed the research specific to demographic variables, personality factors and cognitive variables. Petry and Weinstock (2007b) reviewed research looking at substance use, mood disorders and anxiety disorders. Other examples include reviews and meta-analytic studies specific to genetic factors (Walters, 2001), substance misuse (Spunt, Dupont, Lesieur, Liberty, & Hunt, 1998) or risk factors for certain demographic groups such as adolescents (Shaffer & Hall, 1996) or aboriginal peoples (Wardman, el-Guebaly, & Hodgins, 2001). In many of the aforementioned studies conclusions were not drawn or they were made speculatively, cautioning readers to acknowledge the many confounds in the research. Even with narrowly focused reviews, decisions about what constitutes risk factors can be problematic because results have been inconsistent, studies are often carried out with specific populations (e.g., adolescents) or convenience samples and many of the variables are interrelated; thus teasing out specific influences is not possible.

Recently researchers conducted a review of empirical evidence to try to elucidate factors that had the most support for involvement in problem gambling development (Johansson, Grant, Kim, Odlaug, & Gotestam, 2009). The reviewers included original research in international journals with a specific sample size, explicit instrument, and detailed design and statistical analysis that produced conclusive results. The following were identified as well-established risk factors for pathological gambling: age, gender, illusion of control, greater availability of play, higher schedules of reinforcement, enhanced sensory characteristics, obsessive compulsive disorder, alcohol use, drug abuse and a history of delinquency/illegal acts. A confound with the meta-analytic review was that despite the stated criteria for inclusion, the decision to include certain risk factors as well-established seemed to be predicated on very limited empirical evidence or based solely in theory.
Although there is no universal agreement about the best predictors of problem gambling, there are certain risk factors that show strong evidence of association based on consistent findings. There has been evidence from a variety of researchers in different countries that have demonstrated that males and younger individuals are more likely to be problem gamblers. The range of cognitive domains tested with gamblers has been diverse but the majority of studies show that problem gamblers exhibit a higher level of distorted thinking. A relationship between substance, drug use and problem gambling is fairly well established and rates of depression and anxiety are generally higher among problem gamblers. Empirical evidence for the aforementioned risk factors and the theoretical association to Internet gambling is presented below.

Risk Factors and Internet Gambling

Research into Internet gambling is still in its infancy and the next logical step is to investigate the ecological, psychological, dispositional and cognitive factors that may be influencing problems. Beginning to isolate the reasons why Internet gamblers have higher rates of problems necessitates considering the complex multifactorial nature of a wide variety of potential influences. The following section outlines risk factors associated with a.) the medium b.) comorbid mental health conditions and c.) cognitive variables associated with problem gambling. Within each section a theoretical basis is provided for why these factors might be related to Internet gambling.

Risk Factors Associated with the Medium

From a behavioural perspective, recreational and problem gambling work under the principles of operant and classical conditioning. In operant conditioning, reinforcement is
an important component of the learning processes and the schedule of reinforcement (when and how often behaviour is reinforced) can dramatically impact the strength and rate of the response. In gambling, behaviour is reinforced on a variable-ratio schedule whereby the reinforcer is delivered after an unpredictable number of responses. Classical conditioning is thought to explain the maintenance of behaviour when people persist in gambling. Conditioning occurs in response to the excitement, environment, cognitions and autonomic arousal associated with gambling. Avoiding aversive stimuli such as negative emotional states and life circumstances compound the potential for reinforcement.

Factors associated with electronic gaming machines (EGMs) and online gambling could explain why these formats generally result in higher levels of problem gambling. With these types of gambling there is a brief interval between wager and outcome, unlike games such as lotteries where the stake and reward are farther in temporal propinquity. Internet gambling in particular has a number of features that could make it more reinforcing from a behavioural perspective. The degree to which players can maximize the duration and frequency of play compounded by the greater potential for early wins and escape could serve to increase the reinforcing properties. Griffiths and colleagues have identified several factors that would provide additional reinforcement to draw players into this medium (for a complete summary see Griffiths, 2003; Smeaton & Griffiths, 2004; Griffiths, Parke, Wood, & Parke, 2006):

**Accessibility.** Gamblers have access 365 days a year, 24 hours a day.

**Convenience.** Staying at home gives players easy, comfortable access, particularly for individuals who do not enjoy the atmosphere of casinos or bars.
Event frequency. It has been shown that slot machines on some Internet sites spin faster than the industry standard for land-based slots. Moreover, a gambler may access many sites at once and play multiple games simultaneously.

Affordability. Given the low overhead expenditures needed to run an online casino, coupled with the lack of corporate and gambling taxes, online casinos can offer higher payout rates than their land-based counterparts.

Money value. Just as chips in a casino decrease the apparent value of money, electronic cash and other forms of payments to online gambling could increase a player’s tendency to spend money. Many unregulated sites do not prominently display the actual monetary value of wagers and the illusion of simulation can be compounded by bonuses, “free money” and promotions.

Anonymity. One of the major concerns put forth by the American Psychological Association’s Advisory Committee on Internet Gambling was the potential for exacerbation of gambling problems due to the solitary nature of Internet gambling (American Psychological Association, 2001).

Many of the initial concerns specific to the reasons why individuals would be attracted to online gambling and the potential risk factors associated with the medium have been validated. Research indicates that many of the above mentioned factors are indeed what attract players to gamble online. Researchers found that the primary reasons individuals reported for preferring online gambling over land-based gambling were because of the convenience, ease, comfort, accessibility and privacy (Wood, Williams, & Lawton, 2007). When the responses were thematically categorized, the overall reasons for
preference were: (a) convenience, ease and comfort, (b) aversion to land-based establishments, (c) the pace, control and overall experience of the online format and (d) the perception of less expenditures. In a study conducted by the American Gaming Association (AGA, 2006) the main reasons reported for gambling online were convenience, entertainment, comfort, accessibility, monetary incentive, anonymity and privacy. In a large-scale study looking at over 10,000 Internet gamblers in 96 countries, motives of play were examined by gender. The researchers found that men reported playing more for financial reasons and excitement while women reported social and avoidance reasons as prime motivating factors (e-Commerce Online Gambling Regulation and Assurance [eCOGRA], 2007b).

These studies have contributed to our understanding about why individuals would choose to gamble online but do not provide information about whether the medium contributes to problem gambling behaviour. For example, individuals may report a preference for online gambling because of properties such as convenience and accessibility, but does that translate into a higher play frequency? Griffiths and Barnes (2008) found that online gamblers were more likely have a higher frequency of play and spend more money gambling when compared to non-Internet gamblers. The results of this study indicate that the Internet may contribute to perpetuating gambling problems but the study did not account for a variety of individual factors that could also be influencing the observed difference.

Comorbid Risk Factors
Shaffer and colleagues have argued that the Internet is not inherently addictive, contending that it is the interplay of the individual with the activity that determines level of involvement (Shaffer, 1996; Shaffer, Hall, & Vander Bilt, 2000). A large body of empirical research has been conducted on identifying risk and resiliency factors that influence gambling behaviour at the individual level. Researchers have established that gambling problems rarely present in isolation and frequently co-occur a variety of comorbid mental health disorders (for an overview see Petry & Weinstock, 2007b). Gambling problems have been associated with alcohol dependence (Welte, Barnes, Wieczorek, Tidwell, & Parker, 2001), nicotine dependence (Potenza et al., 2004) and drug-use (Toneatto, Skinner, & Dragonetti, 2002). Petry, Stinson, and Grant (2005) found that among a sample of pathological gamblers, 73% had an alcohol use disorder, 38% had a drug use disorder and 60% were nicotine dependent. In addition, they found rates of depression, dysthymia, anxiety and bipolar disorder to be significantly higher among pathological gamblers.

Impulsivity and attention deficit features have also been shown to be elevated in problem gamblers. For example, Alessi and Petry (2003) found that pathological gamblers were more likely to choose an immediate smaller reward than wait for a larger, delayed reward. Scores on the SOGS predicted impulsive decisions better than the Eysenck Impulsivity Scale. Problem gamblers have been shown to score higher on measures of Attention Deficit Hyperactivity Disorder (Littman-Sharp & Jain, 2000) and on measures of novelty seeking and harm avoidance (Nordin & Nylander, 2007). Gamblers who have a history of Attention Deficit Disorder show differential patterns of activity in electrophysiological studies (Carlton et al., 1987) and perform worse than controls on measures of executive function (Rugle & Melamed, 1993).
Only a handful of studies have examined psychological variables that may be associated with online gambling. Petry (2006) collected gambling information on patients in the waiting areas of medical and dental clinics. Internet gambling was a significant predictor of lower scores on mental and physical health measures, even after controlling for age, gender and pathological gambling status. Similarly, in a college sample of undergraduates, the frequency of Internet gambling was a significant predictor of lower scores on mental and physical health measures when controlling for demographics and pathological gambling (Petry & Weinstock, 2007a). Griffiths, Wardle, et al. (2009) found that drinking at least twice the recommended amount in one day was a significant predictor of Internet gambling. Wood and Williams (2009) found a number of variables that predicted Internet problem gambling including: gambling on more formats, higher expenditures, mental health problems, a family history of gambling, Asian ancestry, marital status (never married), lower income, greater number of fallacies, negative gambling attitudes and having a history of addiction. Internet gamblers who engaged in multiple online activities have been shown to endorse problematic gambling behaviour (DSM-IV criteria) and have a history of mood disturbance, self-harm and substance misuse (Lloyd et al., 2010). Hopley and Nicki (2010) examined factors contributing to problem gambling severity in an online poker playing sample and found that hours played per week, dissociation, boredom proneness, impulsivity and negative emotions were significant factors, accounting for 43% of the variance in severity. Their sample consisted of players recruited through discussion forums where the players used poker as a source of employment. The authors acknowledged that the sample restricts the generalizability of the findings.
Comorbid or concurrent risk factors for problem gambling could theoretically be related to Internet gambling. For example, it may be the case that online gamblers are more likely to misuse alcohol because of an inhibitory effect while gambling alone. Conversely, online gamblers may be less likely to consume alcohol because they are not being served promotional beverages in a casino. It may be the case that Internet gamblers are more socially anxious and prefer the solitary nature of play offered through an online medium. Similarly, Internet gambling could be associated with general gambling risk factors such as depression, impulsivity or drug use.

Cognitive Risk Factors

The observation that some players retain an obvious disregard for the house advantage indicates that there may be erroneous and false beliefs that serve to preserve an irrational sense of control over gambling situations. Studies have repeatedly shown that people perceive that they can influence outcomes over which they demonstrably have no control. For example, in a series of studies initiated in the 1960’s researchers investigated cognitive bias by having participants press a button that would light up a “score” or “no score” button. The researchers controlled the probability of light illumination and the degree to which the participant could influence the outcome. Findings demonstrated that the degree of perceived control participants believed to have over the outcome was related to the frequency with which the “score” light was activated and not to the actual level of control imparted by the researchers (Allan & Jenkins, 1980).

The types of cognitive beliefs that may exert an influence when people are gambling have been categorized according to: perceived skill, superstitions or ability to
control outcomes, selective recall, flawed perceptions of randomness and attributional
distortions (Blaszczynski & Nower, 2007; Hodgins & Holub, 2007). Research has shown
that irrational statements in the external dialogue of gamblers are independent of actual
wins and losses (Ladouceur, Gaboury, Dumont, & Rochette, 1988). This finding has been
replicated with a variety of games, in the laboratory and in vivo, with gamblers and non-
gamblers and across various countries. There is evidence to show that there is a relationship
between problem gambling and distorted gambling cognitions. Research has consistently
demonstrated that problem gamblers have higher levels of distortion, with up to 80% of the
vocalizations given during play containing erroneous beliefs (for a summary of research see
Blaszczynski & Nower, 2007). When looking at a variety of gambling-related cognitive
heuristics, researchers have found that pathological gamblers have a higher percentage of
verbalizations related to luck and skill when compared to recreational gamblers
(Baboushkin, Hardoon, Derevensky, & Gupta, 2001). In a recent study, Miller and Currie
(2008) amalgamated five large-scale Canadian provincial prevalence studies and found
there was a positive relationship between irrational cognitions and risky gambling
practices. Lower endorsement of irrational cognitions moderated the relationship between
risky gambling practices and both tolerance and intensity of gambling behaviour.

The notion of perceived control becomes further compounded when an element of
skill is thought to be involved in decision making. When it comes to bingo or lotteries most
individuals would contend that the outcome is based purely on chance with little influence
of ability. When games contain an element of perceived skill, the propensity for illusory
control increases. In a series of seminal studies, Langer (1975) implemented a number of
experimental variants to test the distinction between skill and luck in the confidence in
winning on two random events, where one contained an element of perceived control over the outcome. The researchers tested whether choice, familiarity, active vs. passive involvement and competition would influence the level of perceived control over the outcome. For example, in one study participants were either given or not given their choice of the lottery ticket numbers. In every situation, aspects of skill introduced into chance situations led to higher levels of confidence in the participant’s decisions. People are more willing to bet on events where skill is thought to be involved (Goodie, 2003) and pathological and problem gamblers are more confident in their decisions than non-problem gamblers when skill is thought to be a factor (Goodie, 2005).

There are many aspects of online gambling that add elements of perceived skill. As with EGMs, Internet interfaces are often designed to mimic real-life games where there is a legitimate skill component. In addition, many individuals have played interactive video games, and thus may have a false perception of control when gambling on the Internet that may be enhanced by familiarity with the medium. Demonstration sites are another aspect that provides players with a false perception of skill. Many sites offer the individual the opportunity to learn and practice games prior to wagering money. Demonstration modes can offer higher odds than the actual games (sometimes over 100%) giving players a false perception of being overly adept at playing (Sévigny, Cloutier, Pelletier, & Ladouceur, 2005).
Study 1

Objective 1

No study to date has aimed to differentiate the relative contribution of individual vs. medium-related variables contributing to online gambling and online problem gambling. Therefore, the purpose of this study was to explore differences between Internet and non-Internet gamblers to determine whether differences in known problem gambling risk factors (as outlined above) can account for the higher rates of pathological gambling observed in online gamblers. The primary focus was to investigate a number of demographic, cognitive, psychological, dispositional and medium related factors to determine (a) whether certain risk factors differentially help predict Internet gambling and (b) what factors contribute to problem gambling severity among Internet gamblers. Given the large number of risk factors it would have been overwhelming to attempt to include all possible factors. Decisions for inclusion in this study were based on four aspects of the variables: (a) the theoretical relevance to Internet gambling, (b) strong evidence of an association with problem gambling based on findings in past research (c) preliminary research with Internet gamblers and (d) practicality (e.g., drawing blood from participants was not feasible).

An undergraduate sample was chosen for study because of the higher prevalence rates of Internet gambling reported among college and university students (Griffiths & Barnes, 2008; Petry & Weinstock, 2007a). The convenience sample allowed for a number of variables to be studied simultaneously because the sample size included a sufficient number of online gamblers. In addition, undergraduate students tend to be younger and more familiar with computer technology. It was of interest to sample a population where a
significant proportion of respondents had the option of Internet gambling as soon as they reached the legal gambling age (18 years in Canada).

Based on previous research, it was expected that online gamblers would be more likely to be problem gamblers. It was hypothesised that both individual factors and factors associated with the medium would differentiate online gamblers from those that only gamble in land-based establishments. Notwithstanding the combined influence, it was expected that specific characteristics of the individual who would choose to gamble online would contribute to problem gambling severity above and beyond variables associated with the play medium.

**Objective 2**

The second objective was to determine whether online gamblers are primarily land-based gamblers that also gamble on the Internet or whether they are a distinct subset of individuals. The answer to this question is of interest from a number of perspectives. From a sociological and public health point of view it is important to know whether the Internet is attracting a different group of gamblers so governments can provide the same safeguards afforded to land-based gamblers (e.g., Responsible Gambling Centres). If, on the other hand, the Internet is drawing gamblers away from land-based establishments, then the government may lose a portion of the profits generated from casinos and video lottery terminals; profits that are already allocated to a variety of social programs. From a psychological perspective it is important to understand the pathway to online gambling because it is unclear at this point whether established prevention and treatment initiatives are as effective with this population.
As detailed above, a few studies have investigated why individuals would choose to gamble online (AGA, 2006; eCOGRA, 2007b; Wood, Williams, & Lawton, 2007). Wood et al. (2007) found that males and people who regularly played slots or VLTs (as opposed to other gambling forms) were more likely to prefer online gambling. Disabled individuals and problem gamblers were less likely to prefer Internet gambling. This finding begs the question of whether problem gamblers will primarily engage in online gambling when land-based venues are unavailable. In these studies, players reported that it was the unique attributes of the online environment that were the allure such as convenience, ease, and a distaste for the atmosphere of land-based establishments. It would appear from these findings that online gambling could offer a different experience that could attract a distinct market.

If Internet sites are drawing individuals who would not otherwise gamble, this poses concerns about potential deleterious effects for a new subset of gamblers. Internet gambling may attract individuals who may not otherwise venture into a bar, casino or organized poker tournament. One of the consequences of EGMs and the Internet is that the social component of playing games, such as when playing bingo or table poker, has diminished. Internet gambling, and the Internet in general, allow for greater access for a wide range of individuals but arguably decrease the degree of interpersonal interaction.

**Method**

**Participants**

Three hundred and seventy four participants (143 online gamblers, 172 males) were recruited from the University of Calgary Research Participation System (RPS). The sample
size exceeded the recommended rule of thumb for stepwise logistic regression of at least 10 cases per independent variable (Harrell, Lee, Califf, Pryor, & Rosati, 1984) and the recommended sample size for multiple regression based on Halinski and Feldt (1970). The mean age of participants was 21 years old (range = 18-52; SD = 4.0) with an average of three years of post-secondary education. The sample included students from 11 different faculties. Respondents had to speak English, be at least 18 years of age and have gambled at least once in the past month to participate. Internet gamblers (defined as betting money online at least once in the past month) were over sampled to yield similar cell sample sizes for the logistic regression analysis.

Procedure and Measures

All gamblers were recruited in a similar manner by accessing them through the same portal, posting uniform recruitment messages and directing them to the same survey. Participants were recruited to participate in a study presented as “gambling among university students” or “online gambling among university students”. When participants signed up in the RPS they were given a link to Survey Monkey, an online tool for creating and administering surveys, and a password to access the survey. Once participants accessed the survey they were asked to provide an e-mail address that corresponded to the RPS system so they could receive course credit for participation. After reading the informed consent agreement (Appendix A), participants were required to click on “I consent to participate” to begin the study. It was decided that an online survey would be most advantageous for recruiting and testing a large number of participants to ensure a sufficient sample size for the number of variables. Research has shown that online surveys are
comparable in validity to traditional data collection methods (Gosling, Vazire, Srivastava, & John, 2004).

Each type of gambling activity was queried separately in accordance with Canadian prevalence studies. The response format queried participant’s involvement in each activity according to the CPGI on a scale from 0 = never to 8 = daily. Higher scores indicated more involvement. Types of gambling behaviour in land-based forms included: VLTs, slots, casino poker, casino games (e.g., blackjack, roulette), poker with friends, instant win, raffles, sports select, sports pools, bingo, games of skill (e.g., pool, darts), video games and board games. Types of gambling behaviour queried for online gambling included: casino games, poker against the machine, poker against other players, sportsbooks, bingo, skill games (e.g., solitaire, dominos, darts, suduko, treasure hunts), betting exchanges, backgammon and role-playing games (e.g., World of Warcraft, EverQuest). Information was gathered about demographics (Appendix B), gambling behaviour, problem gambling, cognitive distortions (luck/perseverance beliefs and the illusion of control), erroneous beliefs (awareness of and resistance to common gambling myths), and comorbid psychological factors. Table 1 provides a summary of the instruments used to test each variable. A brief description of each measure is included below and a copy of the measures in Table 1 can be found in Appendices C- I. The questionnaire took approximately 45 minutes to complete and participants were given one bonus course credit. A debriefing form (Appendix J) followed the survey.
### Table 1

*Instruments Measuring Risk Factors in the Questionnaire*

<table>
<thead>
<tr>
<th>Domain</th>
<th>Risk Factor</th>
<th>Instrument</th>
</tr>
</thead>
<tbody>
<tr>
<td>Demographic</td>
<td>Age</td>
<td>Canadian Problem Gambling Index</td>
</tr>
<tr>
<td></td>
<td>Gender</td>
<td>Canadian Problem Gambling Index</td>
</tr>
<tr>
<td></td>
<td>Ethnicity</td>
<td>Statistics Canada</td>
</tr>
<tr>
<td></td>
<td>Academic</td>
<td>Grade Point Average</td>
</tr>
<tr>
<td>Problem gambling</td>
<td>Level of severity</td>
<td>Problem Gambling Severity Index</td>
</tr>
<tr>
<td>Medium related</td>
<td>Frequency of play</td>
<td>Canadian Problem Gambling Index</td>
</tr>
<tr>
<td></td>
<td>Expenditures</td>
<td>Canadian Problem Gambling Index</td>
</tr>
<tr>
<td></td>
<td>Age of onset</td>
<td>Canadian Problem Gambling Index</td>
</tr>
<tr>
<td></td>
<td>Early win</td>
<td>Canadian Problem Gambling Index</td>
</tr>
<tr>
<td>Cognitive</td>
<td>Cognitive distortions</td>
<td>Gamblers’ Beliefs Questionnaire</td>
</tr>
<tr>
<td></td>
<td>Erroneous beliefs</td>
<td>Gambling Fallacies Scale</td>
</tr>
<tr>
<td>Comorbid mental health</td>
<td>Alcohol abuse</td>
<td>Alcohol Use Disorders Identification Test</td>
</tr>
<tr>
<td></td>
<td>Drug use</td>
<td>Drug Abuse Screening Test</td>
</tr>
<tr>
<td></td>
<td>Depression</td>
<td>Beck’s Depression Inventory</td>
</tr>
</tbody>
</table>
Anxiety  
Liebowitz Social Anxiety Scale

Impulsivity  
Barratt Impulsivity Scale

*The Canadian Problem Gambling Index (CPGI; Ferris & Wynne, 2001).* In accordance with past research conducted in Canada, sections of the CPGI were used to measure gambling involvement (type of activity, expenditures, duration of play, age of onset, early wins) and problem gambling. The Problem Gambling Severity Index (PGSI; Appendix C) is a nine-item instrument included in the CPGI designed to measure the severity of gambling problems. The PGSI asks participants to rate how much statements apply to them within the past 12 months on a 4-point scale (never, sometimes, most of the time, almost always). Scores on the PGSI are continuous and are used to classify gambling behaviour as non-problem (score of 0), low-risk (score of 1-2), moderate-risk (score of 3-7) or problem gambling (score of 8-27). The PGSI has a Cronbach’s alpha reliability coefficient of .84, an internal reliability of .72, and a 3-4 week test retest reliability of .78 (Ferris & Wynne). The PGSI was designed for use with non-clinical populations, is comparable to DSM measures (Abbott & Volberg, 2006), and useful for looking at gradations of severity.

*Gamblers' Beliefs Questionnaire (GBQ; Steenbergh, Meyers, May, & Whelan, 2002).* The GBQ (Appendix D) was designed as a self-report measure of gambling-related cognitive distortions. It consists of 21 questions rated on a 7-point Likert scale where respondents rate items from “strongly agree” to “strongly disagree”. Higher scores indicate more gambling related cognitive distortions. Test items were constructed based on existing
theory, empirical evidence and review by expert raters. The scale has an internal consistency of .92 and a 2-week test re-test reliability of .77 (Steenbergh et al.).

*The Gambling Fallacies Scale* (GFS; Williams, 2003). The GFS (Appendix E) is a 10-item scale measuring understanding of common gambling fallacies (e.g., "your chances of winning the lottery are better if you are able to choose your own numbers"). The GFS loads on two factors: a.) failing to understand the random and uncontrollable nature of many gambling activities and b.) not taking statistical probabilities into account. It has a 4-week test-re-test reliability of .70 and an internal consistency of 0.51 (Williams, 2007).

*The Alcohol Use Disorders Identification Test* (AUDIT). The AUDIT (Appendix F) is a ten-question screener for alcohol problems developed by the World Health Organization. Each question can yield a score from 0 to 4. A standard cut-off score of eight or more is suggestive of hazardous or harmful alcohol consumption and a score of 13 or more is indicative of alcohol related harm. The internal consistency has been shown to range from .75 to .94 (Allen, Litten, Fertig, & Babor, 1997) and the AUDIT has a 1-month test retest reliability in a general population sample of 0.84 (Selin, 2003).

*Drug Abuse Screening Test* (*DAST*-10; Skinner, 1982). The DAST-10 (Appendix G) provides an index of drug use and related problems. The purpose is to provide a brief but valid measure for identifying individuals who are abusing drugs and to provide a quantitative score indicating the degree of problematic consumption. The DAST was designed as a brief instrument for clinical and non-clinical screening. A review of the psychometric properties of the DAST demonstrated that it has moderate to high levels of validity, sensitivity, and specificity. The internal consistency for the DAST-10 has been
found to range from .86 to .94 (Yudko, Lozhkina, & Fouts, 2007) and the 2-week test re-test reliability has been shown to be 0.71 for a psychiatric patient population (Cocco & Carey, 1998).

**Beck Depression Inventory-Version 2 (BDI-II; Beck, Steer, & Brown, 1996).** The BDI (not included in an appendix for copyright reasons) is a self-report inventory for measuring severity of depression. The instrument is made up of 21 items relating to depression symptoms such as feelings of pessimism, guilt and physical symptoms such as fatigue. Each question is scored from 0-3 and an overall score of 21 or more is indicative of depression. The BDI-II has been shown to have a 1-week test re-test reliability of .93 and an internal consistency of .91 (Beck et al., 1996).

**Liebowitz Social Anxiety Scale (LSAS; Liebowitz, 1987).** The LSAS (Appendix H) was designed to assess a range of social and performance situations that may be problematic for individuals with social anxiety disorder. The scale is made up of 24 items; 13 concerning performance anxiety and 11 related to anxiety with social situations. For each question the respondent indicates the level of fear ascribed to each situation with 0 = no fear to 3 = severe fear. In addition, the respondent rates the frequency with which they avoid the situation with 0 = never and 3 = usually. The LSAS has been shown to have a 12-week test re-test reliability of .83 and an internal consistency of .95 (Baker, Heinrichs, Kim, & Hofmann, 2002).

**Barratt Impulsivity Scale Version 11 (BIS-11; Patton, Stanford, & Barratt, 1995).** The BIS-11 (Appendix I) is a widely used self-report measure of impulsive personality traits that has been validated on a variety of populations, including undergraduates. The
BIS-11 includes 30 items, which yield 6 first order (attention, motor impulsiveness, self-control, cognitive complexity, perseverance, and cognitive instability) and 3 second order factors (attentional, motor, and non-planning impulsiveness). The items are scored on a four point scale with 1 = rarely/never, 2 = occasionally, 3 = often and 4 = almost always/always. A total score is obtained by summing the first and second-order factors. The BIS-II has a 1-month test re-test reliability of .83 and an internal consistency of .83 (Stanford et al., 2009).

In order to address objective 2, questions were included to query the age at which individuals first engaged in the various types of gambling activities. When taken collectively, it can be determined whether their first gambling experiences occurred online or in land-based establishments. Questions were included to examine various other Internet activities that may contribute to initiating gambling online such as using the computer for work or entertainment purposes, video game play and online role-playing games. Participants were also asked whether they remembered having an early win (yes/no) while gambling.

Data Manipulation

Participants were removed if they completed the survey more than once (n = 5), did not complete at least 10% of the survey (i.e., only answered demographic information and did not answer any gambling-related questions; n = 10), or did not report any gambling behaviours (n = 11). When possible, scale scores were pro-rated when 10% or less of the responses were missing. The age variable had missing values so missing participant ages were estimated with a regression substitution. The expenditures variable had outliers in the
positive \((n = 7)\) and negative \((n = 1)\) direction so outliers above two standard deviations were replaced with the next highest value +1 or -1 (Tabachnick, & Fidell, 2007; Field, 2009). Outliers in the positive direction were removed for the number of computer hours participants spent for entertainment \((n = 2)\) and work-related purposes \((n = 4)\) and replaced with the highest value +1. The variable identifying the age an individual first gambled had a few obvious outliers under 10 years of age so these were removed and replaced with 10 years of age \((n = 5)\). Ethnicity was categorized for data analysis according to European \((55\%)\), Asian \((34\%)\) and a combined “other” category \((12\%)\).

**Data Analysis**

Analyses were completed with the PASW Statistics 17.0 (SPSS Inc., 2009). Given the range of possible variables for inclusion in a logistic regression analysis, initial univariate tests were conducted to identify significant variables for inclusion in a follow-up multivariate analysis. If a significant difference was found at the univariate level between Internet and non-Internet gamblers, the variable was included in a logistic regression analysis to predict Internet gambling.

To measure variables contributing to problem gambling severity among online gamblers, a hierarchical multiple regression analysis was conducted with Internet gamblers to determine if variables with a significant difference between the two groups at a univariate level contributed to problem gambling severity level. Variables were added to the equation by the “enter” method because there was no hypothesis about order of importance of variables within blocks.
A final exploratory analysis was conducted to investigate the interaction of Internet gambling and various risk factors on problem gambling severity. Multiple regression analyses were conducted separately for Internet and non-Internet gamblers for variable groupings of demographic variables, gambling characteristics, cognitive variables and psychological variables. Significant variables in the individual regression models were entered into a final regression analysis to determine their relative contribution to problem gambling severity.

Results

As predicted, Internet gamblers were more likely to be problem gamblers with a mean PGSI score of 3.5 (SD = 3.4) compared to 1.6 (SD = 2.4) for non-Internet gamblers, t(371) = 6.55, p < .001. Less than 15% of Internet gamblers were classified as non-problem gamblers by the PGSI with 35.7% classified as low risk, 40.6% as moderate risk and 10.5% classified as problem gamblers. For non-Internet gamblers, 46.1% were classified as non-problem gamblers, 34.3% as low-risk, 14.3% as moderate risk and 5.2% as problem gamblers, $\chi^2(3, N = 373) = 51.72, p < .001$. Similarly, Internet gamblers were more likely to report gambling problems by answering in the affirmative to the PGSI item: “Have you felt you ever had a problem with gambling”, $\chi^2(3, N = 373) = 9.66, p < .05$. Seventeen percent of Internet gamblers positively endorsed this statement compared to 7% of those that did not gamble online.

Univariate Analysis of Variables Contributing to Online Gambling

Univariate tests were conducted to identify significant variables for inclusion in a follow-up multivariate analysis. Demographic, medium-related, cognitive and comorbid
variables were analyzed at a univariate level to determine the factors that differentiated Internet from non-Internet gamblers. T-tests revealed that significant mean differences were found at a univariate level for the following variables: age, frequency of play, average duration of play, the number of activities played and GBQ. Variables that failed to reach statistical significance included the age first gambled, AUDIT, DAST-10, BDI-II, LSAS, and BIS-II. The results of the parametric univariate analyses are presented in Table 2. Chi-square tests revealed that ethnicity, $\chi^2(2, N = 373) = 15.76, p < .001$, and having an early win (yes/no), $\chi^2(1, N = 341) = 13.57, p < .001$ also significantly differentiated the two groups. Gender was not a significant differentiating factor, $\chi^2(1, N = 372) = 1.27, p = .260$.

The median values for expenditures more accurately reflected the data because of large variances so a Mann-Whitney test was conducted. Expenditures of Internet gamblers ($Mdn = -$1.00) did not significantly differ from non-Internet gamblers ($Mdn = -$5.00), $U = 15252.50, z = -1.07, p = .29$. In order to minimize the number of variables in the logistic regression, the GFS scale was excluded from the main analysis because it was highly correlated with the GBQ and the GBQ has superior reliability and validity indices.
Table 2

*Mean Scores (SD) for Internet and non-Internet Gamblers on Risk Factors for Problem Gambling*

<table>
<thead>
<tr>
<th>Variable</th>
<th>non-Internet(SD) (n)</th>
<th>Internet(SD) (n)</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>21.49(4.73) (230)</td>
<td>20.39(2.30) (146)</td>
<td>3.00*</td>
</tr>
<tr>
<td>Age first gambled</td>
<td>16.52(2.75) (229)</td>
<td>16.13(2.25) (135)</td>
<td>1.46</td>
</tr>
<tr>
<td>Frequency of play</td>
<td>5.08(3.57) (231)</td>
<td>9.46(6.04) (146)</td>
<td>7.85**</td>
</tr>
<tr>
<td>Average duration (min)</td>
<td>38.62(33.16) (228)</td>
<td>49.73(36.85) (143)</td>
<td>3.01*</td>
</tr>
<tr>
<td>Number of activities</td>
<td>3.54(1.63) (231)</td>
<td>6.08(2.00) (146)</td>
<td>13.43**</td>
</tr>
<tr>
<td>AUDIT</td>
<td>6.31(5.32) (226)</td>
<td>6.76(6.00) (144)</td>
<td>0.75</td>
</tr>
<tr>
<td>DAST</td>
<td>0.79(1.19) (230)</td>
<td>0.75(1.05) (145)</td>
<td>0.30</td>
</tr>
<tr>
<td>BDI-II</td>
<td>8.20(9.17) (231)</td>
<td>9.62(9.97) (145)</td>
<td>1.42</td>
</tr>
<tr>
<td>LSAS</td>
<td>35.01(22.14) (227)</td>
<td>37.31(22.28) (143)</td>
<td>0.96</td>
</tr>
<tr>
<td>BIS-II</td>
<td>60.05(9.65) (227)</td>
<td>61.66(10.41) (143)</td>
<td>1.51</td>
</tr>
<tr>
<td>GBQ</td>
<td>54.61(23.68) (228)</td>
<td>73.98(23.34) (144)</td>
<td>7.67**</td>
</tr>
<tr>
<td>PGSI</td>
<td>1.56(2.38) (231)</td>
<td>3.52(3.39) (146)</td>
<td>6.05**</td>
</tr>
</tbody>
</table>

*Note.* SD = Standard Deviation; AUDIT = Alcohol Use Disorders Identification Test; DAST-II = Drug Abuse Screening Test Version 2; BDI-II = Beck Depression Inventory
Version 2; LSIS = Liebowitz Social Anxiety Scale; BIS-II = Barratt Impulsivity Scale 
Version 2; GBQ = Gamblers’ Beliefs Questionnaire; PGSI = Problem Gambling Severity Index.

Logistic Regression Analysis to Predict Online Gambling

Significant variables were entered into a logistic regression model to predict Internet gambling. All assumptions of logistic regression analyses were tested including ratio of cases to variables, linearity of the logit, multicollinearity and outliers (Field, 2009). In accordance with conventional rules for identifying multicollinearity, all tolerance values were less than 0.1 and no Variance Inflation Factors values were greater than 10 (Myers, 1990). The model included eight variables: age, ethnicity, frequency of play, number of gambling activities, average duration of play, early win, PGSI and GBQ. The final model correctly predicted 77% of gamblers (64% of Internet gamblers and 85% of non-Internet gamblers) indicating that the final model is superior to the 62.6% predicted from the constant only model (100% non-Internet gamblers). Variables that significantly differentiated the groups in the final model included ethnicity (with Europeans being less likely to gamble online, $OR = 0.41$, 95% $CI = 0.17 – 0.96$, $p < .05$), number of activities (online gamblers participating in more activities, $OR = 2.38$, 95% $CI = 1.85 – 3.06$, $p < .001$) and GBQ (online gamblers have more distortions, $OR = 1.02$, 95% $CI = 0.89 – 1.14$, $p < .05$). The Nagelkerke $R^2$ value was .47. Table 3 shows regression coefficients with the standard errors, odds ratios and p-values for the predictors.
### Table 3

**Logistic Regression Analysis for Predicting Internet Gamblers (n = 125) from non-Internet Gamblers (n = 209)**

<table>
<thead>
<tr>
<th>Variable</th>
<th>B(SE)</th>
<th>Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>-0.75 (0.51)</td>
<td>0.93</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other</td>
<td></td>
<td></td>
</tr>
<tr>
<td>European</td>
<td>-0.90 (0.45)</td>
<td>0.41*</td>
</tr>
<tr>
<td>Asian</td>
<td>-0.42 (0.48)</td>
<td>0.66</td>
</tr>
<tr>
<td>Frequency of play</td>
<td>-.07 (0.05)</td>
<td>0.93</td>
</tr>
<tr>
<td>Number of activities</td>
<td>0.86 (0.13)</td>
<td>2.36**</td>
</tr>
<tr>
<td>Average duration of play</td>
<td>-0.00 (0.00)</td>
<td>1.00</td>
</tr>
<tr>
<td>Early win</td>
<td>0.01 (0.31)</td>
<td>1.01</td>
</tr>
<tr>
<td>PGSI</td>
<td>0.00 (0.06)</td>
<td>1.00</td>
</tr>
<tr>
<td>GBQ</td>
<td>0.02 (0.01)</td>
<td>1.02*</td>
</tr>
</tbody>
</table>

*Note. $R^2 = .34$ (Cox & Snell), .47 (Nagelkerke). Model $\chi^2(9) = 140.54, p < .001$. PGSI = Problem Gambling Severity Index; GBQ = Gamblers' Beliefs Questionnaire.

*p < .05, **p < .001.*
Multiple Regression Analysis to Predict Problem Gambling Severity

The next step was to determine which variables contributed to problem gambling severity among Internet gamblers. A hierarchical multiple regression analysis was conducted with Internet gamblers to determine which of the variables identified as unique predictors (i.e., age, ethnicity, frequency of play, number of gambling activities, average duration of play, early win, GBQ) contributed to problem gambling severity level. Demographic variables were entered in the first step (model 1), including age and ethnicity. Play variables were entered into the second step (model 2), including frequency of play, number of activities played, average duration of play and having an early win. An indicator of involvement in skill-based games was also included in this step. Given that online gamblers engage in more activities that are skill-based, a variable was added to the equation in model 2 to account for the contribution of games such as poker against other players, games of skill (e.g., pool, darts), sports pools, video games for money and online role-playing games for money. While it may be argued that other gambling formats contain a skill component, these variables were chosen because they have a definitive knowledge or experience-base that could enhance a player’s skill. The GBQ (luck/perseverance and illusion of control) was entered into the third step (model 3). As shown in Table 4, the first model in the multiple regression analysis was not significant, $F(3, 121) = 1.72, p = .17$ ($R^2 = .04$), but models 2, $F(8, 116) = 4.38, p < .001, (R^2 = .23)$ and 3, $F(9, 115) = 6.96, p < .001, (R^2 = .35)$ were significant. Frequency of play (model 2) and GBQ (model 3) were significant independent predictors.
Table 4

*Hierarchical Multiple Regression Analysis for Variables Predicting Problem Gambling Severity Among Internet Gamblers (n =124)*

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>SE B</th>
<th>β</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model 1</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-0.09</td>
<td>0.13</td>
<td>-.07</td>
</tr>
<tr>
<td>European</td>
<td>0.16</td>
<td>0.91</td>
<td>.02</td>
</tr>
<tr>
<td>Asian</td>
<td>1.29</td>
<td>0.91</td>
<td>.19</td>
</tr>
<tr>
<td><strong>Model 2</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-0.16</td>
<td>0.12</td>
<td>-.12</td>
</tr>
<tr>
<td>European</td>
<td>-0.03</td>
<td>0.85</td>
<td>-.01</td>
</tr>
<tr>
<td>Asian</td>
<td>0.56</td>
<td>0.85</td>
<td>.09</td>
</tr>
<tr>
<td>Frequency of play</td>
<td>0.17</td>
<td>0.06</td>
<td>.31*</td>
</tr>
<tr>
<td>Number of activities</td>
<td>0.13</td>
<td>0.19</td>
<td>.08</td>
</tr>
<tr>
<td>Average duration of play</td>
<td>0.01</td>
<td>0.01</td>
<td>.08</td>
</tr>
<tr>
<td>Early win</td>
<td>0.79</td>
<td>0.59</td>
<td>.12</td>
</tr>
<tr>
<td>Skill games</td>
<td>-0.20</td>
<td>0.94</td>
<td>-.02</td>
</tr>
<tr>
<td><strong>Model 3</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
An additional exploratory analysis was conducted to investigate the interaction of Internet gambling and various risk factors on problem gambling severity. A series of multiple regression analyses were conducted separately for Internet and non-Internet gamblers for variable groupings. Specifically, multiple regression analyses were run for demographic variables (age, gender, ethnicity), gambling characteristics (frequency of play, expenditures, age of onset, early win), cognitive variables (GBQ, GFS) and psychological variables (AUDIT, DAST, BDI-II, LSAS, BIS-II). The following variables were significant
predictors of problem gambling severity for non-Internet gamblers: gender, frequency of play, expenditures, early win, GBQ, and BIS-II. Variables that were significant predictors of problem gambling severity for Internet gamblers included: GBQ, GFS, BDI-II and the AUDIT. Significant variables in the individual regression models were entered into a final regression analysis. Interaction terms were created by centering the variables and multiplying the corresponding term by the online gambling variable (-1/+1). The final regression model included significant variables and their corresponding interaction terms. Linear regression was used to test the hypothesis that Internet gambling moderated the relationship between risk factors and problem gambling severity. The final model accounted for 56% of the variance in problem gambling severity, $R^2 = 0.56$, $F(18, 306) = 21.24, p < .001$.

The regression model, summarized by Table 5, had a number of significant main effects (frequency of play, early win, GBQ, GFS, BIS-II, BDI-II) and two significant interactions (shown graphically below). Problem Gambling Severity Index Scores were categorized according to the CPGI for graphical purposes with gamblers falling into one of the following four categories: non-problem (score of 0), low-risk (score of 1-2), moderate risk (score of 3-7), problem gambling (score of 8 or more). Figure 1 shows that non-Internet gamblers categorized as problem gamblers are reporting monthly losses while Internet gamblers categorized as problem gamblers are reporting monthly wins. Figure 2 demonstrates that Internet gamblers categorized as problem gamblers are more likely to have distorted thinking when compared to non-Internet gamblers.
Table 5

*Multiple Regression Analysis for Variables Predicting Problem Gambling Severity Among Gamblers (n = 324)*

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>SE B</th>
<th>β</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>0.01</td>
<td>0.13</td>
<td>.00</td>
</tr>
<tr>
<td>Frequency of play</td>
<td>0.18</td>
<td>0.03</td>
<td>.31***</td>
</tr>
<tr>
<td>Expenditures</td>
<td>-0.00</td>
<td>0.00</td>
<td>-.07</td>
</tr>
<tr>
<td>Early win</td>
<td>0.34</td>
<td>0.13</td>
<td>.12**</td>
</tr>
<tr>
<td>GBQ</td>
<td>0.03</td>
<td>0.01</td>
<td>.25***</td>
</tr>
<tr>
<td>GFS</td>
<td>-0.16</td>
<td>0.06</td>
<td>-.12**</td>
</tr>
<tr>
<td>BIS-II</td>
<td>0.03</td>
<td>0.01</td>
<td>.10*</td>
</tr>
<tr>
<td>BDI-II</td>
<td>0.07</td>
<td>0.01</td>
<td>.22***</td>
</tr>
<tr>
<td>AUDIT</td>
<td>0.00</td>
<td>0.02</td>
<td>-.00</td>
</tr>
<tr>
<td>IG</td>
<td>0.08</td>
<td>0.14</td>
<td>.03</td>
</tr>
<tr>
<td>IG x Gender</td>
<td>-0.07</td>
<td>0.13</td>
<td>-.02</td>
</tr>
<tr>
<td>IG x Frequency of play</td>
<td>-0.06</td>
<td>0.03</td>
<td>-.09</td>
</tr>
<tr>
<td>IG x Expenditures</td>
<td>0.00</td>
<td>0.00</td>
<td>.09*</td>
</tr>
<tr>
<td>IG x Early win</td>
<td>0.09</td>
<td>0.13</td>
<td>.03</td>
</tr>
<tr>
<td>IG x GBQ</td>
<td>-0.01</td>
<td>0.01</td>
<td>-.04</td>
</tr>
<tr>
<td>IG x GFS</td>
<td>-0.21</td>
<td>0.06</td>
<td>-.16**</td>
</tr>
<tr>
<td>IG x BIS-II</td>
<td>-0.00</td>
<td>0.01</td>
<td>.01</td>
</tr>
<tr>
<td>IG x BDI-II</td>
<td>0.02</td>
<td>0.01</td>
<td>.08</td>
</tr>
<tr>
<td>IG x AUDIT</td>
<td>0.02</td>
<td>0.02</td>
<td>.03</td>
</tr>
</tbody>
</table>

Note. $R^2 = .56$. GBQ = Gamblers' Beliefs Questionnaire; GFS = Gambling Fallacies Scale; BIS-II = Barratt Impulsivity Scale Version 2; BDI-II = Beck Depression Inventory Version 2; AUDIT = Alcohol Use Disorders Identification Test; IG = Internet Gambling.

*p < .05, **p < .01, ***p < .001.
Figure 1. Interaction Effect of Internet Gambling on the Relationship Between Expenditures and Problem Gambling
Figure 2. Interaction Effect of Internet Gambling on the Relationship Between Gambling Fallacies and Problem Gambling

Online Gambling Initiation

Online gamblers were more likely to gamble on a variety of activities ($M = 6.1$, $SD = 2.0$) compared to gamblers who had not wagered on the Internet ($M = 3.5$, $SD = 1.6$), $t(371) = -12.82$, $p < .001$. Moreover, online gamblers wagered on more land-based activities ($M = 4.4$, $SD = 1.7$) when compared to non-Internet gamblers ($M = 3.5$, $SD = 1.6$), $t(371) = -4.94$, $p < .001$. Specifically, when compared to participants who had not used the
Internet to gamble, Internet gamblers were more likely to wager on poker in a casino (39% vs. 21%), $\chi^2(6, N = 371) = 24.08, p < .01$, poker with family and friends (70% vs. 56%), $\chi^2(6, N = 371) = 24.17, p < .001$, casino games other than poker (54% vs. 36%), $\chi^2(6, N = 372) = 23.15, p < .01$ and video games for money (14% vs. 4%), $\chi^2(5, N = 372) = 16.62, p < .01$. Of all online gamblers, 99% also gamble on land-based formats. Moreover, the majority of Internet gamblers initiated gambling behaviour in a land-based modality, with less than 3% reporting that their first gambling experience occurred online. Internet gamblers were more likely to use the computer for entertainment, with an average daily use of 3.9 hours ($SD = 3.1$) compared to 2.8 ($SD = 2.4$) for non-Internet gamblers, $t(365) = -3.612, p < .001$.

**Discussion**

The present study was designed to investigate differences between Internet and non-Internet gamblers on problem gambling risk factors. As expected, Internet gamblers experienced higher levels of problem gambling severity. The problem gambling rate among Internet gamblers measured by the PGSI was 10.5% compared to 5.2% for non-Internet gambler. At the time of this writing, no study has used the PGSI to measure problem gambling rates among Internet gamblers in university or college students. The results are not comparable to prevalence rates but can be contrasted with other selected samples. In a volunteer online sample, 20% of Internet gamblers were classified as problem gamblers by the PGSI (Wood & Williams, 2007). In a sample of online gamblers, 11% of were classified as probable pathological gamblers (McBride & Derevensky, 2009).
It is of interest that none of the investigated comorbid mental health factors (alcohol abuse, drug use, depression, anxiety, impulsivity) differentially contributed to predicting Internet gambling. One of the concerns put forth by gambling researchers is that online gamblers could be wagering money while under the influence without the opportunities for intervention that might occur in a bar or casino (McBride & Derevensky, 2009). It seemed logical to assume that comorbid conditions could contribute to choosing a more solitary and anonymous form of gambling. However, as discussed below, online gamblers do not limit their play to Internet activities with the findings indicating that they are typically involved in land-based gambling as well. In the one study where alcohol use was investigated among Internet and non-Internet gamblers, Griffiths, Wardle, et al. (2009) found that hazardous drinking contributed to differentiating whether someone would gamble on the Internet. However, similar to the results of the current study, the researchers found that alcohol consumption was associated with both Internet and non-Internet gambling. At the time of this writing, no studies have been published looking at drug use, depression, anxiety or impulsivity to differentiate Internet gamblers from non-Internet gamblers.

As hypothesized, factors associated with the medium and factors associated with the individual exerted a combined influence to differentiate Internet and non-Internet gamblers. When looking at problem gambling severity among Internet gamblers, demographic variables did not significantly contribute to the variance in severity. Among play variables, the frequency with which a player was involved in gambling contributed to severity and cognitive distortions further strengthened the regression model. Exploratory analysis revealed that Internet gambling significantly moderated the relationship between problem gambling severity for both expenditures and gambling fallacies. In the main analysis,
variables that significantly differentiated Internet and non-Internet gamblers were ethnicity, the number of activities the gambler engaged in and cognitive distortions. The contribution of these individual variables will be discussed in succession.

Previous research has shown that racial minority groups are more vulnerable to developing gambling problems when compared to Caucasians (Alegria et al., 2009). Although the ethnicity categorizations were fairly broad (categories were collapsed because of small numbers), the participants categorized as Caucasian were less likely to be online gamblers than those of Asian decent or participants in other ethnic groups. The results support previous research showing that Internet gamblers are more likely to be non-Caucasian when compared to non-Internet gamblers (Ladd & Petry, 2002). Previous research with university students in Canada has demonstrated ethnicity as a variable that significantly differentiates problem from non-problem gamblers (Williams, Connolly, Wood, & Nowatzki, 2006). Research has also shown that Asian Americans have more advanced levels of Web-use skills when compared to other ethnicities (Hargittai, 2010). Increased gambling involvement coupled with familiarity with the medium could be related to certain ethnic groups having a greater likelihood of wagering money in an online format.

The finding that Internet gamblers engage in a wide variety of gambling activities supports previous research. Wood and Williams (2009) found that online gamblers engaged in an average of 6.1 activities compared to only 3.8 for non-Internet gamblers. It is necessary to view this statistic cautiously because online gamblers are engaging in more activities simply by the nature of adding Internet games to their repertoire. Furthermore, the format of the questions (i.e., each activity queried individually) is likely to result in online gamblers endorsing more types of play. More noteworthy was the fact that online gamblers
also participated in more land-based formats. From a responsible gambling standpoint there have been concerns that the Internet could attract a different subset of gamblers. Particularly, there has been concern that Internet gambling could be more attractive to younger players. In the existing sample, the majority of participants had the opportunity to gamble online and in land-based establishments when they reached 18 years of age. Most participants had their first gambling experience in a land-based format, indicating that the Internet is not generally attracting new players. Wood and Williams (2009) found that the single most significant predictor of Internet gambling for both a Canadian and International sample was the number of gambling formats in which participants engaged. They also found that Internet gamblers had a greater frequency of activity and higher average expenditures when gambling. Similarly, in the current study, frequency of play significantly contributed to problem gambling severity among Internet gamblers. The findings suggest that high-risk individuals are using many forms of accessible gambling opportunities. It should be noted that there are many available forms of remote gambling such as interactive TV and mobile phone accessibility that were not addressed in this study, thus the rates reported here may underestimate involvement.

Cognitive variables were a significant contributor throughout the results. Cognitive distortions differentiated the two groups and was associated with problem gambling severity among Internet gamblers above and beyond play-related variables. In addition, distorted thinking interacted with online gambling participation. Problem gamblers were more likely to have distortions if they had gambled online, but the influence was minimal for non-problem gamblers. Similarly, Wood and Williams (2009) found that fallacies
contributed to Internet problem gambling. There are a number of plausible explanations as to why cognitive processes could influence Internet gamblers.

There are aspects of online gambling that add elements of perceived skill. As with electronic gaming machines (e.g., slots), Internet interfaces are often designed to mimic real-life games where there is a legitimate skill component. In addition, many individuals have played interactive video games and may have a false perception of control when gambling on the Internet. Online gambling demonstration sites are another aspect that provides players with a false perception of skill. Many sites offer the individual the opportunity to learn and practice games prior to wagering money and demonstration modes can offer higher odds than the actual games (Sévigny et al., 2005). In the present study, non-Internet gamblers reported that they were more likely to visit an online gambling site without wagering money (e.g., demonstration games, free credit, bonus credit), indicating that online gamblers are more likely to play for money when they visit sites versus simply playing for entertainment.

An unanticipated result of this study was that the participants reported a mean monthly gambling profit (with a high degree of variability), even after controlling for outliers. In a recent large-scale study of Internet gamblers, Wood and Williams (2009) found a mean monthly loss for Internet gamblers but made the following statement in the discussion: “The lack of significance in the Canadian data set is due to the variability in the expenditure reports of Canadian Internet gamblers, a significant portion of which claimed to have large net wins on gambling in a typical month.” (pp. 88)
The format of the question for expenditures was based on the findings of a report looking at the comparative validity of question wordings used to assess gambling expenditures (Wood & Williams, 2007b). The authors concluded that the question worded as: “Roughly how much money do you spend on [specific gambling activity] in a typical month?” (with totals from each activity then added together) had the most robust validity. The question with the second best evidence of validity and what the author’s deemed to have the most face validity was the above question wording with the added caveat of “what we mean here is how much you are ahead or behind, or your net win or loss in a typical month”. This question format was chosen for the current study. The response design had two separate boxes where participants could input either a loss or a profit. Unfortunately, the survey set up did not allow a restriction to input only one value (either a loss or a profit) and some participants entered a numeric value in both boxes. It was reasoned that someone could have mentally tabulated how much he or she generally lost (inputting that value as a loss) and how much he or she generally won (inputting that value as a profit) in a typical month. Thus, it was decided that the data would be included and a difference score would be calculated for these participants. This decision was in accordance with the expenditures calculation in the large scale Leisure, Lifestyle, Lifecycle Project following 1808 Albertans prospectively over a five-year period from 2005 to 2011, where the researchers decided to calculate a difference score if participants inputted a number for both a net win and net loss (D. Casey, personal communications September, 2010).

Previous studies have shown retrospective estimates of expenditures to be unreliable (Volberg, Moore, Christiansen, Cummings, & Banks, 1998; Williams & Wood, 2004a; Wood & Williams, 2007a). For example, in the 2007 Williams and Wood study,
researchers found that the majority of people did not report similar expenditure amounts when asked a second time within a five minute interval. In addition, expenditure reports did not equal prospective accounts or actual gambling revenues. Notwithstanding the inherent problems with validity of expenditure estimations, it was very unusual that the overall average would be positive and the validity of this variable could be viewed with caution. Another possible consideration is that some Internet gamblers are actually generating a profit.

In terms of researching the online gambling environment, there needs to be consideration of the fact that certain games can be profitable. We cannot make conclusions about the relationship between cognitions and behaviour without knowing whether players can influence outcomes. Anecdotally, there is evidence that online poker players can make money by taking advantage of less experienced players. It has also been reported that players will decisively plan sessions of online poker to coincide with times when their opponents in other time zones would be more vulnerable (such as after 2 am). Collusion offers possibilities for advantage but most sites have mechanisms to detect and prevent this eventuality. Most notably, there is evidence that players can win money. A recent study looking at players wagering on a sports betting site found that 15% of those placing fixed-odds bets and 22% of those placing live-action bets over a 2-year period averaged a net profit (Broda et al., 2008).

One of the endemic issues with gambling research is that all types of gambling activities are aggregated and conclusions are drawn about gambling in general that may or may not apply to every activity. For example, the inclusion of stock market wagering in the definition of gambling is debatable because there is an element of skill involved. When
instruments such as the GBQ or GFS are included in questionnaires, the items refer to all
types of gambling. When considering betting that includes an element of skill, items on the
GBQ might be accurately endorsed without being distorted. For example agreeing with the
statement, “My gambling wins are evidence that I have skill and knowledge related to
gambling” or “I have more skills and knowledge related to gambling than most people who
gamble”, might be legitimate for some players. A similar argument could be made for other
games that involve elements of strategy (backgammon), experience (online role-playing
games), knowledge (betting exchanges) or skill (poker).

Buttressing the above discussion is that fact that a large percentage of the online
gamblers in the present study were poker players (85%). The major distinction between
poker and most other forms of gambling is that poker involves an element of skill and a
profit can be made while playing poker. We cannot make conclusions about the
relationship between irrational cognitions and behaviour without knowing whether
individual players are influencing outcomes.
Study 2

How do we determine whether someone is a skilled player or simply distorting aspects of play? In the past, research has utilized self-report measures where players were asked about their perceived skill level and monetary output in previous gambling sessions (e.g., Griffiths, Parke, et al., 2009). Other self-report measures include Timeline Followback where gamblers recall previous sessions of play (Weinstock, Whelan, & Meyers, 2004). Although Timeline Followback has demonstrated good reliability and validity (Hodgins & Makarchuk, 2003), participant recall is generally compared to collateral or retrospective accounts and not actual play. Studies employing the Timeline Followback method are generally focused on problem gamblers so do not represent a heterogeneous range of gambling involvement. In addition, we know that wins (more salient) tend to be remembered over losses (Tversky & Kahneman, 1973). Shaffer, Peller, LaPlante, Nelson, and Labrie (2010) strongly urged that future research focus on actual behaviour as opposed to self-report measures.

There is some evidence in the area of hockey betting showing that so-called “expert” bettors inflate their sense of skill. In a study examining whether experts could pick teams at a rate higher than chance, Cantinotti, Ladouceur, and Jacques (2004) found the return rate for an expert bettor was 60% compared to 79% based on random selection. Similarly, in horse racing it has been demonstrated that experts were not superior to random selection in return rates (Ladouceur, Giroux, & Jacques, 1998). No study to date has investigated the extent to which online gamblers falsely (or perhaps accurately) perceive their skills. Therefore the overarching purpose of study 2 was to observe actual gambling behaviour during a game of simulated online poker to determine whether Internet poker
players a.) possess a superior skill base when compared to non-Internet gamblers, b.) believe themselves to have more skill in poker than offline poker player, and c.) have more distortions around their ability to control gambling outcomes when compared to poker players that do not wager on the Internet.

Why Poker?

In the 21st century the game of poker has experienced unprecedented growth in popularity, largely because of the advent of online poker and televised poker championships. In 2006, the American Gaming Association (AGA) reported that 20% of American adults played poker in the past year (AGA, 2006). The Responsible Gambling Council (RGC) of Canada reported that 20% of Ontario residents play poker for money (RGC, 2006). A 2007 RGC report with youth (aged 15-17) found that 51% of gamblers had played poker in the past year with 21% reporting playing online (White et al., 2007). Among the youth sample, 10% reported that online poker was a problem for their peers. In a recent investigation into poker participation at the University of Calgary, researchers found that 62% of students had played poker for money in the past year (Shead, Hodgins, & Scharf, 2008). It was also found that poker players spent more time gambling and online/casino poker players had more severe gambling problems. Wood and Williams (2009) found that Internet gamblers reported poker play as the number one activity contributing to gambling problems. At present, there are 526 English language poker sites that accept bets from Canadian citizens (Casino City, 2011).

The major distinction between poker and most other forms of gambling is that poker involves a combination of skill and chance factors that determine the outcome. In as such,
the propensity for illusory control increases. We know from previous research that problem gamblers have an inflated perception of their own skill (Toneatto, Blitz-Miller, Calderwood, Dragonetti, & Tsanos, 1997) and endorse more irrational beliefs about gambling when compared to social gamblers (Joukhador, MacCallum, & Blaszczynski, 2003). Regular gamblers have been shown to believe that they possess above average skills in slot machine play when compared to non-regular players (Griffiths, 1990a). We also know that gamblers with a preference for skill games have a greater illusion of control over outcomes when compared to those that prefer games of chance (Myrseth, Brunborg, & Eidem, 2010). Wohl, Young, and Hart (2005) found that gamblers endorsing problematic behaviours (more than 1 on DSM criteria) were more likely to view themselves as being inherently lucky when their game of choice contained a skill component.

The idea that many players perceive themselves to be skilled is evidenced by the fact that poker players claim that they can make a profit. The recent Ontario Gambling Prevalence study found that one in 10 Ontarians agreed with the statement: “Playing poker is a good way to earn extra money” (RGC, 2006). Poker players were more likely to agree with the statement when compared to non-poker players (20% vs. 5%), as were young adults (16% vs. 4% of those 35 and older). Forty two percent of online poker players agreed that poker was a good way to make money. Research has shown that online poker players claim to be experiencing monetary success. People tend to report more financial gains when playing online poker compared to casino play, with less than one-third of online poker players reporting a monthly loss (eCOGRA, 2007b).

In a sample of online poker players, Hopley and Nicki (2010) found that 19% reported supporting themselves solely via online poker and an additional 15% reported
supplementing their income this way. Playing to win money was listed as the primary reason for online poker gambling (48%) and playing to enhance skills was the second most endorsed reason (12%). Similarly, Wood, Griffiths, and Parke (2007) found that 50% of online poker players said they always or frequently won money. When asked about the contribution of skill vs. chance in online poker, 38% regarded it as predominantly game of skill. Problem gamblers in the sample reported winning more per month than social gamblers and also reported losing more (wins and losses were reported separately). In a similar study with the same sample, the authors detailed that “source of income” was listed as one of the best reasons for playing online poker, while “losing money” was listed among the worst reasons (Griffiths, Parke, et al., 2010). In accordance with the preceding discussion, Internet gamblers in study 1 reported a monthly profit. It is unclear whether this was an artefact of the question structure or an accurate recall of monetary gains. Internet gamblers were more likely to endorse items on the GBQ that related to making money while gambling online. Factors that have been shown to have a significant impact on how much online poker players say they win or lose include: playing to win money, perceived personal skill and the perception that poker is more about skill than chance (eCOGRA, 2007b).

Cotte and Lotour (2009) conducted a unique qualitative investigation to identify differences between those individuals who gamble online and those who gamble in casinos. They concluded that online gamblers perceive that they have greater control over their environment, their finances and the outcome of the games when compared to casino gamblers or themselves in a casino environment. The authors described that this sense of control often leads to playing for longer periods of time. The authors noted, “There exists
among online gamblers a dangerous illusion of control over outcomes, monetary spending and time commitment” (pp. 751). They also found that online gamblers were more inclined to play purely for the challenge and monetary incentive than casino gamblers who described various motivations for play (e.g., social aspect). This finding is an important consideration because research has shown that distorted cognitions can moderate the relationship between 1.) risky gambling practices and spending and 2.) risky gambling practices and tolerance (Miller & Currie, 2008). If Internet gamblers are engaging in risky practices (such as spending more time and money gambling) then erroneous cognitions could be moderating the relationship with problem gambling severity.

From the aforementioned discussion it is evident that poker is an increasingly prevalent activity that lends itself to common distortions of illusory control due to the skill component (online or offline). In study 1 it was determined that online players gamble significantly more on land-based activities than non-Internet gambler and the majority of online gamblers play poker. Accordingly, poker is a suitable activity with which to investigate elements of skill vs. perceived skill among Internet and non-Internet gamblers. Therefore the purpose of study 2 was to investigate how online and offline gamblers differ in their poker skill, perceived poker skill and general gambling cognitions. Poker skill was assessed via a simulated game of online poker (described below). It was hypothesised that Internet gamblers would not possess superior skill in poker play when compared to non-Internet gamblers but would deem themselves to be more skilled than gamblers that had not wagered online. It was also hypothesised that, similar to study 1, Internet gamblers would have more gambling-related cognitive distortions when compared to non-Internet gamblers.
It was expected that cognitions around perceptions of control (general and poker specific) would differentiate whether someone played poker on the Internet.

**Method**

The final sample included 278 participants (111 online gamblers, 140 males). The sample size exceeded the recommended rule of thumb for stepwise logistic regression of at least 10 cases per independent variable (Harrell, Lee, Califf, Pryor, & Rosati, 1984) and the recommended sample size for multiple regression based on Halinski and Feldt (1970). The mean age of participants was 20 years old (range = 18-52; SD = 3.1) with an average of 2.3 years of post-secondary education. Ninety five percent of the sample was single, 97% were full-time students and most lived with family (74%) or roommates (17%). Participants were recruited from the University of Calgary Research Participations System (RPS). Partial course credit was granted to students for their participation. Respondents had to speak English, be at least 18 years of age, know how to play Texas Hold’em poker and have played poker in the past month to be eligible to participate. Internet poker players were over sampled to increase cell sample sizes for the logistic regression analysis. In order to improve engaged poker play, participants were offered an incentive of obtaining one of two $100 gift certificates to the University of Calgary Bookstore.

**Procedure**

All gamblers were recruited in a similar manner by accessing them through the same portal, posting uniform recruitment messages and directing them to the same survey. Participants were recruited to participate in an online study presented as “poker play among university students” or “online poker play among university students”. The study consisted
of three segments; a questionnaire (described below), computer poker play (described below) and post-play questions (Appendix K). After participants signed up in the RPS they were directed to a page where they registered for a code. They were required to put their email in a text field and were emailed a computer-generated individual code. The code was entered prior to completing each section and the segments were linked by the individual code to ensure confidentiality in data collection. Participants began by completing an online questionnaire consisting of questions related to demographics (see study 1), poker experience (type of play, frequency, duration) cognitive distortions (Gambler’s Beliefs Questionnaire; Steenbergh, et al., 2002, Gambling Cognitions Inventory; Holub, Hodgins, & Rose, 2007) perceived poker skills (self-rating on a 7-point Likert scale) and problem gambling level (Problem Gambling Severity Index; Ferris and Wynne, 2001). The Gambling Cognitions Inventory (GCI) can be found in Appendix L and the reader is referred to study 1 for a description of the measures previously detailed.

After reading the informed consent agreement (Appendix M), participants were required to click on “I consent to participate” to begin the study. When participants finished the questionnaire they were directed to a link where they completed the online poker segment. Participant played 75 hands of heads-up limit Texas Hold'em poker against a computer-controlled opponent through a web-based interface run by the University of Alberta Computer Poker Research Group (CPRG). Seventy-five hands were chosen because they provided a reasonable trade-off between the accuracy of the low-variance skill estimator and the time needed to complete the poker game. In a related domain, the computer opponent for this investigation was a relatively strong opponent so the overlap in variability between groups would be lower and lead to a more accurate estimate of skill.
The computer implemented the rules of limit Texas hold'em, securely dealt cards, communicated the state of the game with the players, and logged the players' actions and results of each hand. The web interface provided visual communication to the participant on the state of the hand and provided buttons for the player's options of "fold", "call", or "raise". The program was designed to present an interface similar to that used in online poker establishments and training software. When participants completed the poker segment, they were directed to the post-play questions. The study took approximately one hour to complete and participants were given one bonus course credit. A debriefing form (Appendix N) followed the post-play questions.

*Computer Poker Program*

The results of the poker segment of the study were collected as logs of the poker hands of each participant. The logs contained the full information on the cards dealt, the players' decisions, and the players' winnings as a result of the hand. The same information was made available to the participant, excluding information about the opponent's cards for each hand. Each participant's log was summarized by three statistics: empirical winnings, empirical luck and empirical skill.

Empirical winnings are the amount the player won (positive) or lost (negative) per hand. Empirical skill is a statistic developed by the CPRG that is essentially a measure of how much money the player “should” have won/lost (mathematically) relative to the opponent based on the player’s choices (strategy). For example, on a hand where the player won $12 over the computer opponent, the empirical skill measure might estimate that the
player should have only won $8 on that hand, given the cards dealt and mathematical probability of winning versus losing that hand.

Empirical skill was measured through the statistical principle of control variates. These control variates can be thought of as empirical luck, and can be removed to get a more accurate empirical skill estimate. Empirical skill was measured in small-bets (same units as empirical winnings) and averaged over 75 hands to get a more precise estimation of player skill relative to the opponent (i.e., how much money the player would be expected to win over the opponent). Given that empirical skill has a degree of variability, the CPRG used a combination of DIVAT (Zinkevich, Bowling, Bard, Kan, & Billings, 2006) and imaginary observations (Bowling, Johanson, Burch, & Szafron, 2008) to more accurately derive the measure of empirical skill.

DIVAT is a provably unbiased estimator of winnings that reduces variance through a use of carefully constructed control variants (L’Ecuyer, 1994). While being unbiased, it typically results in a seven-fold reduction in variance. Imaginary observations are a mechanism that can further reduce an estimator's variance by exploiting explicit knowledge of one player's strategy (in this case the computer opponent). This technique is also provably unbiased and results in a 1.5-fold reduction in variance, and can be combined with DIVAT. The empirical skill estimate is therefore an unbiased estimator of winnings, but with a 26-fold reduction in variance due to synergy between the two techniques.

It is important to note that when referring to empirical skill in the context of this study, it is in reference to relative skill and not absolute skill. Empirical skill is a measure of the player’s ability against a particular opponent (in this case the computer opponent).
Given that all participants played against the same opponent, it is reasonable to draw conclusions based on comparisons between players. Moreover, comparisons are being made between groups and not individual play patterns. For the sake of clarity in terminology, “empirical skill” will be used to refer to the computer measure of skill and “perceived skill” will be used to refer to the players’ subjective measure of skill. The term “empirical” will be used when referring to the computer-generated variables because it is the terminology used by the CPRG for the output variables.

Excluded Participants and Data Manipulation

Four hundred and three participants correctly entered their code in all three sections of the study (questionnaire, poker play, post-play questions). Twenty participants experienced a computer glitch during poker play and were permitted to re-start the game. For these participants, the second set of data was retained. Two simple poker questions were included to ensure players had a fundamental, basic understanding of the game. Seventy-four participants were excluded based on incorrectly answering the poker validity questions. Five participants were excluded for extreme missing data. Forty-six participants were excluded from the main analysis because of a computer programming error where they played a different opponent. Females were more likely to be excluded based on the poker validity questions where 24% of excluded participants were female and 13% were male, χ²(1, N = 402) = 7.94, p < .05. No other statistically significant differences existed between included and excluded participants.

The GBQ and GCI were prorated if one value was missing (no participant had more than one missing value for either scale). In cases where participants put a range of values
for duration of play, the midpoint was substituted (e.g., 1-2 hours replaced with 1.5 hours). For the question querying how much money participants believe they would win/lose against the opponent, values outside of 3.29 standard deviations were removed and replaced with the highest value +1 (n = 3) or the lowest value -1 (n = 2). Ethnicity was re-coded for data analysis purposes according to European (48%), Asian (39%) and a combined “other” category (13%).

Data Analysis

Univariate analyses were conducted to determine whether there was a significant difference between Internet and non-Internet gamblers on empirical skill, perceived skill, GBQ and GCI. Subsequently, a logistic regression analysis was conducted to determine whether any of the following variables differentially predicted online poker players: empirical skill, empirical winnings, empirical luck, perceived poker skill rating, perceived skill (game specific), GBQ and GCI. Separate multiple regression analyses were conducted to determine the factors contributing to a.) empirical skill and b.) perceived poker skill among online gamblers. These analyses sought to determine whether any of the investigated variables actually influence empirical skill or mainly influence the subjective perception of skill. An additional post-hoc hierarchical regression analysis was conducted with level of involvement (model 1), cognitive variables (model 2) and level of involvement in online poker (model 3) to further elucidate the relationship between gambling involvement, cognitive distortions and Internet gambling.
Validity of Empirical Skill

Although empirical skill is a mathematically valid measure, analyses were completed to provide further support for the validity of the measure. A comparison of professional players from the CPRG Man-versus-Machine poker competition to average players from an online poker site demonstrated a significant difference on the empirical skill measure for these two groups. The average amount of money lost (in millibets) for professionals ($M = 0.05, SD = 0.98$) was significantly less than that of average players ($M = 0.16, SD = 1.16$), $t(293770) = -4.09, p < .001$. Analyses were also conducted to verify that participants in the current study with limited poker knowledge would score lower than participants who correctly answered the poker knowledge questions. Participants who answered both questions correctly scored significantly higher on the empirical skill measure ($M = -0.37$) when compared to participants who answered one or both of the knowledge questions incorrectly ($M = -0.44$), $t(338) = -2.12, p < .05$. In addition, there was a small but significant correlation between the number of questions correctly answered and empirical skill ($r = .15, p < .01$). The intercorrelations between the variables in study 2 can be found in Appendix O.

Results

Of the sample, 77% played poker with friends or family, 45% played poker at a casino and 31% played poker online. The average age at which the participants started playing poker was 17 years ($SD = 2.6$) and the mean number of times players gamble on poker was approximately once per month, with the average poker session lasting 84 minutes ($SD = 56.0$). Of the entire sample, 36.7% were classified as non-problem gamblers,
30.2% as low-risk, 26.6% as moderate risk and 6.5% as problem gamblers. A one-way Analysis of Variance showed a significant difference in skill perception by PGSI category, $F(3, 277) = 10.77, p < .001$ with problem gamblers differing significantly from the other categories in a post-hoc comparison. Problem gamblers had a mean skill perception rating of 5.1 ($SD = 1.5$) on a 7-point Likert scale compared to 3.2 ($SD = 1.4$), 3.3 ($SD = 1.5$), and 3.9 ($SD = 1.5$) for the non-problem, low-risk and moderate risk categories respectively. Gamblers did not differ on the empirical skill measure by PGSI category, $F(3, 277) = 10.77, p = .155$. An independent samples t-test revealed that similar to study 1, Internet gamblers were more likely to have greater problem severity ($M = 3.5, SD = 3.4$) when compared to non-Internet gamblers ($M = 1.5, SD = 2.1$), $t(276) = -5.54, p < .001$.

The primary research question in study 2 was to determine whether Internet gamblers inflate their skill estimation. Results revealed that Internet gamblers were no more skilled than non-Internet gamblers on the empirical skill measure, $t(276) = -1.45, p = .15$. Internet gamblers were more likely to perceive themselves as skilled at poker, $t(276) = -4.34, p < .001$, and have more distortions on the GBQ, $t(276) = -5.20, p < .001$ and the GCI, $t(276) = -4.39, p < .001$. Internet gamblers were more likely to make probability errors, have magical thinking, illusions of control and information processing errors on the GCI (all significant at $p < .05$). Table 6 provides descriptive information for the comparisons related to empirical skill and the measured cognitive variables.

Internet gamblers perceived themselves as more skilled, but were also more likely to endorse items on the PGSI that indicate they may be having negative financial repercussions when compared to non-Internet gamblers. Specifically, Internet gamblers were more likely to say that they had bet more than they could afford to lose, $\chi^2(3, N = $
278) = 16.03, \( p < .01 \), with 38% of Internet gamblers endorsing this statement compared to 18% of non-Internet gamblers. Online gamblers were also more likely to endorse that gambling had caused financial problems, \( \chi^2 (3, N = 278) = 11.46, p < .01 \), with 14% of Internet gamblers endorsing this statement compared to 4% of non-Internet gamblers. An independent samples t-test revealed that, on a 7 point-Likert scale, Internet gamblers were more likely to say that they would play the computer opponent for money (\( M = 3.8, SD = 2.0 \)) when compared to non-Internet gamblers (\( M = 3.3, SD = 1.9 \)), \( t(276) = 2.16, p < .05 \). The greater willingness to play the opponent was despite the fact that Internet gamblers were no more skilled (as above) and on average lost simulated money during the game.
Table 6

Mean Scores (SD) for Internet (n = 111) and non-Internet (n = 167) Gamblers on Measures of Empirical Skill, Perceived Skill and Cognitive Distortions

<table>
<thead>
<tr>
<th>Variable</th>
<th>non-Internet(SD)</th>
<th>Internet(SD)</th>
<th>t-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Empirical skill</td>
<td>-0.39(0.25)</td>
<td>-0.35(0.21)</td>
<td>1.45</td>
</tr>
<tr>
<td>Perceived skill</td>
<td>3.25(1.46)</td>
<td>4.03(1.48)</td>
<td>4.34**</td>
</tr>
<tr>
<td>GBQ</td>
<td>67.02(21.04)</td>
<td>80.17(20.00)</td>
<td>5.21**</td>
</tr>
<tr>
<td>GCI sub-scales</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Probability errors</td>
<td>26.34(6.27)</td>
<td>28.42(7.35)</td>
<td>3.61**</td>
</tr>
<tr>
<td>Magical thinking</td>
<td>26.13(7.80)</td>
<td>28.42(7.35)</td>
<td>2.45*</td>
</tr>
<tr>
<td>Illusion of control</td>
<td>21.20(4.84)</td>
<td>24.19(4.69)</td>
<td>5.11**</td>
</tr>
<tr>
<td>Information processing</td>
<td>10.46(2.34)</td>
<td>12.01(2.32)</td>
<td>5.42**</td>
</tr>
<tr>
<td>GCI Total</td>
<td>81.87(16.60)</td>
<td>91.22(17.10)</td>
<td>4.39**</td>
</tr>
</tbody>
</table>

Note. SD = Standard Deviation; GBQ = Gamblers’ Beliefs Questionnaire; GCI = Gambling Cognitions Inventory

*p < .05, **p < .001.

Logistic Regression Analysis to Predict Online Poker Play

To further substantiate the above findings, a logistic regression analysis was conducted to determine the relative contribution of variables differentiating online and
offline gamblers related to game play, perception of skill and cognitive distortions. All assumptions of logistic regression analyses were tested including ratio of cases to variables, linearity of the logit, multicollinearity and outliers. In accordance with conventional rules for identifying multicollinearity, all tolerance values were less than 0.1 and no Variance Inflation Factors values were greater than 10 (Myers, 1990). A test of the full model with seven predictors (empirical skill, empirical winnings, empirical luck, perceived poker skill, rating of game play, GBQ, GCI) against a constant only model was statistically reliable, \( \chi^2(7, N = 278) = 34.12, p < .001 \). The model correctly classified 67% of gamblers (43% Internet gamblers; 83% non-Internet gamblers) indicating that the final model is superior to the 60.1% predicted from the constant only model (100% non-Internet gamblers). Table 7 shows regression coefficients with standard errors, odds ratios and p-values for the predictors. Empirical skill (computer measure) was not an independent contributor to predicting Internet gambling. Additionally, empirical luck, empirical money (won/lost) during the game, and the perception of how well the gamblers thought they played the game did not differentiate the two groups. Two factors that did significantly differentiate Internet from non-Internet gamblers were general gambling-related cognitions (GBQ) and their subjective rating of poker skill.
Table 7

*Logistic Regression Analysis for Predicting Internet Poker Players (n = 111) from non-Internet Poker Players (n = 167)*

<table>
<thead>
<tr>
<th>Variable</th>
<th>B(SE)</th>
<th>Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Empirical skill</td>
<td>0.32(0.68)</td>
<td>1.37</td>
</tr>
<tr>
<td>Empirical winnings</td>
<td>0.23(0.34)</td>
<td>1.26</td>
</tr>
<tr>
<td>Empirical luck</td>
<td>-0.28(0.44)</td>
<td>0.76</td>
</tr>
<tr>
<td>Perceived poker skill</td>
<td>0.22(0.10)</td>
<td>1.25*</td>
</tr>
<tr>
<td>Skill rating (game specific)</td>
<td>-0.012(0.11)</td>
<td>0.089</td>
</tr>
<tr>
<td>GBQ</td>
<td>0.02(0.01)</td>
<td>1.02*</td>
</tr>
<tr>
<td>GCI</td>
<td>0.00(0.01)</td>
<td>1.00</td>
</tr>
</tbody>
</table>

*Note. $R^2 = .12$ (Cox & Snell), .16 (Nagelkerke). Model $\chi^2(7) = 34.12, p < .001$. GBQ = Gamblers' Beliefs Questionnaire; GCI = Gambling Cognitions Inventory.*

*$p < .05$.*

**Empirical Skill vs. Perceived Skill among Internet Gamblers**

Analyses were conducted to determine the factors contributing to a.) empirical skill and b.) perceived poker skill among online gamblers. Investigated variables included demographics, play-related variables, gambling cognitions and problem gambling severity. Two separate regression analyses (empirical skill and perceived skill) were run to determine the contribution of the following variables: gender, age, ethnicity, frequency of land-based poker play, duration of play, age first played, GBQ, GCI and PGSI. Table 8
shows that none of the investigated variables predict empirical skill among online gamblers \( F(10, 105) = 1.61, p = .115 \), although ethnicity and gender appear to be approaching significance. Conversely, Table 9 shows that gambling in land-based formats and playing for longer periods of time significantly influenced the perception of poker skill for Internet gamblers, \( F(10, 105) = 5.37, p < .001 \).
Table 8

*Multiple Regression Analysis for Variables Predicting Empirical Skill (n = 105)*

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>SE B</th>
<th>β</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>-0.08</td>
<td>0.05</td>
<td>-.18</td>
</tr>
<tr>
<td>Age</td>
<td>0.01</td>
<td>0.01</td>
<td>.10</td>
</tr>
<tr>
<td>European</td>
<td>0.13</td>
<td>0.07</td>
<td>.30</td>
</tr>
<tr>
<td>Asian</td>
<td>0.01</td>
<td>0.07</td>
<td>.02</td>
</tr>
<tr>
<td>Land-based poker (freq)</td>
<td>0.01</td>
<td>0.01</td>
<td>.08</td>
</tr>
<tr>
<td>Duration of play (min)</td>
<td>0.00</td>
<td>0.00</td>
<td>.00</td>
</tr>
<tr>
<td>Age first played</td>
<td>0.00</td>
<td>0.01</td>
<td>.01</td>
</tr>
<tr>
<td>GBQ</td>
<td>-0.00</td>
<td>0.00</td>
<td>-.17</td>
</tr>
<tr>
<td>GCI</td>
<td>0.00</td>
<td>0.00</td>
<td>.12</td>
</tr>
<tr>
<td>PGSI</td>
<td>0.00</td>
<td>0.01</td>
<td>.06</td>
</tr>
</tbody>
</table>

*Note. R² = .15. GBQ = Gamblers' Beliefs Questionnaire; GCI = Gambling Cognitions Inventory; PGSI = Problem Gambling Severity Index*
Table 9

*Multiple Regression Analysis for Variables Predicting Perceived Skill (n = 105)*

<table>
<thead>
<tr>
<th>Variable</th>
<th>B</th>
<th>SE B</th>
<th>β</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gender</td>
<td>-0.27</td>
<td>0.27</td>
<td>-0.09</td>
</tr>
<tr>
<td>Age</td>
<td>-0.04</td>
<td>0.08</td>
<td>-0.05</td>
</tr>
<tr>
<td>European</td>
<td>-0.03</td>
<td>0.40</td>
<td>-0.01</td>
</tr>
<tr>
<td>Asian</td>
<td>-0.49</td>
<td>0.39</td>
<td>-0.17</td>
</tr>
<tr>
<td>Land-based poker (freq)</td>
<td>0.14</td>
<td>0.05</td>
<td>0.28*</td>
</tr>
<tr>
<td>Duration of play (min)</td>
<td>0.01</td>
<td>0.00</td>
<td>0.28*</td>
</tr>
<tr>
<td>Age first played</td>
<td>-0.10</td>
<td>0.06</td>
<td>-0.17</td>
</tr>
<tr>
<td>GBQ</td>
<td>-0.01</td>
<td>0.01</td>
<td>-0.09</td>
</tr>
<tr>
<td>GCI</td>
<td>0.02</td>
<td>0.01</td>
<td>0.19</td>
</tr>
<tr>
<td>PGSI</td>
<td>0.01</td>
<td>0.05</td>
<td>0.01</td>
</tr>
</tbody>
</table>

*Note. R² = .36. GBQ = Gamblers' Beliefs Questionnaire; GCI = Gambling Cognitions Inventory; PGSI = Problem Gambling Severity Index*

*p < .01.

*Post-Hoc Analysis*

An additional post-hoc analysis was conducted to further elucidate the relationship between gambling involvement, cognitive distortions and Internet gambling. In study 1 and
2, a pattern has emerged that appears to implicate the above variables as contributing factors to problem gambling severity. Namely, level of gambling involvement and cognitive distortions have repeatedly emerged as significant independent contributors. The overarching question in this research project was to determine whether online gambling could be a causal indicator for problem severity or whether gambling online has an accumulative contribution to gambling problems. In order to further delineate the contribution of gambling on the Internet to level of involvement and cognitive distortions, a final hierarchical regression analysis was completed. Model 1 included level of involvement (frequency of land-based poker play, average duration of play), model 2 included cognitive variables (poker skill rating, GBQ, GCI) and model 3 included level of involvement in Internet poker. Table 10 demonstrates that, similar to study1, level of involvement in land-based poker activities, $F(3, 263) = 44.19$, $p < .001$, ($R^2 = .34$) and cognitive distortions, $F(6, 260) = 40.01$, $p < .001$, ($R^2 = .48$) significantly contribute to problem gambling severity. Model 3 shows that adding Internet poker into the equation has a small but significant contribution to the model fit, $F(7, 259) = 35.42$, $p < .001$, $R^2 = .49$. 
<table>
<thead>
<tr>
<th>Variable</th>
<th>B(SE B)</th>
<th>β</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Model 1</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poker with friends and family (freq)</td>
<td>0.76(0.13)</td>
<td>.42***</td>
</tr>
<tr>
<td>Poker at a casino (freq)</td>
<td>0.48(0.15)</td>
<td>.21**</td>
</tr>
<tr>
<td>Average duration of poker play (min)</td>
<td>0.00(0.00)</td>
<td>.02</td>
</tr>
<tr>
<td><strong>Model 2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poker with friends and family (freq)</td>
<td>0.52(0.12)</td>
<td>.29***</td>
</tr>
<tr>
<td>Poker at a casino (freq)</td>
<td>0.32(0.13)</td>
<td>.14*</td>
</tr>
<tr>
<td>Average duration of poker play (min)</td>
<td>0.00(0.00)</td>
<td>-.01</td>
</tr>
<tr>
<td>Poker skill rating</td>
<td>-0.04(0.10)</td>
<td>-.02</td>
</tr>
<tr>
<td>GBQ</td>
<td>0.04(0.01)</td>
<td>.28**</td>
</tr>
<tr>
<td>GCI</td>
<td>0.03(0.01)</td>
<td>.18*</td>
</tr>
<tr>
<td><strong>Model 3</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Poker with friends and family (freq)</td>
<td>0.45(0.12)</td>
<td>.25***</td>
</tr>
<tr>
<td>Poker at a casino (freq)</td>
<td>0.26(0.14)</td>
<td>.12</td>
</tr>
<tr>
<td>Average duration of poker play (min)</td>
<td>0.00(0.00)</td>
<td>-.01</td>
</tr>
</tbody>
</table>
Poker skill rating -0.05(0.10) -.03
GBQ 0.04(0.01) .27**
GCI 0.03(0.01) .18*
Poker on the Internet (freq) 0.23(0.11) .12*

Note. $R^2 = .33$ for model 1; $\Delta R^2 = .15$ for model 2 ($p < .001$); $\Delta R^2 = .01$ for model 3 ($p < .001$). GBQ = Gamblers' Beliefs Questionnaire; GCI = Gambling Cognitions Inventory.

* $p < .05$, ** $p < .01$, *** $p < .001$.

Discussion

The results of study 1 and 2 support the hypothesis that Internet gamblers perceive themselves to be more skilled and exhibit higher levels of gambling-related cognitive distortions when compared to non-Internet gamblers. This elevated level of perceived skill was demonstrated despite showing no superiority in poker ability. In both studies, level of gambling involvement was related to distortions and to problem gambling severity. It appears that high levels of gambling involvement, distorted thinking around perceptions of control and the Internet as an additional medium of play are involved in contributing to gambling severity. Problem gamblers were more likely to perceive themselves as skilled. This finding substantiates previous research showing that problem gamblers have an exaggerated sense of their own skill (Toneatto et al., 1997).

Griffiths et al. (2009) showed that problem gambling in a student sample of online poker players was associated with increased frequency of play and longer durations of play. Similarly, in the current studies, frequency of play in various formats was related to
problem gambling severity. The hierarchical multiple regression in study 1 revealed that adding Internet gambling to the equation accounted for a small addition in variance in problem gambling severity. Thus, after accounting for frequency of play, Internet gambling has a further effect on contributing to problematic behaviour. For games like poker where players already demonstrate an inflated sense of control, (Myresth, et al., 2010) the online element appears to have an additive effect on such perceptions.

Shead et al. (2008) found that poker players who favoured gambling in a casino or online had more gambling problems when compared to those who play with family or friends. Poker players who reported gambling predominantly for the skill factor spent a higher proportion of time playing online compared to players who preferred it for the socialization aspect. Similarly, Cotte and Latour (2009) highlighted that the players in their qualitative sample who preferred online gambling described engaging in play because of the skill-base component, control and competitive nature of play. It may be that online gamblers enjoy moving away from the socialization aspect of the game because it allows them to focus more intently on the game. The asocial nature of Internet gambling is a valid concern. This shift from a social to a solitary activity is especially detrimental to those susceptible to problem gambling. Research has demonstrated that problem gamblers are more likely to play in isolation and to report that, at the height of their addiction, they did the majority of their gambling alone (e.g., Griffiths, 1995). Gamblers in the Cotte and Latour (2009) study described playing for longer periods of time online because of a feeling of power and control in the environment. Unlike the casino, there are less external stimuli for distraction, the surroundings are familiar and the player has command over the pace and timing of play. Oxymoronically, it may be that Internet gamblers are susceptible
to developing problems because they experience a greater subjective sense of control in gambling situations.

Is it possible that an inflated sense of skill could lead to financial success? Certainly from an entrepreneurial perspective, success may be generally achieved through confidence in one’s abilities. Griffiths et al. (2010) found that financial success in online poker was associated with disciplined play (e.g., staying to a budget), playing at higher stakes, not overestimating the skill involved in poker and having a self-perception of being skilled. Similarly, in a study of Internet poker players commissioned by eCOGRA (2007b), financial success was associated with the perception of skill. Given the self-report nature of the data, it would be difficult to determine whether the players were legitimately experiencing financial success. There are a number of complicating issues involved in teasing out the factors that might facilitate drawing accurate conclusions about the relationship between skill and financial success.

First, it is inherently confounding that self-perceptions of skill are likely directly derived from a players (perhaps inaccurate) recall of monetary output. We know from previous studies that recall of money won/lost can be inaccurate (Volberg, et al., 1998; Williams & Wood, 2004a; Wood & Williams, 2007a). Most salient to this point are the results from study 1 where most players claimed to be making a profit; a highly unlikely reality for the majority of undergraduate students. Furthermore, online gamblers in the current study were more likely to perceive themselves as skilful and be willing to play the opponent for money despite having just lost against that opponent.
The second issue is the question of how we define skill. According to researchers in the CPRG, monetary output for poker matches is a highly variable and unreliable indicator of skill and many possible factors could be inclusive in the definition. Skill could encompass knowing which games have higher odds, understanding the rules of the game, having certain strategies or systems, making smaller wagers on a higher amount of hands over time, strategic timing of entering the game, choice of opponents, or playing at more tables so competitors gain less information. The current study only employed an operational definition of skill as a relative measure against a single opponent. When we expand the definition of skill, there may be some validity to players experiencing success. Moreover, the gamblers in the current investigation played against a computer opponent and there may be elements of skill that only exist in live situations or applicable to games with other online players.

The third related confound is that the chance vs. skill nature of poker makes subjective interpretations of skill prone to the fundamental attribution error. The combination of an actual skill and luck component in games like poker changes the nature of the possible attributions in a game situation. For example, players may possess a certain amount of skill that allows them to be successful up to a point where after relative skill is lower than competing players. Given that poker has a degree of variance in outcomes anyway (i.e., an inferior player can sometimes beat a superior player), a less skilled player may initially attribute losses to variable, external factors such as a bad hand. This losing situation may continue for an extended period of time and be attenuated by intermittently reinforcing wins. Moreover, it has been demonstrated that being adaptive to strategy changes enhances one’s ability to be successful in poker (Dedonno & Detterman, 2008).
Strategic changes may provide additional opportunities for success. After a certain point, it will probably become apparent to the player that he is relatively less skilled but at the cost of financial losses.

If online gamblers perceive themselves to be more skilled, playing on the Internet may serve as a means to subjectively hone skills by attending exclusively to the game in the absence of feedback or transparency. In examining specific questions on the GBQ, the items with the largest mean discrepancy between Internet and non-Internet gamblers were those related to perceived gambling skills (e.g., “I have more skills and knowledge related to gambling than most people who gamble”), monetary gain (e.g., “In the long run, I will win more money than I will lose gambling”) or a combination of the two (e.g., “My knowledge and skill in gambling contribute to the likelihood that I will make money”). This inflated sense of skill in the absence of salient feedback countering such beliefs could make Internet gamblers particularly intransigent to cognitive treatment strategies.

From a treatment perspective, it is more difficult to address games like poker because the chance component is equivocal. What is commonly referred to as “primary illusory control” (beliefs in the able to control outcomes) is not completely illusory when players can influence the game. Wohl et al. (2005) found that individuals who had problems with games that contained a skill component (such as poker) had more negative beliefs about seeking treatment than those who had problems with games of chance (e.g., slot machines). It appears anecdotally that there is a milieu of bravado around poker that does not exist with other gambling forms that is undoubtedly influenced by the sensationalized nature of the game. The stereotype of an avid poker player is qualitatively different from that of a chronic VLT player. As a speculative observation, it maybe the case
that poker players have unrealistic expectancies about future winnings because of their assumptions of perceived skill and control. Without contrary feedback about the true nature of their ability, it would be easy for gamblers to disregard intervention strategies that highlight erroneous perceptions.

A valuable follow-up study would be to employ a similar methodology to study 2 but add a feedback component. Participants could be informed that the computer program has the capability to assess their skill and they could receive feedback about where their skill level falls relative to other players. It would be of interest to try a variety of messages to determine whether certain feedback is more effective in changing both subsequent game play and distortions. It is also of note that the gamblers in study 2 played a relatively strong computer opponent because less hands were required to reach optimal reliability in responding (i.e., a mediocre opponent would have led to more variability in play). In such, the majority of players lost the simulated game. A variety of opponent skill levels might have been an advantageous covariate to identify a wider range of post-play responses.

General Discussion

The overarching objective in these studies was to elucidate reasons why Internet gamblers are more likely to be problem gamblers. Akin to previous research, in study 1 the sample of Internet gamblers were more likely to have gambling problems with a mere 15% categorized as non-problem compared to 46% of the sample who did not wager online. Various analyses were conducted throughout the investigation to look at variables contributing to Internet gambling and factors associated with problem severity. One of the
main areas of interest was to tease out the relative influence of gambling on the Internet with variables associated with the individual. Previous research has demonstrated an association between gambling expansion and increased problems at a population level (Shaffer, Hall, & VanderBilt, 1997). Correspondingly, the greater availability and accessibility of gambling provided through the Internet could be directly related to the higher levels of problems seen among this population.

The results indicate that the relationship is complex and multifaceted. Participation in numerous gambling activities (including more offline activities) contributed to participation in Internet gambling, as was being in an ethnic category that was not Caucasian and having more gambling-related distorted cognitions. Further evidence for the role of involvement and distortions came from a hierarchical analysis showing that play variables and distorted beliefs contributed to a greater degree of problem severity among Internet gamblers. Thus, it may be the case that people who choose to gamble on the Internet are already experiencing problems or gambling at a level that could be indicative of developing problems. The Internet as an alternative gambling option may present a particularly hazardous additional forum to access opportunities for this high-risk population.

The tenants behind such a supposition are in line with the distribution of consumption model whereby problem gambling is highly skewed to the right in the frequency distribution of a population of gamblers and increases in availability will most heavily impact the tail end of the distribution (Chipman, Govini, & Roerecke, 2006). In other words, a small number of individuals are gambling at a level that is substantially more than the consumption level of the typical population and these individuals will be most susceptible to developing problems. According to the model, factors combine in a
multiplicative fashion (as opposed to additive) whereby problem gamblers will be impacted at a level that is more substantial than the general population. Non-problem or gamblers with moderate problems may experience minimal impact from the advent of Internet gambling whereas problem gamblers may be susceptible to harm in an exponential fashion. The factors in the present study that appeared to have the strongest combined influence were distorted beliefs around perceived control and heavy gambling involvement. The joint effects of these two risk factors may put gamblers with higher problem severity at greater risk for being impacted by an online medium. The finding that 99% of online gamblers also wager in land-based formats and less than three percent had their first gambling experience online adds support to a speculative assumption that those participants that gamble online were already heavy consumers.

An additional compound to problem susceptibility could be the ubiquitous presence of poker play among online gamblers. Research has shown that irrational beliefs exist around games that are ostensibly governed by chance (Toneatto et al., 1997). Thus interpretive biases with Internet gamblers may be especially difficult to combat. If cognitions can moderate the relationship between risky practices and gambling intensity as previous research has demonstrated (Miller & Currie, 2008), then the relative intractable nature of beliefs among Internet gamblers could exacerbate their vulnerability. The belief in a superior skill base in the absence of an actual proficiency is a factor of consideration. Internet gamblers may believe that they are ameliorating game play through repeated losses. In as such, they may view persistence in the face of financial failure as fortitude and sacrifice to hone their skills. It is conceivable that even professional poker players would meet criteria for pathological gambling at points in their career. With other addictive behaviours such as alcohol or drug use, there is no possibility of a successful outcome with
increased use. Conversely in poker, pre-occupation and chasing are routinely endorsed through the sensationalism of the most adept players.

In the final regression analysis, it was determined that adding an online component to poker play had a small but significant impact on severity. The percentage of variance accounted for beyond the individual and play factors was minimal ($\Delta R^2 = .01$). When individuals play with friends and family they may be more inclined to gradually attenuate play. In examining the results in their entirety, it appears that heavily involved gamblers with an inflated sense of perceived control are attracted to the Internet wherein there is the potential for symptom exacerbation. How then, do we protect gamblers from the potential the Internet has to intensify symptom severity?

Online gambling presents a unique challenge for researchers, treatment providers and policy makers. Prohibition and a corresponding lack of regulatory standards could perpetuate unfair and illegal business practices and increased prevalence and problem gambling rates with a lack of responsible gambling guidelines. Alternatively, legalization could permit for economic benefits and consumer protection. Regulation would allow for checks into the provider to guarantee that sites are legitimate and fair, would help ensure that underage gamblers are not permitted to wager money, and would offer various safeguards for problem gamblers. Moreover, Internet technology could render prohibition futile (for a discussion of legalization vs. prohibition of Internet gambling see Wood & Williams, 2008). Accessibility and increased potential for frequency of play makes the proliferation of Internet gambling a viable concern. In a review of the evidence for the prevention of problem gambling Williams, West, and Simpson (2007b) concluded that policy initiatives were effective in offsetting harm resulting from legalized gambling. In as such, the future of Internet gambling is a societal issue that will require policy initiatives
and an overarching public health perspective. It is important that Internet gambling is considered within the full context of the interplay of individual and sociological factors.

**Limitations**

An obvious limitation in these studies is the generalizability of the findings. Although an undergraduate sample provides benefits (less treatment related confounds, higher levels of Internet gambling involvement, shorter gambling histories), the corollary is the associated drawbacks. Undergraduates tend to be younger than the general population and previous research has shown the average age of Canadian Internet gamblers to be 36 years old (Wood & Williams, 2009). Undergraduates would also have a lower average income compared to a general population sample of Internet gamblers. An income discrepancy could affect the results in terms of expenditures and negative consequences. Moreover, undergraduate students may experience less harmful ramifications in familial and vocational responsibilities than players in their 30’s.

One of the drawbacks experienced through the collaboration of the two universities was the loss of a large number of participants because of design requirements. It was important to protect the confidentiality of students from the University of Calgary so successful completion of the study required a series of steps. It was necessary to have students enter a code at all stages so student names would not be linked to data collected at the University of Alberta. Many participants inaccurately followed the directions or incorrectly entered their code at one or all of the segments. A loss of participants was expected prior to the commencement of the study so more data were collected to obviate problems in this eventuality. Of benefit to the research is that data from the remaining sample are likely more valid.
The reliability of the expenditure variable was a significant limitation to developing a full picture of the Internet gambler. A primary area of interest was to investigate beliefs around the perception of success as a gambler wherein monetary outcomes are an integral component. Examining actual play in collaboration with the tools provided by the CPRG provided a useful means to measure skill but it would have been beneficial to acquire other valid measures of actual play. For example, it would be useful to have participants provide researchers with information for their online accounts that would detail winnings and expenditures. Unfortunately, for the current study, it was unclear how to reliably obtain such information.

A final limitation in this study is the trade off between depth and breadth. Gambling behaviour is comprised of a complex array of interacting variables that are difficult to study simultaneously but less rich to study in isolation. Study 1 was an effort to investigate a range of variables thought to be potential contributors to Internet gambling. Study 2 sought to gain more depth in the identified factors of interest. Even within an analysis of one gambling form (poker) and with limited variables, there existed confounds in interpretation. Similarly, there was a trade off between the quantitative analysis, which afforded a large number of participants at the expense of a more in depth analysis of the participants.

Implications

The Internet now has the potential to exacerbate a range of behaviours including pornography, gaming and shopping. As gambling moves out of the Impulse Control Disorders and into Addiction and Related Disorders in the fifth edition of Diagnostic and Statistical Manual of Mental Disorders (Petry, 2010), it presents an opportunity for other
behavioural excesses to be considered for inclusion. Given the substantial amounts of research into gambling relative to other possible inclusionary behaviours, gambling researchers are in a position to influence the conceptualization of “behavioural addictions”. Moreover, the contribution of the Internet in perpetuating gambling problems can be understood within the context of research existing both before and after the advent of computer technology.

In the past, policy decisions regarding the legality of various gambling modalities have been made with little social or empirical input or influence. Given that the Criminal Code makes it illegal to gamble within Canada unless the activity falls under the jurisdiction of the provinces and territories, the future of Internet gambling in Canada remains in kind of legal purgatory (for a discussion see Mackay, 2004). Such caution on the part of the government provides a unique opening for researchers to gather evidence that can inform policy not yet established.

Internet gambling also presents a unique means to be able to identify problem gamblers. During sessions of Internet play, data are being collected at a rapid and consistent rate in a way that has never been possible before. Sites track demographic information about players because it is required for opening an account. Play is then linked to individual statistics on expenditures, frequency, duration, and time of day when play occurs. Individuals who may be experiencing gambling problems or are at risk of developing problems can be potentially identified through available statistics. The information collected by Internet gambling providers could be used in a way to provide prevention and intervention resources for gamblers. Such initiatives would require collaborations between online gambling providers, researchers and treatment agencies.
While such a partnership may seem idealistic, it is already underway. Recent research is using this data as a means to better understanding gambling behaviour (LaBrie, LaPlante, Nelson, Schumann, & Shaffer, 2007; LaPlante, Schumann, LaBrie, & Shaffer, 2008; Lloyd et al., 2010), problem gambling (LaBrie & Shaffer, 2011) and harm reduction strategies (Broda et al., 2008; Nelson et al., 2008).

From a public health standpoint, legalization and promotion of new gambling forms should be epistemologically based in factual information about the potential harmful effects. Research into land-based gaming has demonstrated that it is the interplay of various risk factors that coalesce to precipitate a progression to disordered gambling. Comprehensive research must address the factors that evoke transitions from healthy to disordered gambling at an individual and population level. As we have already witnessed, new forms of technology have the capacity to considerably change the way people gamble. It is hoped that this research will be a starting point to understanding some of the unique factors influencing online gamblers.


Hodgins, D. C. (2005). *What is the impact of gambling availability on gambling problems?*


Miller, N. V., & Currie, S. R. (2008). A Canadian population level analysis of the roles of irrational gambling cognitions and risky gambling practices as correlates of
gambling intensity and pathological gambling. *Journal of Gambling Studies, 24*, 247-274.


SPSS Inc. (2009). SPSS (Version 17.0) [Computer software]. Chicago, IL: SPSS.


APPENDIX A

Consent Form Study 1

Investigators: Terri-Lynn MacKay, Doctoral Candidate, Department of Psychology, University of Calgary, and David C. Hodgins, Ph.D., Associate Professor, Department of Psychology, University of Calgary.

Study Title: Gambling among university students

This study has been approved by the University of Calgary Conjoint Faculties Research Ethics Board and the Psychology department of the University of Calgary. The student researcher involved in this project, Ms. Terri-Lynn MacKay, is under the supervision of Dr. David Hodgins in the Psychology Department.

Participation in this study is completely voluntary. This consent form is only part of the process of informed consent. It should give you the basic idea of what the research project is about and what your participation will involve. If you would like more detail about something mentioned here, or information not included here, you should feel free to email Terri-Lynn MacKay at tlmackay@ucalgary.ca or Dr. David Hodgins at dhodgins@ucalgary.ca. Please take the time to read this carefully and to understand any accompanying information.

What is the purpose of the study?
The researchers are examining the gambling behaviour of university students.

What will I be asked to do?
Participation involves completing an online questionnaire concerning gambling behaviour, beliefs about gambling, personality characteristics, leisure activities and demographic variables. You will be asked to answer questions in response to these descriptions. Total time required for participation will be half an hour. Please note that it is possible to withdraw from the study at any time without penalty.

What type of personal information will be collected?
Participants are asked to provide their name and student number to ensure receipt of credit; however, this information will only be seen by the principle investigator, and will only be used to ensure you get credit.

Are there risks or benefits if I participate?
In exchange for your participation in this study, you will receive 0.5 psychology course credits with the University of Calgary. There are no anticipated risks to participants. Benefits of participating in this study include exposure to graduate level university research and an opportunity to learn what such a project might entail. At the completion of the study you are welcome to ask any questions you might have about the project. Your participation may also benefit others. The results of this study may be useful in gaining an understanding of gambling behaviours and help researchers and clinicians design prevention and treatment programs.
What happens to the information I provide?
Your questionnaire and test responses will be kept confidential and your participation in this study will be completely anonymous. No personal information will be made available to the public that may identify you in any way. Once credit has been received, your name and student number will be deleted from the data file and you will simply be assigned a random participant number. The data file will be electronically stored without identifying information and only the investigators will have access. The data file will be kept for a period of no longer than 10 years. All data will be reported in aggregate form.

Results will be available in April, 2009. Results of this study will be published in the form of a thesis document. The author also intends to discuss these results at a psychological conference and publish them in a professional journal. Should you be interested in the results please contact Ms. Terri-Lynn MacKay and she will be happy to send you information once the study is complete.

What does clicking “I consent to participate” mean?
Clicking “I consent to participate” indicates that you have understood to your satisfaction the information regarding participation in the research project and agree to participate. In no way does this waive your legal rights nor release the investigators, sponsors, or involved institutions from their legal and professional responsibilities. You are free to withdraw from the study at any time without penalty. If at any time you wish to discontinue the survey simply exit the questionnaire and any information they have provided up to that point will be destroyed and will not be used in the study. If you choose to withdraw your consent, you may contact the researcher and you will still receive credit. Furthermore, if you do not wish to participate but have questions you may close the page and contact the researcher at tlmackay@ucalgary.ca.

Participation in this study is part of your educational experience in the Psychology Department. In exchange for your time you should expect to gain some understanding of research and some of the ideas currently being explored in psychology. If, after the study, you feel you have not gained sufficient educational benefit, or have other concerns regarding this experience, you may register any concerns with Dr. Tavis Campbell (t.s.campbell@ucalgary.ca or 220-7490), Chair: Psychology Department Ethics Committee (Human Participants). He will insure that your comments are acted upon with no fear that you will be identified personally.

If you have questions concerning matters related to this research, please contact Terri-Lynn MacKay at tlmackay@ucalgary.ca or Dr. David Hodgins at dhodgins@ucalgary.ca. If you have any questions or issues concerning this project that are not related to the specifics of the research, or if you have any concerns about the way you’ve been treated as a participant, you may also contact Bonnie Scherrer, Ethics Resource Officer, Research Services Office, University of Calgary at (403) 220-3782; email bonnie.scherrer@ucalgary.ca.
APPENDIX B

Demographics

Age________
Gender________

Current Marital Status
a.) Single_______
b.) Married_______
c.) Divorced_______
d.) Common-law_______
e.) Separated_______
f.) Widowed_______

Living Arrangements
a.) Alone_______
b.) With family_______
c.) Other________
d.) With roommates_______
e.) With spouse_______

Are you enrolled as a full-time or part-time student?
a.) Full-time_______
b.) Part-time_______

How many years have you attended university (including this year)?_______

What is your major?_______

Current employment status
a.) Employed full-time_______
b.) Employed part-time_______
c.) Disability/EI_______
d.) Unemployed_______
e.) Retired_______

Current income
a.) Under 10,000________ e.) 40,000-50,000________
b.) 10,000-20,000________ f.) 50,000-60,000________
c.) 20,000-30,000________ g.) 60,000-70,000________
d.) 30,000-40,000________ h.) more than 70,000________

Ethnicity

Ethnic origin pertains to ancestral identity or background and should not be confused with citizenship or nationality. If you have multiple ethnic origins, then please select the one that you most strongly identify with.

a.) European (including British Isles) _______
b.) East Asian (e.g. China, Hong Kong, Korea, Japan) _______
c.) South Asian (e.g. India, Pakistan, Bangladesh) _______
d.) Middle Eastern _______
e.) African _______
f.) Latin, Central, and South American _______
g.) Pacific Islands (e.g. Philippines, Hawaii) _______
h.) Caribbean _______
i.) Aboriginal _______
Other (please specify) _______________________

How important is religion/spirituality in your life?

a.) Not at all important_______
b.) Not very important_______
c.) Neither important or not important (neutral)_______
d.) Somewhat important_______
e.) Very important_______
In the last 12 months, how often have you attended religious services?

a.) Never
b.) About once a year

c.) About 2 to 3 times a year
d.) About once a month
e.) About 2 to 3 times a month
f.) At least once a week

What political orientation would best describe yours?

a) Far Right
b) Conservative
c) Middle of the Road
d) Liberal
e) Far Left
f) Other or none
APPENDIX C

Problem Gambling Severity Index

Some of these questions may not apply to you but please try to be as accurate as possible.

THINKING ABOUT IT IN THE LAST 12 MONTHS how often have you……..

1.) Bet more than you could really afford to lose?
   Never
   Sometimes
   Most of the time
   Almost always

2.) Needed to gamble with larger amounts of money to get the same feeling of excitement?
   Never
   Sometimes
   Most of the time
   Almost always

3.) Gone back another day to try to win back the money you lost?
   Never
   Sometimes
   Most of the time
   Almost always

4.) Borrowed money or sold something to get money to gamble?
   Never
   Sometimes
   Most of the time
   Almost always

5.) Felt that you might have a problem with gambling?
   Never
   Sometimes
   Most of the time
   Almost always

6.) Been criticized about you betting or been told that you had a gambling problem, regardless of whether or not you though it was true?
   Never
   Sometimes
   Most of the time
   Almost always

7.) Felt guilty about the way you gamble or what happens when you gamble?
   Never
Sometimes
Most of the time
Almost always

8.) Found that gambling caused you any health problems, including stress or anxiety?
Never
Sometimes
Most of the time
Almost always

9.) Found that your gambling has caused any financial problems for you or your household?
Never
Sometimes
Most of the time
Almost always
APPENDIX D

Gamblers’ Beliefs Questionnaire

Read each of the following statements carefully. Rate to what extent you agree or disagree with each statement by circling a number from 1 (strongly agree) to 7 (strongly disagree).

1.) I think of gambling as a challenge.

strongly agree  strongly disagree
1 2 3 4 5 6 7

2.) My knowledge and skill in gambling contribute to the likelihood that I will make money.

strongly agree  strongly disagree
1 2 3 4 5 6 7

3.) My choices or actions affect the game on which I am betting.

strongly agree  strongly disagree
1 2 3 4 5 6 7

4.) If I am gambling and losing, I should continue because I don’t want to miss a win.

strongly agree  strongly disagree
1 2 3 4 5 6 7

5.) I should keep track of previous winning bets so that I can figure out how I should bet in the future.

strongly agree  strongly disagree
1 2 3 4 5 6 7

6.) When I am gambling, “near misses” or times when I almost win remind me that if I keep playing I will win.
strongly agree   strongly disagree
           1    2    3    4    5    6    7

7.) Gambling is more than just luck.

strongly agree   strongly disagree
           1    2    3    4    5    6    7

8.) My gambling wins are evidence that I have skill and knowledge related to gambling.

strongly agree   strongly disagree
           1    2    3    4    5    6    7

9.) I have a “lucky” technique that I use when I gamble.

strongly agree   strongly disagree
           1    2    3    4    5    6    7

10.) In the long run, I will win more money than I will lose gambling.

strongly agree   strongly disagree
           1    2    3    4    5    6    7

11.) Even though I may be losing with my gambling strategy or plan, I must maintain that strategy or plan because I know it will eventually come through for me.

strongly agree   strongly disagree
           1    2    3    4    5    6    7

12.) There are certain things I do when I am betting (for example, tapping a certain number of times, holding a lucky coin in my hand, crossing my fingers, etc.) which increase the chances that I will win.
strongly agree  strongly disagree
   1       2 3 4 5 6 7

13.) If I lose money gambling, I should try to win it back.
strongly agree  strongly disagree
   1       2 3 4 5 6 7

14.) Those who don’t gamble much don’t understand that gambling success requires dedication and a willingness to invest some money.
strongly agree  strongly disagree
   1       2 3 4 5 6 7

15.) Where I get money to gamble doesn’t matter because I will win and pay it back.
strongly agree  strongly disagree
   1       2 3 4 5 6 7

16.) I am pretty accurate at predicting when a “win” will occur.
strongly agree  strongly disagree
   1       2 3 4 5 6 7

17.) Gambling is the best way for me to experience excitement.
strongly agree  strongly disagree
   1       2 3 4 5 6 7
18.) If I continue to gamble, it will eventually pay off and I will make money.

<table>
<thead>
<tr>
<th>strongly agree</th>
<th>strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1   2   3   4   5   6   7</td>
<td></td>
</tr>
</tbody>
</table>

19.) I have more skills and knowledge related to gambling than most people who gamble.

<table>
<thead>
<tr>
<th>strongly agree</th>
<th>strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1   2   3   4   5   6   7</td>
<td></td>
</tr>
</tbody>
</table>

20.) When I lose at gambling, my losses are not as bad if I don’t tell my loved ones.

<table>
<thead>
<tr>
<th>strongly agree</th>
<th>strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1   2   3   4   5   6   7</td>
<td></td>
</tr>
</tbody>
</table>

21.) I should keep the same bet even when it hasn’t come up lately because it is bound to win.

<table>
<thead>
<tr>
<th>strongly agree</th>
<th>strongly disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1   2   3   4   5   6   7</td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX E

Gambling Fallacies Scale

1.) Which of the following sets of Lottery numbers has the greatest probability of being selected as the winning combination?
   a.  1,2,3,4,5,6
   b.  14,43,5,32,17,47
   c.  Each of the above have an equal probability of being selected

2.) What gives you the best chance of winning the jackpot on the slot machine?
   a.  Playing a slot machine that has not had a jackpot in over a month
   b.  Playing a slot machine that had a jackpot an hour ago
   c.  Your chances of winning are the same on both machines

3.) How lucky are you? If 10 people’s names were put into a hat and one name drawn for a prize, how likely is it that your name would be chosen?
   a.  About the same likelihood as everyone else
   b.  Less likely than other people
   c.  More likely than other people

4.) If you were to buy a lottery ticket, which would be the best place to buy it from?
   a.  A place that has sold many previous winning tickets
   b.  A place that has sold few previous winning tickets
   c.  One place is as good as the other

5.) A positive attitude increases your likelihood of winning money when playing bingo or slot machines?
   a.  Disagree
   b.  Agree

6.) A gambler goes to the casino and comes out ahead 75% of the time. How many times has he likely gone to the casino?
   a.  4 times
b. 100 times

c. It is just as likely that he has gone 4 or 100 times

7.) You go to the casino with $100 hoping to double your money. Which strategy gives you the best chance of doubling your money?
   a. Betting all your money on a single bet
   b. Betting small amounts of money on several different bets
   c. Either strategy gives you an equal chance of doubling your money

8.) Which game can you consistently win money at if you use the right gambling strategy?
   a. Slot machines
   b. Roulette
   c. Bingo
   d. None of the above

9.) Your chances of winning a lottery are better if you are able to choose your own numbers?
   a. Disagree
   b. Agree

10.) You are on a betting hotstreak. You have flipped a coin and correctly guessed “heads” 5 times in a row. What are the odds that heads will come up on the next flip? Would you say…
   a. 50%
   b. More than 50%
   c. Or less than 50%
APPENDIX F

Alcohol Use Disorders Identification Test

1. How often do you have a drink containing alcohol?
   Never (skip to q’s 9-10)
   a.) Monthly or less
   b.) 2-4 times a month
   c.) 2-3 times a week
   d.) 4 or more times a week

2. How many drinks containing alcohol do you have on a typical day when you are drinking?
   a.) 1 or 2
   b.) 3 or 4
   c.) 5 or 6
   d.) 7 to 9
   e.) 10 or more

3. How often do you have five or more drinks on one occasion?
   a.) Never
   b.) Less than monthly
   c.) Monthly
   d.) Weekly
   e.) Daily or almost daily

4. How often during the last year have you found that you were not able to stop drinking once you had started?
   a.) Never
   b.) Less than monthly
   c.) Monthly
   d.) Weekly
   e.) Daily or almost daily

5. How often during the last year have you failed to do what was normally expected from you because of drinking?
   a.) Never
   b.) Less than monthly
   c.) Monthly
   d.) Weekly
   e.) Daily or almost daily

6. How often during the last year have you needed a first drink in the morning to get yourself going after a heavy drinking session?
   a.) Never
   b.) Less than monthly
7. How often during the last year have you had a feeling of guilt or remorse after drinking?
   a.) Never
   b.) Less than monthly
   c.) Monthly
   d.) Weekly
   e.) Daily or almost daily

8. How often during the last year have you been unable to remember what happened the night before because you had been drinking?
   a.) Never
   b.) Less than monthly
   c.) Monthly
   d.) Weekly
   e.) Daily or almost daily

9. Have you or someone else been injured as a result of your drinking?
   a.) No
   b.) Yes, but not in the last year
   c.) Yes, during the last year

10. Has a relative, friend, doctor or any other health worker been concerned about your drinking or suggested you cut down?
    a.) No
    b.) Yes, but not in the last year
    c.) Yes, during the last year
APPENDIX G

Drug Abuse Screening Test (DAST-10)

The following questions concern information about your possible involvement with drugs not including alcoholic beverages during the past 12 months. Carefully read each statement and decide if your answer is “Yes” or “No”.

In the statements “drug abuse” refers to (1) the use of prescribed or over the counter drugs in excess of the directions and (2) any non-medical use of drugs. The various classes of drugs may include cannabis (e.g. marijuana, hash), solvents, tranquilizers (e.g. Valium), barbiturates, cocaine, stimulants (e.g. speed), hallucinogens (e.g. LSD, magic mushrooms) or narcotics (e.g. heroin).

Please answer every question. If you have difficulty with a statement, choose the response that is mostly right.

1. Have you used drugs other than those required for medical reasons? .................. Yes No
2. Do you abuse more than one drug at a time? .......................................................... Yes No
3. Are you always able to stop using drugs when you want to?............................... Yes No
4. Have you had "blackouts" or "flashbacks" as a result of drug use? ...................... Yes No
5. Do you ever feel bad or guilty about your drug use? ........................................... Yes No
6. Does your spouse (or parents) ever complain about your involvement with drugs? ........................................................................................................ Yes No
7. Have you neglected your family because of your use of drugs? ......................... Yes No
8. Have you engaged in illegal activities in order to obtain drugs? ......................... Yes No
9. Have you ever experienced withdrawal symptoms (felt sick) when you stopped taking drugs? .......................................................... Yes No
10. Have you had medical problems as a result of your drug use (e.g. memory loss, hepatitis, convulsions, bleeding, etc.)?.............................. Yes No
# APPENDIX H

**Liebowitz Social Anxiety Scale**

<table>
<thead>
<tr>
<th>Fear or Anxiety:</th>
<th>Avoidance:</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 = None</td>
<td>0 = Never (0%)</td>
</tr>
<tr>
<td>1 = Mild</td>
<td>1 = Occasionally (1—33%)</td>
</tr>
<tr>
<td>2 = Moderate</td>
<td>2 = Often (33—67%)</td>
</tr>
<tr>
<td>3 = Severe</td>
<td>3 = Usually (67—100%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Statement</th>
<th>Fear/Anxiety</th>
<th>Avoidance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Telephoning in public.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Participating in small groups.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Eating in public places.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. Drinking with others in public places.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Talking to people in authority.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Acting, performing or giving a talk in front of an audience.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Going to a party.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Working while being observed.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Writing while being observed.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Calling someone you don’t know very well.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>11. Talking with people you don’t know very well.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>12. Meeting strangers.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>14. Entering a room when others are already seated.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Being the center of attention.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>16. Speaking up at a meeting.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>17. Taking a test.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. Expressing a disagreement or disapproval to people you don’t know very well.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>19. Looking at people you don’t know very well in the eyes.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20. Giving a report to a group.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>21. Trying to pick up someone.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>22. Returning goods to a store.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>23. Giving a party.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>24. Resisting a high pressure salesperson.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX I

Barratt Impulsiveness Scale

Please rate each of the following statements on the following 4-point scale:

1 = rarely/never
2 = occasionally
3 = often
4 = almost always/always

1. I plan tasks carefully.
2. I do things without thinking.
3. I make up my mind quickly.
4. I am happy-go-lucky.
5. I don’t “pay attention”.
6. I have “racing” thoughts.
7. I plan trips well ahead of time.
8. I am self-controlled.
9. I concentrate easily.
10. I save regularly.
11. I “squirm” at plays or lectures.
12. I am a careful thinker.
13. I plan for job security.
15. I like to think about complex problems.
16. I change jobs.
17. I act “on impulse”.
18. I get easily bored when solving thought problems.
19. I have regular health check ups.
20. I act on the spur of the moment.
21. I am a steady thinker.
22. I change residences.
23. I buy things on impulse
24. I can only think about one problem at a time.
25. I change habits.
26. I walk and move fast.
27. I solve problems by trial and error.
28. I spend or charge more than I earn.
29. I talk fast.
30. I often have extraneous thoughts when thinking.
31. I am more interested in the present than the future.
32. I am restless at the theatre or lectures.
33. I like puzzles.
34. I am future oriented.
APPENDIX J

Debriefing Form Study 1

Thank you for participating in this study on gambling behaviours. This research constitutes the PhD dissertation of Terri-Lynn MacKay, and your contribution to this research is greatly appreciated.

The researchers were seeking to determine whether there are differences between students that gamble on the Internet and those that do not. There is evidence to suggest that Internet gambling may cause more problems for people than gambling in land-based establishments. It is unclear whether this is because the Internet games have aspects that make them more addictive or whether there are individual differences in people that choose to gamble online.

Thank you once again for your participation. If you would like to learn more about Internet gambling, there are some relevant references listed below. If you are interested in the results of this study you may contact Terri-Lynn MacKay (210-9500; tlmackay@ucalgary.ca) who will arrange to send you information when the study is complete. Please also contact her if you should have any questions or concerns regarding this research. Questions and interest are welcomed, and any concerns you might have are important to the researchers.

If you have any questions or issues concerning this project that are not related to the specific aspects of the research, or if you have any concerns about the way you’ve been treated as a participant, you may also contact Bonnie Scherrer, Ethics Resource Officer, Research Services Office, University of Calgary at (403) 220-3782; email b.scherrer@ucalgary.ca.

Finally, participating in this study may have triggered concerns that you may have a gambling problem. If you think you may have a gambling problem there is help available. Please call the Alberta gambling help line, which is anonymous and confidential at 1-800-665-9676. Additionally, if for any reason you have experienced any distress as a result of your participation in this study, I would like to advise you that the university offers a confidential counselling service to all current students. Students may receive three sessions free per academic year. The Counselling Centre is located in the MacEwan Student Centre – Room 375 and will accept either walk-in appointments or appointments made by telephone (220-5893).

Websites
Online gambling: http://www.gamcare.org.uk/pages/online.html

References

APPENDIX K

Post Poker Play Questions

1.) Which statement do you agree with the most?
   a.) I should have won more, my opponent got lucky.
   b.) I should have lost more, I got lucky.
   c.) Neither, luck was about even.

2.) Which statement do you agree with the most?
   a.) I was the better player.
   b.) My opponent was the better player.
   c.) Neither, we were both equally skilled.

3.) How well do you think you played?

<table>
<thead>
<tr>
<th>Poor</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4.) How well do you feel your opponent played?

<table>
<thead>
<tr>
<th>Poor</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

5.) Do you think you could beat this opponent?

<table>
<thead>
<tr>
<th>Never</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Always</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

6.) I would play this opponent for money?

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Disagree</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

7.) I would expect to win against this opponent in the long run?

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Disagree</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

8.) On the whole, I played better than my opponent?

<table>
<thead>
<tr>
<th>Strongly Agree</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Strongly Disagree</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
9.) If you were to play another 100 hands, how much money do you think you would win/lose?
APPENDIX L

Gambling Cognitions Inventory

The following statements contain thoughts and opinions that people have about gambling. Please choose the answer that best describes how much you agree with each statement.

1=Strongly Agree
2= Somewhat Agree
3= Somewhat disagree
4= Strongly Disagree

1. After losing, people should go back to win back the money they lost
2. I am certain that my time for a big win is soon
3. Although I am upset when I lose, I use it as a learning opportunity to improve my gambling
4. I am a very skilled gambler
5. I can sense when I am going to win
6. I am surprised at how much money I seem to have spent gambling
7. I am very confident about my gambling ability
8. I can analyze my wins to give me strategies to make me a better gambler
9. I lose because the probability of winning is extremely low
10. After losing, I know I can win back the money I lost.
11. I can stay ahead or keep even by winning back money I have lost
12. I can tell when I am lucky or I am having a lucky day, and that is a good day to gamble
13. When I gamble, I know my chances of winning are extremely low
14. It is good to look for special signs that might help a person win
15. I lose because I am having a bad or unlucky day
16. I need to keep a positive attitude to help me win at gambling
17. Repeating certain phrases or thoughts to myself will give me good luck
18. People should take advantage of times when they have good luck, and gamble more
19. I tell myself losing is my fault
20. I try not to dwell on my losses and focus on my wins
21. I try to associate with people who win at gambling, who I think are lucky
22. I try to figure out why I lost
23. A winning attitude will improve my chances in gambling
24. If I use special rituals, I can avoid bad luck
25. I will get better at gambling with practice
26. If I don’t have good connection with the slot machine or VLT, I’m more likely to lose
27. If I forget a certain special item at home, I wouldn’t be as lucky while gambling
28. If I have negative thoughts, it contributes to my bad luck and losses
29. The more I lose, the closer I am to winning
30. If you are having a losing streak, you should keep gambling
31. In roulette, a good strategy is to bet on numbers (or suits or colours) that have not come up recently, as they are due to win
32. Staying at the same machine increases my chances of winning
33. The more skilled at gambling I become, the more money I expect to win
34. There are certain strategies that can help people win on a slot machine
35. There is no reason for winning; it is completely random
36. When I look back at my gambling, I am surprised by the number of times I lost
37. When I win at gambling, I know that it is just a fluke
38. You have a better chance of becoming rich by gambling than by working
39. You must work hard at gambling to be able to do well
40. In a lottery, all numbers have the same chance of winning
APPENDIX M

Consent Form Study 2

Investigators: Terri-Lynn MacKay, Doctoral Candidate, Department of Psychology, University of Calgary, David C. Hodgins, Ph.D., Associate Professor, Department of Psychology, University of Calgary, and Michael Bowling, Ph.D., Associate Professor, Department of Computing Science, University of Alberta.
Study Title: Poker play among university students

This study has been approved by the University of Calgary Conjoint Faculties Research Ethics Board and the Psychology department of the University of Calgary. The student researcher involved in this project, Ms. Terri-Lynn MacKay, is under the supervision of Dr. David Hodgins in the Psychology Department. This study is a collaboration between the University of Calgary and the Computing Science department at the University of Alberta.

Participation in this study is completely voluntary. This consent form is only part of the process of informed consent. It should give you the basic idea of what the research project is about and what your participation will involve. If you would like more detail about something mentioned here, or information not included here, you should feel free to email Terri-Lynn MacKay at tlmackay@ucalgary.ca (phone: 403-210-9500) or Dr. David Hodgins at dhodgins@ucalgary.ca (phone: 403-220-3371). Please take the time to read this carefully and to understand any accompanying information.

What is the purpose of the study?
The researchers are examining poker play among university students. The purpose is to investigate the relationship between cognitive distortions and poker play using a poker interface with a low-variance analysis estimator of player skill.

What will I be asked to do?
Participation involves completing an online questionnaire concerning demographics, gambling behaviour, beliefs about gambling and poker play. The online survey is being administered by SurveyMonkey©, an American software company. As such, your responses are subject to U.S. laws, including the USA Patriot Act. The risks associated with participation are minimal, however, and similar to those associated with many e-mail programs, such as Hotmail© and social utilities spaces, such as Facebook© and MySpace©.” You will then be asked to play Texas hold’em poker against a computer opponent and answer some questions about your poker play. Total time required for participation will be approximately one hour. Please note that it is possible to withdraw from the study at any time without penalty.

What type of personal information will be collected?
Participants are asked to provide their name and e-mail address in order to receive credit. You will also be asked to provide your e-mail in order to receive a computer key code to the survey and poker game. The code will be automatically sent to you via e-mail. Your name and e-mail will be removed from the file when data collection is complete. If you choose to give consent,
your e-mail address will be retained for the purposes of a gift draw where winners will be contacted via e-mail.

**Are there risks or benefits if I participate?**
In exchange for your participation in this study, you will receive 1.0 psychology course credits with the University of Calgary. In addition, you will be eligible to receive one of 2, $100 gift certificates for the University of Calgary Bookstore. There are no anticipated risks to participants. Benefits of participating in this study include exposure to graduate level university research and an opportunity to learn what such a project might entail. At the completion of the study you are welcome to ask any questions you might have about the project. Your participation may also benefit others. The results of this study may be useful in gaining an understanding of gambling behaviours and help researchers and clinicians design prevention and treatment programs.

**What happens to the information I provide?**
Your responses will be kept confidential and your participation in this study will be completely anonymous. No personal information will be made available to the public that may identify you in any way. All data will be reported in aggregate form. Once credit has been received, your name will be deleted from the data file and you will simply be assigned a random participant number. The data file will be electronically stored without identifying information and only the investigators will have access. Researchers from the University of Alberta will have access to the poker play data. This data will only be identifiable by a computer key. Once data collection is complete, this data will be transferred and housed at the University of Calgary. If you choose to withdraw, your data will be removed from the data file. The final data file will be kept for a period of no longer than 10 years and then it will be destroyed.

Results will be available in September 1010. Results of this study will be published in the form of a thesis document. The author also intends to discuss these results at a psychological conference and publish them in a professional journal. Should you be interested in the results please contact Ms. Terri-Lynn MacKay and she will be happy to send you information once the study is complete.

**What does clicking “I consent to participate” mean?**
Clicking “I consent to participate” indicates that you have understood to your satisfaction the information regarding participation in the research project and agree to participate. In no way does this waive your legal rights nor release the investigators, sponsors, or involved institutions from their legal and professional responsibilities. You are free to withdraw from the study at any time without penalty. If you choose to withdraw your consent, you may contact the researcher and you will still receive credit. Furthermore, if you do not wish to participate but have questions you may contact the researcher at tlmackay@ucalgary.ca.

Participation in this study is part of your educational experience in the Psychology Department. In exchange for your time you should expect to gain some understanding of research and some of the ideas currently being explored in psychology. If, after the study, you feel you have not gained sufficient educational benefit, or have other concerns regarding this experience, you may register any concerns with Dr. Tavis Campbell (t.s.campbell@ucalgary.ca or 220-7490), Chair:
Psychology Department Ethics Committee (Human Participants). He will insure that your comments are acted upon with no fear that you will be identified personally.

If you have questions concerning matters related to this research, please contact Terri-Lynn MacKay at tlmackay@ucalgary.ca or Dr. David Hodgins at dhodgins@ucalgary.ca. If you have any questions or issues concerning this project that are not related to the specifics of the research, or if you have any concerns about the way you’ve been treated as a participant, you may also contact Russell Burrows, Ethics Resource Officer, Research Services Office, University of Calgary at (403) 403-220-3782; email: rburrows@ucalgary.ca.
APPENDIX N

Debriefing Form Study 2

Thank you for participating in this study on poker play among university students. This research constitutes a portion of the PhD dissertation of Terri-Lynn MacKay and your contribution to this research is greatly appreciated. The researchers were seeking to determine whether individuals accurately assess their poker skills. The University of Alberta’s Computer Poker Research Group developed the game you were playing and the program is able to separate much of the luck from the skill component of poker.

Thank you once again for your participation. If you would like to learn more about poker play in North America there are some relevant references listed below. If you are interested in the results of this study you may contact Terri-Lynn MacKay (210-9500; tlmackay@ucalgary.ca) who will arrange to send you information when the study is complete. Please also contact her if you should have any questions or concerns regarding this research. Questions and interest are welcomed, and any concerns you might have are important to the researchers.

If you have any questions or issues concerning this project that are not related to the specific aspects of the research, or if you have any concerns about the way you’ve been treated as a participant, you may also contact Russell Borrows, Ethics Resource Officer, Research Services Office, University of Calgary at (403) 403-220-3782; email: rburrows@ucalgary.ca.

Finally, participating in this study may have triggered concerns that you may have a gambling problem. If you think you may have a gambling problem there is help available. Please call the Alberta gambling help line, which is anonymous and confidential at 1-800-665-9676. Additionally, if for any reason you have experienced any distress as a result of your participation in this study, I would like to advise you that the university offers a confidential counselling service to all current students. Students may receive three sessions free per academic year. The Counselling Centre is located in the MacEwan Student Centre – Room 375 and will accept either walk-in appointments or appointments made by telephone (220-5893).

Websites
Online gambling: http://www.gamcare.org.uk/pages/online.html

References


Appendix O

*Intercorrelations Between Variables in Study 2*

<table>
<thead>
<tr>
<th>Variable</th>
<th>Internet Gambling</th>
<th>Perceived Poker Skill</th>
<th>GBQ</th>
<th>GCI</th>
<th>Game specific rating</th>
<th>Empirical Skill</th>
<th>Empirical Winnings</th>
<th>Empirical Luck</th>
</tr>
</thead>
<tbody>
<tr>
<td>Internet Gambling</td>
<td>1.00</td>
<td>.253**</td>
<td>.299**</td>
<td>.255**</td>
<td>-.028</td>
<td>.087</td>
<td>-.050</td>
<td>-.081</td>
</tr>
<tr>
<td>Perceived Poker Skill</td>
<td></td>
<td></td>
<td>.432**</td>
<td>.382**</td>
<td>.147*</td>
<td>.258**</td>
<td>.061</td>
<td>-.053</td>
</tr>
<tr>
<td>GBQ</td>
<td></td>
<td></td>
<td>.816**</td>
<td>.032</td>
<td>.020</td>
<td>-.025</td>
<td>-.139*</td>
<td></td>
</tr>
<tr>
<td>GCI</td>
<td></td>
<td></td>
<td>.105</td>
<td>.023</td>
<td>-.019</td>
<td></td>
<td>-.056</td>
<td></td>
</tr>
<tr>
<td>Game specific rating</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.131*</td>
<td>.461**</td>
<td>.445**</td>
</tr>
<tr>
<td>Empirical Skill</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.253**</td>
<td>-.017</td>
<td></td>
</tr>
<tr>
<td>Empirical Winnings</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>.633**</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Empirical Luck</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1.00</td>
<td></td>
</tr>
</tbody>
</table>

*Note. GBQ = Gamblers’ Beliefs Questionnaire; GCI = Gambling Cognitions Inventory*

*p < .05, **p < .001.