

Final Report
**Special Problems in Gambling: Attention Deficit Hyperactivity
Disorder (ADHD) and Pathways to Problem Gambling**

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Table of Contents

Executive Summary	3
Introduction	7
Method	10
Results	14
Discussion	53
Theoretical Models	60
Implications	60
References	61

Executive Summary

In this study, a number of variables putatively linked to gambling were examined through a combination of testing and analytical techniques. First, responses from self-described social gamblers were collected via an extensive questionnaire. Second, attention span and impulsivity was tested using a computer software package. Thirdly, genetic analysis was performed on blood samples taken from the participants. Data were analyzed using factor analysis, as well as a statistical modelling technique known as LISREL analysis.

The recruitment effort invited people who were self-described social gamblers to participate. However, consistent with previous experience by the investigators, the study attracted gamblers representing the full spectrum of gambling involvement, from non-problem social gamblers to people with severe gambling problems.

The overall aim of the investigation was to develop a quantified picture of the factors that lead people into problem gambling. Specifically, we examined the link between impulse control disorders, such as Attention Deficit Hyperactivity Disorder (ADHD), and problem gambling.

The present study was heavily influenced by the work of Alex Blaszczynski (1998), who proposed a general model postulating the existence of different “pathways” which lead people into excessive gambling. The contribution of the current study is that it provides quantified data measuring the influence of these paths within the framework of Blaszczynski’s historically important pathways model. Additionally, the study closely explores the overlap between impulsivity and gambling disorders.

Main Findings:

Problem gamblers were not significantly more likely than non-problem gamblers to have had an early history of gambling involvement. This finding contradicts the widely held conception that exposure to gambling during the teenage years (or earlier) predisposes individuals to acquire a gambling problem later in life. What appears to be more important in the development of an interest in gambling is the actual experience of winning itself. However, to turn an interest into a problem often also requires the addition of stressful life events, poor coping skills, or impulsivity. Both the timing and the size of the win were associated with problem gambling. The definition of what constituted “big” varied among gamblers, but on average there was very little difference between what problem and non-problem gamblers felt was a big win.

Other Notable Findings:

- 1. Distorted self-perceptions:** Many problem gamblers tended to diminish the meaning and significance of their gambling behaviour. More than half of the surveyed problem gamblers (30 out of 54) considered themselves to be social gamblers while only 22 correctly identified themselves as either problem or pathological gamblers.
- 2. Lottery and scratch tickets:** The most popular forms of gambling were lottery and scratch tickets. These activities were among the most frequently mentioned by gamblers irrespective of the severity of their gambling involvement. After a probe of this issue it was found that few appreciated the overwhelming odds against winning, even during an entire lifetime. The fact that problem gamblers listed lottery and scratch tickets as among their most favoured activities contradicts the stereotype that these are benign forms of gambling.
- 3. Games favoured by problem gamblers:** Certain activities showed highly significant correlations with gambling-problem severity. Gamblers with the most severe gambling

problems were most likely to be spending time playing slot machines, casino table games, bingo, lotteries, or scratch tickets.

- 4. Playing strategies reflect intensity of involvement in gambling:** Problem gamblers tended not to set limits when they gambled, and even if they did, they rarely adhered to them. They also reported not quitting at a set time, and often gambled until closing time, or for as long as possible. Also, they often gambled beyond the point when they felt tired or bored, and preferred to play alone rather than in the company of friends.
- 5. Effect of early big wins:** Gamblers who experienced sizeable wins early in their gambling career were most likely to develop gambling problems later on. A loss followed by a big win was associated with gambling problems. Although a big win early in one's gambling career was a prominent feature in problem gambling, there was evidence that psychological factors (i.e., the attitudes toward the entire experience of gambling) were also important in the development of a gambling problem. People with gambling problems are convinced that they can beat the odds and will win big again. The role of attitudinal factors was further evidenced by the findings that continued gambling is reinforced not only by winning, but also by losses and by breaking even.
- 6. Combined effect of multiple precursors:** Big wins alone are sometimes sufficient to produce a gambling problem, though the majority of problem gamblers appear to have been influenced by more than one risk factor. Also, the greater the number of risk factors, the more likely the individual will develop a gambling problem.
- 7. Problem and non-problem gamblers have similar reactions to winning:** Winning is a positive experience for most gamblers irrespective of the severity of their gambling problem. All groups reported that winning made them feel happy, excited, and gave them a rush. However, problem gamblers were more likely than non-problem gamblers to report that wins raised their self-esteem.
- 8. Life stress is a precursor for many problem gamblers:** Problem gamblers tended to have more stressful life experiences in the year before they started to gamble compared to non-problem gamblers. Problem gamblers were also more likely than other gamblers to have reported histories of personal and family drug and/or alcohol abuse, difficulty at school, high stress levels, or a problematic romantic relationship (or the lack of a romantic relationship). We also had people plot their mood on a graph across their life-span and confirmed that problem gamblers were more likely to have been unhappy in their youth compared to non-problem gamblers. However, a substantial number of problem gamblers did not report any history of pre-morbid unhappiness. This finding was consistent with evidence (see point 10 and 16 below) that there are subgroups of problem gamblers. This issue is not sufficiently recognized in the gambling literature.
- 9. Problem gamblers tend to be anxious, impulsive and depressed:** Psychometric testing revealed positive correlations among the various personality traits and problem gambling. Problem gamblers had elevated profiles on impulsivity, depression, and several measures of stress or anxiety. High scores on a combination of these traits within a single gambler were progressively associated with more serious gambling problems. These variables were highly

correlated with each other, and together accounted for about 40% of the variance of problem gambling.

- 10. There are subgroups of problem gamblers. Stress is not the only precursor:** A stressful life event was reported by 31% of the respondents, while 23% reported that everything was going well. Stress plays a role in problem gambling, but does not explain all instances of problem gambling. In some cases, problem gambling can develop in the absence of stressful life experiences. A total of 50% of problem gamblers endorsed statements relating to “stressful life events” and/or “life going nowhere”. That is, 50% of the problem gamblers were “unhappy” before their problem began, leaving 50% that were apparently “happy”.
- 11. Problem gamblers use “escape” as a coping mechanism:** One of the strongest effects found in this study was that problem gamblers relied on escape as one of their primary coping styles. Escape coping was also negatively correlated with knowledge of randomness, suggesting a close relationship between erroneous beliefs and escape coping.
- 12. ADHD and associated conditions:** Current symptoms of ADHD, Oppositional Defiant Disorder (ODD), and Conduct Disorder (CD) were all highly correlated with the probability of having a gambling problem. Approximately 20% of problem gamblers were found to reach criterion for ADHD. However, the roles of impulsivity and ADHD as precursors to problems with gambling were found to be even more important when the variables were treated as continuous rather than categorical. Specifically, using this transformation we found elevated impulsivity scores in approximately 50% of the problem gamblers. These two figures (20% and 50%) should therefore be thought of as upper and lower estimates for the role of ADHD. However, the higher estimate (50%) includes a lot of false positives (non-problem gamblers), so it should not be taken too seriously. It is likely that sub-clinical impulsivity is not normally associated with problem gambling unless it is combined with other factors (emotional, or cognitive/behavioural)
- 13. Dissociated states:** Dissociation is a transient mental state described as a sense that things are not real, or that one is performing actions in an automatized or disconnected manner. Problem gamblers report having these experiences more often than non-problem gamblers, although the experiences of dissociative states interacted with context. Problem gamblers were significantly more likely to report dissociating while gambling, but only slightly more likely to report dissociating during a non-gambling activity. Borderline gamblers fell somewhere in-between the problem and non-problem gamblers in terms of the frequency of reporting these experiences.
- 14. Genetics:** We also examined the influence of three genes on problem gambling (*drd4*, *COMT NlaIII*, *DAT VNTR*) but failed to find any evidence of their effects, either individually or in aggregate, on the likelihood of developing a gambling problem. Based on the data in the present study, we are unable to support the hypothesis that these specific genes play more than a small role in problem gambling. More research is needed in this area, specifically focussing on the idea that a variety of different genes, rather than any one specific gene, might influence problem gambling. We speculate that this influence is indirect, possibly mediated by a disruption of the normal functioning of the (dopaminergic) reward system.

- 15. Personality:** We found that problem gamblers scored higher than other gamblers on impulsivity, but not on thrill seeking. On the Temperament and Character Inventory (TCI), problem gamblers scored much lower on self-directedness and cooperativeness, but much higher on harm avoidance, novelty seeking, and self-transcendence compared to other gamblers. This composite suggests that many problem gamblers might be viewed as “armchair adventurers” (i.e., those who seek stimulating, but not physically threatening experiences). Self-transcendence appears to be related to superstitious beliefs.
- 16. Clusters:** We used personality measures to conduct a cluster analysis and found that there are at least 2 distinct groups of problem gamblers. Several of the effects described above are related to these different subgroups. For example, there appears to be one subgroup of problem gamblers who are superstitious and thrill seekers. The other subgroup is depressed, anxious, and harm-avoidant. Still, others score within the ‘normal’ range on most of these variables. These findings may suggest why researchers looking for an addictive or gambling personality have had so little success. Problem gamblers are not a unitary group, but form different subgroups.
- 17. Structural equation modeling:** Structural equation modeling was used to test different models of problem gambling. The findings suggest that about half of the variance of problem gambling can be explained by the combination of escape coping and pre-morbid misery. Random-events knowledge was found to operate through escape coping, rather than having a direct effect on problem gambling.
- 18. Pathways:** The investigators acknowledge their intellectual debt to the pioneering work of Alex Blaszczynski, who has hypothesized the existence of different pathways that lead people into problem gambling. Overall, the findings provide general support for this model. Our study however, made several new contributions to our knowledge of how problem gambling develops. We found, for instance, a considerable overlap among the pathway variables. That is, individuals often had high scores on variables related to more than one pathway. The findings suggest an association between the number of factors present and the likelihood of developing a gambling problem. Personal vulnerability owing to psychogenic or life history factors, combined with environmental experience (early big wins), beliefs, and opportunities to gamble, were the major pathways related to problem gambling.

Introduction

Views of Problem Gambling

Problem gambling is a disorder that centers on excessive involvement in gambling. The disorder is often called an addiction because of the large number of similarities between drug addiction and problem gambling. Some problem gamblers begin gambling at an early age (e.g., 14 years old) and gradually escalate to larger bets and greater risks. Other people begin gambling as a social activity when a casino opens nearby. For most people, the enjoyment of the gambling experience is closely linked to the opportunity to affiliate with others. However, for the problem gambler it is gambling itself which assumes paramount importance. Increasingly, gambling becomes a preoccupation, which progressively takes up greater amounts of time and financial resources. While the problem gambler is actively playing, the initial excitement and thrill are often replaced by mounting desperation as he tries to win back what he has lost. Symptoms of problem gambling include frequent betting, long hours of play, chasing losses, making progressively larger bets, entering into a trance-like state while gambling, guilt interspersed between arguments over money and gambling, lying, cheating, and borrowing to make "just one more bet". Problem gamblers sometimes engage in illegal activities to finance their addiction, including fraud, cheating, and embezzlement. Problem gambling is usually a progressive disorder, although untreated recovery is also common. Problem gamblers often have low self-esteem, are damaged by an inability to control their own behaviour, and have a growing awareness of how badly their life has been disrupted by their gambling problem.

Etiology

Currently there is a wide divergence of theory and opinion about the etiology of problem gambling. This is evident when one considers even the terms used to describe the condition: addicted, compulsive, pathological, problem, diseased, erroneous cognitions, or on tilt. Throughout this report, we will use the term problem gambler because it is a-theoretical. Problem gamblers are people whose gambling behaviours cause them problems. When we use the term "problem gambling" we are referring to clinically significant levels of problematic gambling. That is, a problem gambler is someone who has been unable to control their gambling or has suffered consequences as a result of their gambling. However, problem gambling actually refers to a continuum from very severe to relatively minor problems. In most of our analyses we will treat problem gambling as a continuous variable, but it is often useful to simply group people into problem and non-problem gamblers. When we treat problem gambling as a categorical variable, we will refer to sub-clinical levels of problem gambling as "borderline" problem gambling.

Theories of problem gambling range from socialization to genetics. Some theories have emphasized learning and experience, while others have focused on the avoidance of negative affect, or have given erroneous beliefs a key role. Still, other theories focus on the role of personality, and some have postulated that physiological and genetic predispositions are responsible (see Griffiths, 1995, for a review).

Recent genetic studies have suggested that familial factors play an important role in susceptibility to the disorder. A study of 3,359 monozygotic and dizygotic twin pairs with a history of gambling demonstrated that inherited factors account for 35-54% of the liability for five symptoms of pathological gambling (Eisen et al., 1998). Other work investigating the role of potential candidate genes have similarly pointed to a genetic component in the etiology of gambling (Comings et al., 1996; Comings et al., 1999; Perez de Castro et al., 1999; Ibanez et al., 2000). After carrying out a meta-analysis of genetic research, Blum et al. (1995) concluded that convincing

evidence existed of an association between polymorphisms of the DRD2 receptor gene and certain impulsive-addictive-compulsive behaviours (IACB's), including pathological gambling, Attention Deficit Hyperactivity Disorder (ADHD), alcoholism, obesity, drug dependency, and smoking, which they termed a "reward deficiency syndrome".

In contrast, B. F. Skinner (1953) presented a behavioural theory of gambling addiction noting the similarity between slot machine play and the operant conditioning of rats in Skinner boxes. Still, other theories have emphasized social norms, deviance, and availability as keys to understanding the problem. A number of Canadian researchers have also made major contributions to the development of theories of gambling addiction. Rina Gupta and Jeffery Derevensky (e.g., Derevensky, Gupta, & Herman, 1997), for example, have argued that gambling addiction results from a need to escape from stress, and have provided evidence in support of physiological and emotional predisposition theories. Their views are closely aligned with Durrant Jacobs' (1986) general theory of addiction. In contrast, Robert Ladouceur (e.g., Ladouceur, et al., 1991) has argued that gambling addiction is the result of misunderstandings about the nature of probability. Griffiths (1995) reviewed the various theories of gambling addiction and concluded that the most promising approach was an eclectic view which considered gambling from a variety of perspectives. In support of this view, Turner and Liu (1999) have found that some problem gamblers report experiencing early wins, supporting the behavioural theory (i.e., Skinner, 1953), while other gamblers report gambling to escape (i.e., Jacobs, 1986), and still others exhibit errors in their reasoning, supporting cognitive theories (i.e., Ladouceur, et al, 1991). It is likely that each of these theories is a partial answer to the question. A key contribution of this study will be an examination of how these factors work together to produce problematic gambling.

Impulsivity and ADHD

ADHD, according to the Diagnostic and Statistical Manual, fourth edition (DSM-IV: APA, 1994), is the most common psychiatric disorder in childhood. Outcome studies (Weiss et al., 1985; Barkley et al., 1993) have suggested that ADHD persists beyond adolescence and has a probable prevalence rate of around 3-5% in the adult population. Its three main impairing symptoms are impulsivity, inattention, and motor hyperactivity. Some research appears to support the conclusion that impulsivity is at the core of all other manifestations of ADHD behaviour and is biologically based. Neuropsychological studies suggest that individuals with ADHD may have their most salient difficulties in the areas of organizing, preparing, and inhibiting responses. Neurobiologic studies suggest that the circuitry involving frontal cortical-basal ganglia connections may be structurally or functionally different in individuals with ADHD, although the specificity of these findings has not been researched thoroughly (see Mercugliano, 1999, for a review). Evidence from family, twin and adoption studies has shown that ADHD has an underlying genetic predisposition (Goodman and Stevenson, 1989; Gillis et al., 1992; Levy et al., 1997). Different molecular genetics studies have been conducted on child ADHD (reviewed in Thapar et al., 1999), including our Adult ADHD clinic at the CAMH, in the Adult ADHD patients (Muglia et al., 2000a; Muglia et al., 2000b; Muglia et al., 2000c). A recent meta-analysis of association studies conducted on ADHD (Faraone et al., in press) has shown a high rate of replications implicating involvement of the 7-repeat allele of the DRD4 receptor gene with the disorder.

The Overlap of ADHD with Problem Gambling

Problem gambling is sometimes viewed as an impulse control disorder and several recent studies have found apparent commonalities between its severest forms and ADHD. Specker et al. (1995) examined the occurrence of impulse control disorders and ADHD in 40 pathological

gamblers and found significant correlations with compulsive buying and compulsive sexual behaviour. Symptoms of ADHD were seen in 20% of the participants. Other research supporting a possible association between pathological gambling and ADHD is based on subtle electroencephalogram (EEG) deficits found in pathological gamblers, such as deficits in task-appropriate hemispheric differentiation, which seem to parallel those found in children with ADHD (Carlton et al., 1987; Goldstein et al., 1985). Carlton and others obtained retrospective self-report data concerning childhood behaviours from 14 pathological gamblers and 16 controls showing strong correlations between pathological gambling and childhood behaviours related to ADHD (Carlton et al., 1987). Rugle and Melamed (1993) compared pathological gamblers with controls and found that pathological gamblers did significantly worse on measures of higher order attention and reported more childhood behaviours related to ADHD, which was confirmed by collateral data. Carlton et al. (1994) examined whether impulsivity differentiated 12 recovering pathological gamblers from 15 controls using the Barrat Impulsivity Scale and found that the gamblers were significantly more impulsive. However, the sample sizes used in most of these studies were small and until they are confirmed by a larger number of prospective investigations these findings must be regarded as preliminary.

Nevertheless, problem gambling is often viewed clinically as an impulse disorder. In fact, the DSM-IV categorizes problem gambling as an impulse control disorder. Labelling problem gambling as an impulse disorder is not accepted by all counsellors (personal communication). Many argue that this label fits a sub-set of problem gamblers, the impulsive gamblers, many of which have ADHD-like symptoms in addition to their gambling problems. These problem gamblers are often the most severe and the most difficult to treat, but exactly what percent of the problem gambling population falls into this group and how important impulsivity is in understanding problem gambling remains unconfirmed.

Blaszczynski's Pathways Model

Alex Blaszczynski (1998) has argued that people develop gambling problems for different reasons. His pathways model posits that there are three pathways which lead people into gambling problems. The first of these are social and cognitive factors that motivate a person to want to gamble. These factors include friends, family or co-workers that gamble, proximity to a casino, the allure of excitement and money, and erroneous beliefs that might lead a person to think he can beat the odds. A key factor in this pathway is a strong positive experience from gambling, such as having a great time and/or winning.

A second pathway is "emotional vulnerability". Depression, hopelessness, frustration and stress are factors that can make a person emotionally vulnerable. A key factor in this pathway is the escape produced by gambling that can help a person forget about his problems.

The final pathway is physiological vulnerability. Blaszczynski (1998) has argued that non-optimal arousal states and an increased need for rewarding activity, such as those found in people with ADHD and related disorders, increase the chances that a person will become hooked by the powerful stimulating effect of gambling. The dopamine system is believed to play a major role in mediating and maintaining rewarding processes (Spanagel and Weiss 1999). Molecular genetic studies have focused interest on this area as the site of candidate genes, whose variability can increase the risk for pathological gambling behaviour (Comings et al., 1996; Perez de Castro et al., 1999; Comings et al., 1999; Ibanez et al., 2000).

The pathways model used in our study is consistent with clinical experience, and different aspects of the model have now been confirmed by previous investigations (see Griffiths, 1995 for a review of theories of gambling). However, little empirical research has been carried out to validate the model or to determine the relative importance of each of the pathways. The present study will

allow us to determine how strongly impulsivity is related to problem gambling, and also functions as an empirical test of Alex Blaszczynski's theoretical model of gambling addiction. Specifically, we are attempting to determine the extent to which the cognitive, social, emotional and physiological pathways explain problem gambling. As a result, the study will help us to understand the relative importance of impulsivity as it relates to gambling. This will allow us to incorporate this knowledge into treatment planning for people with gambling problems and ADHD, as well as determine how much of an emphasis in prevention should be placed on targeting this population (non-impulsive adolescents vs. adolescents with elevated levels of impulsivity, such as those with ADHD).

Goals and Significance of the Present Study

The study had three goals: a) to investigate the link between impulsivity (e.g., ADHD) and problem gambling; b) to determine the degree to which the pathways model is a useful explanatory theory of problem gambling, and; c) to determine the relative importance of each of these pathways in the development of problem gambling.

Hypotheses

The study sought to test the following hypotheses: 1) Impulsivity would account for 10-20% of the variance in the path analysis model of problem gambling; 2) The cognitive, social, and emotional factors would all separately account for a significant amount of the variance associated with problem gambling; 3) When operating *interactively*, the combined effect of the factors would make a greater contribution to the variance than would each factor separately; 4) The genetic component would influence gambling behaviour only indirectly with its principal action being its effect on impulsivity; 5) The direct (separate) influence of the biological variables would have a strength of association with problem gambling equal to that of the cognitive, social, or psychological variables. In addition, we tested the extent to which the pathways were distinct or overlapping. To address this issue, cluster analysis and discriminant function analyses were used to examine the paths that people appear to have followed.

Method

This was a single site study conducted at the Centre for Addiction and Mental Health (CAMH) at the Problem Gambling Service (a program that assesses and treats gamblers as part of the CAMH) and the Clarke Adult ADHD Research Program (a multi-disciplinary program that assesses and treats adults with ADHD) and the Neurogenetics Section (a genetics laboratory which conducts genetic studies of psychiatric disorders).

Research Design

The study used a correlational design. Purposive sampling was utilized for sample selection. Participants had to meet the criteria for social, problem, or pathological gambling as indicated below ("Screening Criteria") and all others were excluded. The measures and data analysis techniques that were employed are also described below.

Sample Size

The sample consisted of 161 people with gambling involvement, ranging from problem to non-problem. A sample of 150 was selected in order to give us sufficient power for an 80% chance of detecting correlations of .24 (moderately small effect size). Due to dropouts and/or disqualification of results, the final sample size was 144 subjects. Although this total is somewhat less than our

recruitment target, this number was still sufficient to allow for an 80% chance of detecting effects as small as .2 (one-tailed, which is legitimate in the case of a-priori predicted results).

An advertisement was placed in the Toronto Sun newspaper for 'social gamblers'. Those who called in response to the ad were pre-screened to ensure that they did in fact gamble.

Screening Criteria

The participants had to be at least 18 years old, and they had to be current gamblers. The final sample included gamblers representing the full spectrum of gambling involvement, from non-problematic social gambling (at least once a month, or in the case of lottery players, at least once a week) to pathological gambling. Recovered gamblers were excluded from the sample since the recovery process might have affected their beliefs, behaviours and attitudes. However, three people who qualified as recovered gamblers did slip through our initial screening process. Their data is shown throughout the text along with the other groups of participants, but little can be said about this gambling subgroup as only three people were included.

Ethics Review

The participants were asked to read and sign an informed consent form that explained the purpose of the study and outlined their rights. Care was taken to ensure the confidentiality of all information. Raw data was stored in a locked filing cabinet. Test forms did not use the names of any participants.

Procedure

People responding to the advertisement were asked about their gambling, and were then either scheduled for an appointment to be tested or their name and phone number were recorded so that we could call back at a later time. Recovered gamblers (not currently gambling) and infrequent gamblers were told that we were currently not testing those groups, but were asked if we could contact them in the future if we were examining those groups. Data from three "recovered" gamblers who slipped through our screening net had little effect on the overall results. In many parts of the results section a recovered problem gambler category is given for the sake of interest.

Measures

This study used structural equation modelling in which the analysis is based on latent constructs rather than observed variables. As such, each of the following sets of variables represents factors that we will be measuring.

Dependent Variables

The dependent measure was problem gambling. This was measured using the South Oaks Gambling Screen (SOGS), phrased in terms of lifetime and past 12 months, a self report version of the DSM-4 for problem gambling, and responses to a set of questions about the harmful consequences of gambling (Turner & Liu, 1999). All of these measures were treated as continuous measures (e.g., number of 'yes' responses). That is, we used the raw scores from each, rather than grouping people into problem vs. non-problem. Lifetime gambling experience was also examined using life charts (see below). In addition, the Gambling Behaviour Questionnaire (Turner & Liu, 1999) was used to determine the games that the participants played.

Cognitive Factor

This factor measured a person's knowledge or understanding of the nature of reality, specifically random events. Previous research has indicated that this construct is negatively related

to problem gambling, with an effect size of around .33 (Turner & Liu, 2000). The measures were: (1) number of years of school completed (education); (2) The Random Events Knowledge Test, developed by Dr. Turner, which measures a person's knowledge of random events (Macdonald & Turner, 2000; Turner & Liu, 1999), and; (3) two questionnaires that we developed asking the respondents about how they play (gambling strategy).

Emotional Factor

Since emotional issues are often the result of problem gambling, we need to be able to isolate mood problems that occurred before vs. after the gambling problem began. This approach is similar to that used by Blaszczynski (personal communication) to determine whether the emotional issues or the gambling came first. To measure the emotional factor we used a negative life experiences checklist (a checklist developed by Turner that is currently being validated) and the Life Experience Timeline Scale, which involves having participants plot changes in their mood, stress, hope, and coping ability over the course of their lives. This scale was developed by Turner and Zangeneh based on earlier work by Koski-Jannes (see Koski-Jannes & Turner, 1999). We also used the Zung Anxiety Scale (Zung, 1971) to measure anxiety as an additional validity test. These scores were then used to compute two factors; current emotional problems and pre-gambling emotional problems. Six other scales were included in the study to measure mood and "emotional vulnerability": The Ways of Coping Questionnaire (Folkman & Lazarus, 1988), depression (Radloff, 1977; see also Robinson, Shaver, & Wrightsman, 1991), social anxiety (Leary, 1983; see also Robinson, et.al, 1991), the PSI (Heppner & Petersen, 1982), the Inventory of Clinical Stress (Abell, 1991), and sociability (Buss & Plomin, 1984).

Behaviour Experiential Factor

The Winning-Experiences Questionnaire, developed by the second author for a previous study, asked the participants a number of questions about their experiences of winning and events surrounding the time when they started gambling.

Impulsivity/ADHD

Five measures of impulsivity were used in the study, including: (1) a test of impulsivity (Barrat, 1987); (2) The Temperament and Character Inventory, which is a 240 item questionnaire that is computer-scored using a T/F format (there are internal mechanisms to test for response authenticity and internal consistency); (3) The Stopsignal Paradigm Test (SSPT: Lassaline and Logan, 1993), and; (4) The Wender Utah Rating Scale (WURS: Ward et al., 1993), which measures ADHD and risk-taking (Zuckerman, 1979). All of these measures have been validated as measures of inattention and impulsive behaviour. It is also important to note that we experienced too many technical problems in using the stop signal test, so we discarded the data.

Physiological Measures

To measure physiological contributions to problem gambling, candidate genes in the dopamine system were tested. Three genes (DRD4, COMT NlaIII, DAT VNTR) were examined to determine if they were associated with problem gambling.

Life Charts

An important part of our research is to determine the likely causal pathways of people. The problem is that most of our questionnaires focuss on a single time frame (e.g., past 12 months). To determine if a person had a pre-existing mood disorder, we needed to measure their mood at various times throughout their life. Having the participants complete a depression questionnaire for each

period of their life would be unmanageable, so instead we had them draw a chart illustrating how their mood and other variables have changed throughout their lives since the age of ten. A simple version of this procedure was used by Hanninen and Koski-Jannes (1999) which focused on people's "turning points". Our approach was to expand this measure by having people complete seven separate charts of changes in their mood and gambling across their lifespan. Respondents were asked to draw a line on a scaled chart to represent their attitudes or feelings (i.e., "happiness", "feeling lucky", "stress", "hopes", etc.) from the age of ten to present day. We must note that the data are retrospective and potentially biased by a person's current mood. By having the participants fill out seven separate charts on related topics, we hoped to obtain a somewhat more accurate view than would be obtained from a single chart. The use of multiple charts also allowed us to test their validity by comparing conceptually related variables (e.g., happiness and stress) from the same person. Due to the lack of pre-existing norms, the life charts from our non-problem gamblers were used for comparative purposes.

Data Analysis & Interpretation

The first stage of data analysis was an examination of the descriptive statistics of gambling, gambling problems, and various gambling related experiences. Secondly, correlational analyses were used to explore the interrelationship of the various sets of variables. We then carried out an exploratory factor analyses of our variables. These explorations culminated in several attempts to quantify the different pathways using structural equation modelling (SEM), cluster analysis and discriminant function analysis.

Following this confirmation, the remaining analyses were conducted using SEM. Several theoretical models were then tested to explore potential relationships among variables. However, in the text only two models are actually discussed. This was done by specifying a particular theory of how the variance components are related and then fitting the model to a covariance matrix from the data. An evaluation was then made to determine how well the data fit the model. The model was then re-specified until it represented the most parsimonious accounting of the data. SEM consists of a combination of measurement models (factor analyses of the indicator variables) and regression analysis relating the exogenous (independent) to the endogenous (dependent) factors. As part of this process we carried out a regression analysis. However, this was done on latent factors rather than on observed variables, thus allowing us to estimate the relationship between two factors and determine if these factors were measured without error.

SEM is often called causal modelling, although the data are correlational in nature. Therefore, the method cannot "prove" or even test causality. The idea behind SEM is to rule out hypotheses rather than to confirm them. SEM allows a determination of whether a causal theory is consistent with the data, but not whether it is "true". Often times the reverse direction of a causal path will fit just as well. However, it is possible to show that some models do not fit the data, while others produce a good fit to the data. What's more important is the comparison of models that do not fit, versus those that do fit. We use the term "causal" to mean that we are testing if the causal model was plausible, but if it does fit, it does not prove causality. Conversely however, if it does not fit, then the model is not a plausible explanation of the data. That is, modelling can determine which model is more likely to be an accurate causal model, not which is actually the true model.

A final analysis tested the contingency of relations among the variables. Using discriminant function analysis we conducted separate analyses with a group of "pathway" relevant variables. For example, we conducted an analysis to determine how many of the problem gamblers could be identified using three impulse control related variables. We conducted separate analyses for impulse-related, "emotional vulnerability" and cognitive/behavioural variables. We then examined

the number of people correctly identified as problem gamblers by each of these three separate analyses. This gave us an estimate of the overlapping nature of these pathways.

Results

Sample Description

Study participants were sought through newspaper advertising. Our announcement asked for people who considered themselves to be “social gamblers” to call a number and leave a message. Subsequently, the callers were contacted by telephone and qualified through a series of screening questions adapted from the DSM-IV, as well as with questions concerning the callers’ preferred types of gambling activities (as reflected in their frequency of participation in the month preceding the call). The announcement, which mentioned that compensation would be provided (\$100 for an afternoon of filling out questionnaires and doing a computer test), was successful in attracting a large number of initial responses. As noted above, the recruitment effort produced replies from callers representing the full range of gambling involvement, from those with a minimal interest in gambling (non-problem gamblers) to those with serious gambling problems, as evidenced by consequential disruption to their lives.

The final study sample consisted of 159 participants, although the questionnaire responses of 14 had to be discarded because the participant answered “true” to the quality control question “I have lied a lot on this questionnaire”. Thus, the remaining total of 145 respondents consisted of 77 men and 68 women. The average age of the men was 40 and the average age of the women was 43. The individuals listed a range of occupations, although most were concentrated in the non-skilled or semi-skilled categories. Thirty-four percent of the sample described themselves as being employed on a full time basis, 17 % were employed part-time, and 11% were unemployed. A minority of participants were retired (8%), disabled (11%), working as homemakers (3%), living on public assistance sources (2.5%), or students (4%). Forty-two percent of the sample stated that they were married and 31% were single. The remainder were either separated/divorced (15%) or widowed (2.5%). Thirty-six percent had either completed their secondary education (21%) or had some secondary schooling (15%). Twenty-four percent reported that they had some college or university training while 21% had graduated from college or university. Two percent of the sample had a graduate or professional degree.

A majority of the sample (64%) described themselves as social gamblers, while smaller proportions said that they were problem (15%), infrequent (7%), professional (2%), pathological (2%), or recovered gamblers (2%).

Problem Gambling

Four questionnaires were used to determine problem gambling status, including the DSM-IV pathological gambling questionnaires that were translated into a questionnaire, past year SOGS, lifetime SOGS, and a questionnaire about the harmful consequences of gambling. The correlation between the past year DSM-IV and the past year SOGS was $r = .83$, $p < .01$. The lowest correlation among these four measures was between the harmful consequences and the past year SOGS, $r = .64$, $p < .01$. All other correlations fell between these two figures. The average score on the DSM-IV was 3.2 (SD = 3). However, the distribution was bimodal with one mode clustered around 0, and the other clustered around 7. This is not surprising because during the latter part of our recruitment effort we focused on making sure that we had sufficient numbers of males and females who were problem and non-problem gamblers. To simplify the presentation of results, we computed an aggregate problem score derived from all four scales using a factor analysis procedure. Following factor analysis, a single eigenvalue was extracted. This accounted for 78.4% of the variance of the

four measures. We used the regression method to compute an aggregate problem gambling index score. In most correlation analyses we used the aggregate scores in order to simplify the presentation of the results. However, where the four measures produced inconsistent results, we discussed the individual measures.

Although treating the aggregate as a continuous variable is the single best way of measuring problem gambling, in some cases it is useful to examine those people who fall into the problem gambling group versus the other groups. To facilitate group comparisons we computed a classification of the participants based on their SOGS and DSM-IV scores. Category assignment for DSM-IV and SOGS ratings is based on criteria determined from our previous work. A person is classified as not having a problem if they score no more than 2 on either the past year SOGS and the DSM-IV, and less than 5 on the lifetime SOGS. A person is scored as a problem gambler if they score 5 or more on either the past year SOGS or the DSM-IV. People who reach the criterion of 5 on only one of these two instruments, but score 4 on the other are also classified as having a problem. People who score 2 or less on the past year SOGS and DSM-IV, but score 5 or more on the lifetime SOGS were classified as recovered gamblers ($n=3$). The remainder were grouped together as borderline cases. These people either have sub-clinical levels of problems or inconsistent scores. This classification scheme results in relatively pure samples of problem and non-problem gamblers, but the borderline group is very heterogeneous. Note that the small number of recovered and borderline problem gamblers says nothing about the relative number of people in these groups within society. Our recruitment efforts focused specifically on trying to recruit problem and non-problem gamblers. In society at large, borderline problem gamblers most likely outnumber problem gamblers.

One of the first items on the questionnaire asked people to group themselves into categories of non-gambler, infrequent gambler, social gambler, professional gambler, problem gambler, pathological gambler, or recovered problem gambler, based on their gambling activities. The main purpose of this question was to give us insight into the gambler's self-perception.

Table 1 shows the relationship between the participants' self-perceptions of their gambling and our own behaviourally-based classification scheme. One noteworthy finding is that many problem gamblers tended to diminish the meaning and significance of their gambling behaviour. For example, more than half of the problem gamblers (30 out of 54) considered themselves to be social gamblers while only 22 correctly identified themselves as either problem gamblers or pathological gamblers. Both borderline problem gamblers and non-problem gamblers were most likely to see themselves as social gamblers. Since we only surveyed three recovered problem gamblers, we cannot say much about this group. However, it is interesting that only one identified themselves' as a recovered gambler on the survey.

Table 1: Perceived vs. Actual Severity of Gambling Problems: Self-ratings vs. diagnostic groupings based on DSM-IV and SOGS ratings of reported behaviour.

DSM-IV & SOGS Self-Rating	Non-Problem	Borderline	Problem	Recovered	Total
Non Gambler					
Infrequent Gambler	8	2		1	11
Social Gambler	47	24	30		101
Professional Gambler	1	1	1		3
Problem Gambler		3	20		23
Pathological Gambler			2	1	3
Recovered Problem Gambler		1	1	1	3
Total Sample Size	56	31	54	3	144

Note: The number in each cell represents the number of people attaining a joint rating according to the respondent's self assessment (horizontally) vs. their classification using DSM-IV and SOGS ratings (vertically) of reported behaviour. Category assignment for DSM-IV and SOGS ratings is based on criteria determined from our previous work.

Table 2 gives a breakdown of the scores of each group on the DSM-IV and the other measures. The last column is an aggregate problem score derived from all four scales using a factor analysis procedure. To simplify the presentation of the results, in most correlation analyses we use the aggregate scores. However, where the four measures produce inconsistent results, we discuss the individual measures.

Table 2: Average scores on the problem gambling indicators by problem gambling group.

Problem Gambling Group	N	DSM-IV	SOGS 1 year	SOGS Lifetime	Harmful Consequences	Aggregate Problems
Non-Problem	55	.58 (.71)	.89 (.85)	1.31 (1.23)	.47 (.72)	-.95 (.22)
Borderline Problems	31	2.554 (2.23)	4.19 (2.63)	4.32 (3.43)	1.31 (1.05)	-.29 (.45)
Problem/pathological	55	6.36 (1.74)	11.58 (3.58)	10.82 (4.75)	3.10 (1.33)	1.09 (.56)
Recovered Problem	3	.67 (1.15)	.67 (1.15)	12.33 (6.66)	4.06 (3.15)	.20 (.68)
Total	144	3.22 (3.02)	5.68 (5.46)	5.82 (5.57)	1.73 (1.65)	-0.004 (1.01)

Note: standard deviations in brackets.

Table 3 illustrates the demographics characteristics of the participants broken down by problem gambling status. Nearly half the sample in all groups was male. Roughly half were married. Borderline problem gamblers were most likely to report being married while problem gamblers were the least likely, but these differences are fairly small and not significant. Around 40% of the sample was employed full-time. The problem and borderline gamblers showed lower rates of full-time employment than the other gambling groups, but this difference was not statistically significant. The average age of the participants was in the early forties.

Table 3: Demographic characteristics by problem gambling status.

Demographics	Non-Problem (n=56)	Borderline Problems (n=31)	Problem Gamblers (n=55)
Male	55.4%	48.4%	54.6%
Married	44.60%	54.80%	41.80%
Employed full-time	42.90%	35.50%	35.20%
High school or greater	87.30%	66.70%	70.90%
Average age	43.18 (13.45)	41.03 (14.97)	40.15 (14.31)

Note: The age is given in years and the standard deviation is in brackets.

Games Played

Participants were asked to report how often they played each type of game. This was translated into days per year. In some cases, these numbers were estimated using category mid points (e.g., if the subject reported 1 or 2 times per month this was translated into 18 times per year).

Numbers that exceed 365 are from people who reported gambling more than once a day (e.g., three times per day).

The most popular forms of gambling (largest number of people) were lottery and scratch tickets (see Tables 4 & 5). Between 105 and 137 respondents (73-95% of the total sample) spent a portion of their days, on 92 to 99 days a year, making these purchases. Casino games were also popular with up to 36% of the sample reporting that they spent 25 to 52 days per year in these activities.

Table 4: Frequency in the past 12 months of engaging in each type of gambling: Number of days per year (estimated from subjects' responses).

Type of gambling	N/subjects	Range: days/yr	Mean	SD
Lottery	137	0 to 363	92.3	87.8
Scratch tickets	105	0 to 623	99.2	117.6
Pull tabs	47	0 to 519	62.7	112.5
Card games (private)	60	0 to 364	55.7	84.0
Casino games/card games	52	0 to 189	25.4	36.8
Casino games/other table games	27	0 to 364	45.6	85.0
Casino games/slots	68	0 to 207	25.2	37.4
Casino games/video gambling (poker, keno, slots, etc)	23	0 to 259	52.5	72.1
Stocks/futures	12	0 to 239	45.8	74.8
Races (track & off-track betting)	52	0 to 364	49.9	82.3
Sports lottery (e.g., Proline)	55	0 to 364	89.6	108.2
Bingo	81	0 to 365	78.9	92.0
Real estate	1	0 to 3	3.0	--
Sports betting	28	0 to 364	78.4	115.1
Internet gambling	7	0 to 364	112.4	146.1
Other	9	0 to 28	10.8	13.4

Note: Participants were asked to report how often they played each type of game. This was translated into days per year. In some cases, these numbers were estimated using category mid points (e.g., if the subject reported 1 or 2 times per month, this was translated into 18 times per year). Numbers that exceed 365 are from people who reported gambling more than once a day (e.g., three times per day).

The total amount of time spent in casino games is comparatively significant when considering that unlike the widespread availability of venues for purchasing lottery and scratch tickets, the gambler actually had to make a special trip to the casino, and probably spent several hours there after arriving. Sports-oriented gambling activities (e.g., race track, sports lotteries, other types of sports betting), traditionally favoured by male gamblers, were less universally popular among the total number of respondents, but took up a large amount of time (49 to 78 days) among those who did engage in these activities (up to 38% of the sample). Internet gambling, often publicized as the latest gambling craze, was reported by only seven respondents. Interestingly however, a few of these computer gamblers spent more time (average of 112 days per year) visiting internet gambling sites than other gamblers did in any other gambling activity. The large variability in the reported time commitment, combined with the small sample size, make it difficult to predict if internet gambling will become as mainstream as some reports are suggesting.

Certain activities showed highly significant correlations with gambling problem severity. These correlations were computed in two different manners. First, we computed the correlations of frequency and problems only including those people who had positively responded to that specific game. In a second analysis, non-responses were score as zero (the respondent engaged in the game 0 times during the year). In the first analysis, gamblers with the most severe gambling problems were

most likely to be spending time in playing slot machines, $r = .49$, $p < .01$, casino table games, $r = .48$, $p < .01$, playing bingo, $r = .37$, $p < .01$, or purchasing lottery, $r = .26$, $p < .01$, or scratch tickets, $r = .30$, $p < .01$. The results of the second analysis were largely consistent with the first except that the correlations of problem gambling with pull tabs, card games, and video gambling reached significance. The effects of real estate and internet gambling also reached significance, but the samples sizes for these games are too small ($n = 1$ & 7 respectively) to take the correlations very seriously. The correlation of lottery purchases with problem gambling goes against the stereotype of lotteries as a relatively benign form of gambling.

Table 5: Games played and their correlation with problem gambling.

Games	Number of Players	Players Only	All Participants (non-players scored as 0)
Lottery	137	.263**	.25**
Scratch tickets	105	.303**	.33***
Pull tabs	47	.160	.23**
Card games (private)	60	.104	.06
Casino Games/card games	52	.135	.18*
Casino Games/other table games	27	.484*	.18*
Casino Games/slots	68	.487***	.36***
Casino Games/video gambling (poker, keno, slots, etc)	23	.341	.22*
Stocks/futures	12	-.306	-.11
Races (Track & off Track Betting)	52	.124	.14
Sports Lottery (e.g., Proline)	55	.219	.15
Bingo	81	.367***	.33***
Real estate	1	-	.18*
Sports betting	28	.190	.11
Internet gambling	7	.593	.17*
Other	9	.577	.05

Note: Correlations with “*” are significantly associated with the likelihood of having a gambling problem.

*** Correlation is significant at the 0.001 level (2-tailed); ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed).

Early Gambling and Winning Experiences Questionnaire

There were several experiences that tended to be associated with an increased likelihood of having a gambling problem (see Tables 6, 7 & 9). The amount of money won in a person’s early experiences with gambling and their subsequent attitudes toward winning generally were closely linked to problem gambling. Gamblers who experienced sizable wins ($r = .240$, $p < .01$) at a fairly early age were likely to develop gambling problems later on. After this early win, there was a tendency for those with gambling problems to go on to bet larger sums of money ($r = .530$, $p < .001$). Although a big win early in one’s gambling career was a prominent feature in problem gambling, there was evidence that psychological factors (i.e., the attitudes toward the entire experience of gambling) were also important in the development of a gambling problem. People who were likely to have a gambling problem were convinced that they could beat the odds ($r = .435$, $p < .001$), and that they would win big again ($r = .210$, $p < .05$). The role of attitudinal factors was further evidenced by findings that continued gambling was reinforced not only by winning ($r = .462$, $p < .01$), but also by losses ($r = .333$, $p < .01$), and by breaking even ($r = .315$, $p < .001$). Big wins by themselves were sometimes sufficient to produce a gambling problem, although the majority of the respondents appeared to have more than one risk factor, with a greater number of risk factors increasing the likelihood that the individual would have a gambling problem.

Interestingly, having “pleasant memories of gambling as a child” was unrelated to problem gambling. Nearly equivalent proportions of non-problem (58.2%) and problem (52.7%) gamblers reported having pleasant memories of gambling. Also, the age at which a person started gambling, had their first win or had a big win were unrelated to problem gambling. Sixty percent reported having gambled before age 18 and there were no significant differences between the groups on this question.

Table 6: Correlations between experiences and problem gambling.

Gambling Experience Questions	N	Gambling Problems
At what age did you first gamble?	141	-.014
Do you have pleasant memories of gambling as a child?	144	.021
Thinking about the first time you gambled seriously (excluding informal bets between friends) was it a memorable experience?	144	.117
Did you win, lose or break even the first time gambled?	141	-.092
After you started gambling, how much time passed while you still thought you were ahead in gambling?	135	-.026
What would you consider a long winning streak?	140	-.142
Age at first win?	131	-.05
How much did you win? (log \$)	134	.240**
Age at first big win?	127	-.08
How much did you gamble after this win?	136	.530***
Did you believe you could win big again?	137	.210*
Did you believe you could beat the odds?	139	.435***
In general, do wins make you want to gamble more or less?	144	.462**
In general, do losses make you want to gamble more or less?	143	.333**
In general, does breaking even make you want to gamble more or less?	144	.315***

Note: Some questions are paraphrased to indicate the “idea”, rather than the exact wording. Correlations for the occurrence of a win are computed based on all “no” responses to the question “Did you ever have a big win or winning streak” being scored as 0. This was done so that (for example) the variable reflects if the person “won” versus “not won” the first time they played seriously.

*** Correlation is significant at the 0.001 level (2-tailed); ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed).

Table 7 shows that problem gambling was related to the experience of big wins early in one’s gambling career, regardless of the gambler’s age when that event occurred. Problem gamblers were likely to report that they experienced a large win or winning streak ($r = .287, p < .001$) and that this happened either on the first time they gambled seriously ($r = .228, p < .01$) or right after they learned to gamble ($r = .243, p < .01$). Furthermore, problem gamblers reported larger first wins, $r = .24, p < .01$.

Table 7: Correlations of winning experiences with the aggregate problem gambling score (N=144).

Winning Experience Questions	Gambling Problems
Have you ever experienced a large win or long winning streak?	.287***
When: The first time I ever gambled seriously.	.228**
When: In the early days right after I learned how to gamble.	.243**
When: Every now and then.	.094
When: Recently	.003

*** Correlation is significant at the 0.001 level (2-tailed); ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed).

Table 8 gives a detailed description of the size of first wins, and Table 9 shows how these correlate with the severity of gambling problems.

Table 8: Average size of first win.

Descriptives	Non-Problem	Borderline	Problem	Recovered
Sample size	51	28	52	3
Mean	\$839.49	\$484.57	\$1,076.52	\$139.30
Std. Deviation	\$2,276.52	\$567.04	\$1,623.80	\$62.65
Median	\$140.00	\$225.00	\$500.00	\$120.00
Minimum	\$3.00	\$1.00	\$5.00	\$50.00
Maximum	\$15,000.00	\$2,000.00	\$8,000.00	\$175.00
Geometric Mean	\$139.30	\$176.55	\$354.94	\$101.64
Mean of Log Values	2.1577	2.2632	2.5558	2.012
Std. Deviation of log values	0.85404	0.75094	0.75675	0.27588

Table 9: Winning experiences questionnaire continued: Correlations of big wins, losses and expectations with gambling problems.

Big Wins, Losses & Expectations Questions	N	Gambling Problems
How much money do you consider a "Big Win"? (log \$)	142	.163
How much money do you consider a "Big Loss"? (log \$)	139	.189*
Smallest amount you would have to win to feel really happy?(log \$)	144	.125
Smallest amount you would have to lose to feel really unhappy?(log \$)	141	.114
Largest amount of money you ever lost in a single day?(log \$)	144	.515***
Did this loss make you want to gamble more?	144	.171*
Have you ever experienced a big loss followed immediately by a big win?	144	.363***
Did this loss followed by a win make you want to gamble more or less?	126	.297***
Have any of your close friends or relatives ever won big gambling?	143	.067
How much money did they win?(log \$)	113	.066
Did their win make them gamble more or less? (1=a lot less; 5=a lot more)	122	.279**

*** Correlation is significant at the 0.001 level (2-tailed); ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed).

Because there was high variability in the size of the wins, as well as differing psychological interpretations of what constituted a "big" win, log-transformed values were used in the tables to facilitate comparisons. Table 8 indicates means, medians, log means and geometric means of the amounts of money won by gamblers with differing degrees of problem severity. The geometric mean is probably the most useful value for making inter-group comparisons. The table shows that problem gamblers had the largest average first win but also shows considerable variability (large standard deviation) in this figure (i.e., a number of respondents reported wins significantly above or below the average size of "win", and the distribution of these wins was highly skewed). The analysis of variance of this table is based on the log means, but log means are essentially equivalent to geometric means (a log scale is a geometric progression). The geometric mean of the non-problem gamblers' first win was \$139.30 whereas the geometric mean of the problem gamblers was \$354.00, more than twice that of the non-problem gamblers. Problem gamblers tended to have large first wins. Problem gamblers also reported that this win made them want to gamble a lot more, $r = .53$,

$p < .01$. Curiously, there was no relationship between the size of the win and the desire to gamble more, $r = .01$, ns. That is, problem gamblers experienced larger wins, and this win made them want to gamble more, but there was no relationship between the objective size of the win and its psychological impact in terms of increasing the desire to gamble more, per se.

How gamblers react to wins and losses is correlated with problem gambling (see Table 9). The correlations in the table show that a history of experiencing large losses is associated with an increased likelihood of having a gambling problem, but it also shows that a certain pattern of gambling is associated with these losses. The largest single day losses were reported by those with the highest probability of having a gambling problem ($r = .515$, $p < .001$). In addition, this loss, $r = .173$, $p < .05$, losses followed by a big win, $r = .297$, $p < .01$, and losses in general, $r = .333$, $p < .01$, increase their desire to gamble more. This finding is consistent with other evidence indicating that problem gamblers are much more likely than non-problem gamblers to chase their losses.

What is a Big Win or Loss?

One question of interest was the concept of a large win or loss. We asked participants to estimate how much money they considered a big win, how much they considered a big loss, how much they would have to win to be really happy, and how much they would have to win to feel really unhappy.

Large disparities existed between what gamblers consider a “big win” and a “big loss”. Table 10 gives details of the responses to the questions regarding the size of a big win, big loss, a win “that would make you really happy” and a loss “that would make you very unhappy”.

Table 10: Descriptive statistics on how much people consider a big win or big loss. Descriptive statistics on how much people consider a big win or big loss.

Variable	N	Median	Mode	Mean	Geometric Mean	Log 10 Mean	SD log Mean
How much is a "Big Win"?	142	\$1000	\$1000	\$122,445.86	\$1,767.38	3.2483	.91245
How much is a "Big Loss"?	139	\$200	\$100	\$944.75	\$265.60	2.4113	.68275
Smallest win to feel really happy?	144	\$100	\$100	\$771.95	\$127.53	2.1176	.75423
Smallest loss to feel really unhappy?	141	\$100	\$100	\$214.52	\$74.65	1.8750	.60357

The data reveal a strong asymmetry between the wins and losses. As noted above, when discussing the size of first big wins, the best representation for these comparative figures is the geometric mean, which controls for the high variability of responses. The geometric mean value comparisons show that winnings (\$1,767.38) need to be 6.6 times greater than losses (\$265.60) before they are considered “big”. Similarly, the smallest win required to make one feel “really happy” (\$127.53) needs to be nearly twice the amount of the smallest loss (\$74.65) that would make one feel “really unhappy”. Each of these means is significantly different. That is, the concept of a big win is significantly greater than the concept of a big loss.

When tested with correlations, only one of the four questions yielded a significant relationship to problem gambling, and this related to losses. Problem gamblers indicated that they had a larger definition of a big loss compared to non-problem gamblers ($r = .189$, $p < .05$). Problem gamblers appeared to be willing to tolerate losses more than non-problem gamblers. In a previous

study, we used these same questions but failed to find any difference on all four of these questions, although a trend did suggest a somewhat larger definition of a large loss amongst problem gamblers than amongst non-problem gamblers.

Table 11 breaks these figures down by problem gambling group. The definitions of a “big win” or “big loss” were consistent across gambler subgroups. The amounts of money fulfilling the definition of a “big win” or “big loss” (converted to log scores because of the large variances of the raw scores) were in general consistent for all types of gamblers. Even though the correlations for big losses reached significance, a test of the pairwise groups differences (one-way ANOVA and post-hoc testing) failed to confirm any subgroup differences. Taken together, these findings suggest that problem gamblers tend to have a larger concept of a big loss than non-problem gamblers, but this effect is quite small.

Table 11: Comparison of gambling groups in terms of the average amount of money they think is a big win, big loss, happy win or unhappy loss (converted to log base 10).

Questions	Non-Problem	Borderline	Problem	Recovered
How much is a "Big Win"?	3.1654 (.92314)	3.0819 (.65254)	3.4501 (1.01276)	2.8273 (.75157)
How much is a "Big Loss"?	2.3223 (.68638)	2.2936 (.84017)	2.5604 (.57494)	2.4360 (.51116)
Smallest win to feel really happy?	2.0024 (.83056)	2.1844 (.79101)	2.1856 (.66455)	2.2944 (.36183)
Smallest loss to feel really unhappy?	1.8138 (.59713)	1.8084 (.61321)	1.9421 (.60118)	2.4360 (.5116)

Note: The number in brackets is the standard deviation

It is interesting that in spite of the more extensive experience of the problem gamblers with gambling and with losing, that a larger difference in the concept of wins and losses was not found. On the positive side, it is important to note that these data suggest that when we ask problem and non-problem gamblers about their experience with big wins, the two groups are answering equivalent questions. A large effect on these questions would invalidate some of the correlations reported in the previous three tables. These findings suggest that the concept of big win and big loss are remarkably similar between problem and non-problem gamblers.

Experience with Wins and Losses

As shown in Table 9, people who had experienced a big loss followed immediately by a big win were more likely to have a gambling problem ($r = .363$, $p < .001$). In addition, people with gambling problems were more likely to report that the loss followed by a win made them want to gamble even more ($r = .297$, $p < .001$). These findings are consistent with a behavioural learning theory of gambling addiction. Those with the more serious gambling problems were also more likely to say that they were influenced by the reported gambling successes of their friends and relatives, $r = .279$, $p < .001$.

Reactions to Winning

Gamblers in all groups have similar reactions to winning. Winning is a positive experience for almost all gamblers irrespective of the severity of their gambling problems. Table 12 shows the response to each of these questions by problem gambling group. All groups reported that winning made them feel happy (91.7% of the total sample), excited (91.0%), and gave them a rush (54.9%). Compared to non-problem gamblers, problem gamblers were a little less likely to say winning made

them feel happy (96.4% vs. 87.3%), but this difference was not significant. To a somewhat lesser extent it also made them feel in control of their lives (34.0%), and raised their self-esteem (39.6%). Problem gamblers were also significantly more likely than non-problem gamblers to report that wins raised their self-esteem (29.1% vs. 45.5%). There were significant correlations between problem gambling and depression, $r = .18$, $p < .05$, anger, $r = .18$, $p < .05$, indifference, $r = .18$, $p < .05$, and increased self-esteem $r = .17$, $p < .05$. The effect of self esteem is a replication of another study we conducted and suggests that problem gamblers rely too much on wins to define their self worth. The effects for anger and depression are interesting, but because only a single person checked off this response, the findings cannot be interpreted. Some of the problem gamblers (10.9%), and borderline gamblers (9.7%), reported that wins made them feel “indifferent”, suggesting that they got relatively little out of the gambling experience.

This effect might be related to the experience of being on “autopilot”, as described by some problem gamblers in treatment. However, the majority in all groups report that winning is a very pleasant experience.

Table 12: How different types of gamblers react to winning.

How did winning make you feel?	Non-Problem	Borderline Problem	Problem	Total Sample
Happy?	96.4%	90.3%	87.3%	91.7%
A rush?	49.1%	64.5%	54.5%	54.9%
Depressed?	0.0%	0.0%	1.8%	0.7%
Lowered self-esteem?	1.8%	0.0%	0.0%	0.0%
Excited?	90.9%	93.5%	89.1%	91.0%
Indifferent?	1.8%	9.7%	10.9%	6.9%
Angry?	0.0%	0.0%	1.8%	0.7%
In control?	29.1%	35.5%	38.2%	34.0%
Increased self-esteem?	29.1%	51.6%	45.5%	39.6%

Life Stress and Problem Gambling

The participants were given a checklist of negative (stressful) and positive life experiences, events and circumstances, and were asked which of the following occurred in the year before they started gambling. These events and experiences had been compiled through interviews and focus groups in a previous study (Turner, Littman-Sharp, Zangeneh and Spence, 2002). Table 13 gives the percentage of problem, non-problem and borderline gamblers reporting each of the life events, experiences and circumstances that happened in the year preceding their first venture into gambling.

Table 13: Life events during year before the participants started gambling (n=144) by problem status.

Life Events	Social	Borderline	Problem	Total Sample
Parents divorced	12.7%	22.6%	36.4%*	24.3%
Financial problem	21.8%	35.5%	30.9%	28.5%
Drug-alcohol abuse	9.1%	6.5%	27.3%*	16.0%
Drug-alcohol abuse in the family	5.5%	12.9%	25.5%*	15.3%
Difficulty at school	18.2%	22.6%	36.4%	27.1%
Lots of stress	21.8%	32.3%	54.5%***	37.5%
Sickness in the family	7.3%	3.2%	18.2%*	10.4%
Death in the family	7.3%	12.9%	18.2%	13.2%
Lack of romantic relationship	10.9%	12.9%	25.5%	16.7%
Problematic romantic relationship	7.3%	16.1%	29.1%**	18.8%
Bought a car or house	5.5%	0.0%	5.5%	4.2%
Supportive parents	40.0%	19.4%	23.6%	29.9%
Supportive spouse/partner/girlfriend/boyfriend	21.8%	9.7%	16.4%	16.7%
Supportive friends	34.5%	25.8%	27.3%	29.9%
Free from drug-alcohol abuse	27.3%	22.6%	14.5%	22.2%
Doing well at school	30.9%	16.1%	12.7%	20.1%
Doing well at work	23.6%	35.5%	18.2%	23.6%
Have career goal	20.0%	16.1%	12.7%	16.0%
Free stress/low stress life	25.5%	16.1%	16.4%	19.4%
Financially secure	10.9%	16.1%	0.0%*	7.6%
Satisfying romantic relationship	10.9%	25.8%	10.9%	13.9%
Birth of child	3.6%	9.9%	9.1%	6.9%

*** Correlation is significant at the 0.001 level (2-tailed); ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed).

Table 14 shows the correlations of each type of event with problem gambling as identified by the major classification inventories (DSM-IV, SOGS, etc.). Problem gamblers tended to have more stressful life experiences in the year before they started to gamble. The table confirms that there are strong (a number of correlations significant at the .001 level) correlations between life stressors and problem gambling. Problem gamblers are more likely than other gamblers to report histories of personal ($r = .276$, $p < .001$) and family ($r = .297$, $p < .001$) drug abuse or alcohol abuse, having difficulty at school ($r = .275$, $p < .001$), having “lots of stress” ($r = .350$, $p < .001$), or having a problematic romantic relationship ($r = .248$, $p < .01$), or no romantic relationship at all ($r = .172$, $p < .05$). They reported to a greater extent than other gamblers that their parents are divorced ($r = .214$, $p < .01$) or that there is sickness ($r = .206$, $p < .05$) or death ($r = .182$, $p < .05$) in their family. To a somewhat lesser extent they also say that they do not have financial security ($r = -.186$, $p < .05$). There was also a trend for problem gamblers to report fewer positive circumstances, such as supportive parents or doing well at school or work. A total score of the stressful circumstances or events was positively correlated with problem gambling, $r = .43$, $p < .01$. A total score of positive events was negatively related to problem gambling, but this correlation fell just short of significance, $r = -.16$, $p = .06$.

Table 14: Correlations of life events that happened during the year before the participants (n=144) started gambling, with indicators of problem gambling.

Variable	DSM-IV	SOGS 1 year	SOGS Lifetime	Harmful Consequences	Aggregate Problems
Parents divorced	.159	.158	.153	.296***	.214**
Financial problem	.170*	.051	.093	.118	.121
Drug-alcohol abuse	.227**	.221**	.243**	.289***	.276***
Drug-alcohol abuse in the family	.226**	.248**	.292**	.287***	.297***
Difficulty at school	.159	.228**	.355***	.231**	.275***
Lots of stress	.298***	.262**	.335***	.351***	.350***
Sickness in the family	.180*	.162	.277***	.106	.206*
Death in the family	.129	.151	.198*	.166*	.182*
Lack of romantic relationship	.228**	.143	.125	.109	.172*
Problematic romantic relationship	.190	.159	.240**	.294***	.248**
Bought a car or house	-.038	-.032	-.025	-.003	-.028
Supportive parents	-.168*	-.121	-.085	-.159	-.150
Supportive spouse/partner/ girlfriend/boyfriend	-.069	.013	.008	-.153	-.055
Supportive friends	-.021	-.031	-.031	-.144	-.062
Free from drug-alcohol abuse	-.188*	-.095	.008	-.130	-.114
Doing well at school	-.151	-.101	-.127	-.172*	-.155
Doing well at work	-.029	-.033	-.029	-.093	-.051
Have career goal	-.063	-.058	-.075	-.064	-.073
Free stress/low stress life	-.047	-.010	-.006	-.028	-.026
Financially secure	-.177*	-.171*	-.165*	-.144	-.186*
Satisfying romantic relationship	-.089	.005	-.012	-.116	-.058
Birth of child	.099	.116	.078	.046	.097

*** Correlation is significant at the 0.001 level (2-tailed); ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed).

Events Preceding the Development of a Gambling Problem

The previous set of questions focused on the year prior to starting gambling. A second set of questions tried to get at this same issue by phrasing them in terms of events that occurred just prior to developing a problem. For these questions, people were asked to answer only if they had ever felt that they had a gambling problem. Sixty-two people completed the questionnaire, including most of the problem gamblers (44 out of 55), two of the recovered problem gamblers (2 out of 3), and a bit more than half of the borderline problem gamblers (17 out of 31). Interestingly, 10 out of the 55 non-problem gamblers also completed this question, but their responses (mostly “nothing unusual” and “not applicable”) have not been included in the subsequent analyses.

The results of this questionnaire are shown in Table 15. A little over forty percent of the sample of those who responded said that among the events that preceded their gambling problems were the opening of a new gambling venue (44%), the feeling that their lives were going nowhere (42%), or having the experience of a big win (40%). A stressful life event was also reported by 31% of the respondents, but nearly the same number (23%) reported that everything was going well.

These data again suggest that stress plays a role in problem gambling, but that it does not explain all or even most cases of problem gambling. In some cases, problem gambling can develop

when everything is going well. If we combine “stressful life event” and “life going nowhere” we obtain a total of 50%. That is, the evidence suggests that 50% of the participants were unhappy before their gambling problem began. That still leaves 50% that were apparently happy. People were invited to make multiple responses, and on average the respondents checked 2.4 of the items. Some people checked off as many as six items. This finding reinforces our argument that problem gambling is not the result of a single cause, but is the result of multiple causes.

Table 15: What happened just before gambling became a problem for you (N=71-73)?

Event	Percent of Sample
A new casino, bingo hall or other gambling venue opened up near where I live	44%
I had a big win	42%
I felt that my life was going no where	40%
I experienced a stressful life event	31%
Everything was going well for me	23%
I changed my usual game	19%
I changed my usual playing strategy	16%
Nothing unusual	16%
I changed my usual gambling type or strategy and then experienced a big win	11%
Not applicable	0%

Knowledge of Random Events

The findings regarding strategy and belief bring up the question of cognitive distortions and knowledge. Turner (2002) has developed a psychometric instrument to measure a person’s knowledge of random events. Based on previous data, he computed a total score using the most reliable item and found that problem gamblers tend to have a poorer understanding of the nature of random events. Based on a compilation of data from several studies, he conducted a factor analysis of this scale and isolated six subscales. The correlations of these subscales and problem gambling are shown in Table 16. The results show that the first scale, lottwin, produced the only significant negative correlation. This finding indicates that problem gamblers have a poorer understanding of their chances of winning big prizes in the long term.

Table 16: Knowledge of random events subscales and best total scale.

Scale	Aggregate Problems
LOTTWIN: realistic beliefs about ones chances of winning a lottery	-.201*
INDEPMAC: understanding of the independence of random events	-.150
PREDICT: correct beliefs about the inability to predict random events	-.136
CHANCE: knowledge of game related probability	.103
PATTERNS: an understanding of patterns that are possible	-.085
LONGTERM: erroneous beliefs about the meaning of long-term odds	.015
REKTBS2: random events scale composed of the most reliable items	-.213*

* Correlation is significant at the 0.05 level (2-tailed).

Knowledge of randomness was negatively related to aggregate gambling problems, but knowledge of game-related probability was positively related to gambling problems. In fact, when we examine our data from several different studies, we find that problem gamblers score higher on game-related probability questions, and lower on questions related to long term outcomes and the independence of random events. It is argued that part of the reason problem gamblers used gambling

as an escape is that they do not understand the nature of random events, but do understand the odds of winning a specific game. It's not an overall lack of knowledge, but the wrong type of knowledge.

Playing Strategies Part 1: How People Play

The respondents were asked a number of questions regarding how they play (see Table 17). Problem gamblers tend not to set limits when they gamble. They reported that they usually did not set a spending limit ($r = -.490, p < .001$), and even when they did, rarely adhered to it ($r = -.589, p < .001$). Also, they did not quit at a set time ($r = -.223, p < .05$) and often gambled until closing time, or as long as possible ($r = .413, p < .001$). They reported gambling even beyond the point when they were tired or bored ($r = -.549, p < .001$) and preferred to play alone rather than in the company of friends ($r = -.223, p < .01$). In addition, they were more likely to believe that they could tell when they were due for a win ($r = .211, p < .05$) and were somewhat more likely to prefer games based on luck over games of skill ($r = -.197, p < .05$). Finally, they tended to agree with the idea that they could actually control luck ($r = .189, p < .05$). These findings replicate our earlier findings that problem gamblers are less likely to set or keep limits (Turner & Liu, 1999; Winners report).

Table 17: Gambling strategies Part 1.

Variable	DSM IV (n=143)	SOGS 1 year (n=143)	SOGS LIFE (n=143)	HARM (n=143)	Aggregate Problems (n=143)
Are you lucky when gambling?	-.039	-.027	-.048	-.095	-.058
Prefer to play games where some skill is involved in winning?	-.173*	-.170*	-.114	-.248**	-.197*
Usually know when you're due for a win?	.236**	.170*	.198*	.141	.211*
Even though you may lose in the end, do you think it's still fun to gamble?	-.198*	-.096	-.060	-.203*	-.156
How often do you set a spending limit when gambling (any type)?	-.500***	-.403***	-.365***	-.492***	-.490***
How often do you keep to that limit?	-.542***	-.546***	-.507***	-.493***	-.589***
How often do you gamble until closing time or as long as is possible?	.407***	.407***	.368***	.275***	.413***
How often do you stop at a set time?	-.456***	-.422***	-.472***	-.405***	-.223**
How often do you quit when you get bored or tired of playing?	-.521***	-.512***	-.468***	-.443***	-.549***
Do you usually gamble with other people(e.g., family members, friends, co-workers, etc.)?	-.148	-.234**	-.232**	-.175*	-.223**
Do you do anything to try and control luck?	.101	.220**	.135	.216**	.189*

Note: Correlations with a minus sign indicate that the respondent disagreed with the statement. All items, except the last one, were scored on a 5 point scale and were coded so that 5=always and 1=never. The last question was asked in terms of yes & no, and is coded as 1=yes, 0=no (i.e., in the last question only the lack of a minus sign indicates agreement).

*** Correlation is significant at the 0.001 level (2-tailed); ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed).

Playing Strategies Part 2: Betting

A series of questions asked about strategies of placing bets. We asked the participants which strategies they used. The reported strategies for controlling gambling outcomes are shown in Table 18. A large proportion of gamblers (52.7% of the total) thought it was a good idea to avoid jinxing a

gambling outcome by being too confident, although a significantly larger ($p = .02$) percent (63.60%) of the problem gamblers than non-problem gamblers (40.70%) said they believed this. Making a random guess when betting and looking for patterns were also strategies frequently used by the total group (52.00% and 41.2%). Compared to the non-problem gamblers, significantly ($p = .024$) more of the problem gamblers (21.80% vs. 5.60%) reported avoiding gut feelings when gambling.

Table 18: Other strategies used to control gambling outcomes.

Gambling strategy:	Non-Problem n=54	Borderline n=31	Problem n=55	Recovered n=3	Total N=148
When betting, do you...					
Try not to jinx it by being too confident?	40.70%	54.80%	63.60%*	66.70%	52.70%
Avoid random numbers?	3.70%	9.70%	10.90%	100.00%	7.40%
Look for patterns when betting?	31.50%	35.50%	50.90%	66.70%	41.20%
Make a random guess when betting?	42.60%	71.00%	52.70%	33.30%	52.00%
Bet on numbers that follow a sequence?	16.70%	16.10%	27.30%	100.00%	19.60%
Avoid gut feeling when betting?	5.60%	16.10%	21.80%*	100.00%	13.50%
Avoid bets on numbers that follow a sequence when betting?	7.40%	16.10%	3.60%	100.00%	8.10%
Avoid bets that follow a pattern when betting?	5.60%	16.10%	16.40%	100.00%	12.20%

Table 19 gives the correlations between betting strategies and problem gambling. Problem gamblers report looking for patterns when betting ($r = .178$, $p < .05$) but interestingly also claim that they avoid bets which follow patterns ($r = .170$, $p < .05$). This contradiction has also been found in previous research. Problem gamblers will either look for numbers that are coming up regularly or are not coming up. One book on how to gamble (Jones, 1996; See also Turner, Fritz and Mackenzie, 2000) actually recommended to search for numbers that were coming up frequently, because the author argued that there was a bias in favour of those numbers. Then, in chapter 2, he recommended the opposite strategy (looking for numbers that are due to come up). Problem gamblers also say that they avoid gut feelings when they select numbers in gambling ($r = .189$, $p < .05$).

Table 19: Correlations between measure of problems and number selection strategies.

When betting do you ...	DSM-IV	SOGS 1 Year	SOGS LIFE	HARM	Aggregate Problems
Try not to jinx it by being too confident?	0.121	0.162	0.127	0.093	0.143
Avoid random numbers?	0.099	0.078	0.036	0.045	0.074
Look for patterns when betting?	0.186*	0.127	0.127	0.191*	0.178*
Make a random guess when betting?	0.085	0.035	0.035	-0.007	0.043
Bet on numbers that follow a sequence?	0.151	0.1	0.098	0.043	0.112
Avoid gut feelings when betting?	0.189*	0.214**	0.123	0.14	0.189*
Avoid bets on numbers that follow a sequence?	0.021	-0.023	-0.035	-0.097	-0.037
Avoid bets that follow a pattern when betting?	0.201*	0.178*	0.189*	0.025	0.17*

*** Correlation is significant at the 0.001 level (2-tailed); ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed).

Personality Variables

We included a number of variables in our survey that tried to look for individual differences between the participants. In order to facilitate structural modeling we used a four point scale (Never, Rarely, Frequently, Always) on each item and computed a total score by adding up the scores. We then multiplied the total by a constant so that possible scores ranged from 0 (Never to all questions) to 100 (always to all question). As shown in Table 20, problem gamblers tended to be anxious, impulsive and depressed. Psychometric testing revealed positive correlations between various personality traits and problem gambling. Problem gamblers had elevated profiles on impulsivity ($r = .354, p < .001$), depression ($r = .433, p < .001$), and several measures of stress ($r = .483, p < .001$) or anxiety [Zung ($r = .532, p < .001$); Interpersonal Anxiety ($r = .251, p < .01$)]. High scores on a combination of these traits within a single gambler were progressively associated with more serious gambling problems. In contrast to our previous studies, we did not find a relationship between boredom susceptibility and problem gambling.

Table 20: Correlations between individual difference measures and problem gambling.

Individual Difference Measures	DSM-IV	SOGS 1 year	SOGS Lifetime	Harmful Consequences	Aggregate Problems
Boredom susceptibility	.113	.011	.165*	.052	.097
Thrill seeking	.050	-.055	.044	-.064	-.006
Risk Taking	.090	-.034	.111	-.020	.042
Impulsivity	.322***	.282***	.399***	.247**	.354***
Sociability	-.033	-.081	-.210*	-.067	-.111
Depression	.423***	.395***	.335***	.381***	.433***
Interpersonal anxiety	.194*	.199*	.248**	.253**	.251**
Zung score	.538***	.490***	.399***	.444***	.532***
ICS total score (Index of Clinical Stress)	.495***	.421***	.378***	.416***	.483***

*** Correlation is significant at the 0.001 level (2-tailed); ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed).

Temperament and Character in Problem Gamblers

We also used the Temperament and Character Inventory (TCI) to examine the personalities of problem and non-problem gamblers. These data are presented in Table 21. This psychometric testing revealed that problem gamblers tend to be “novelty seekers” ($r = .330, p < .001$) who at the same time are sensitive to their needs for safety (“harm avoidance”, $r = .352, p < .001$). Socially they may sometimes appear stubborn or less than respectful of social conventions (“cooperativeness”, $r = -.262, p < .01$). They also score high on the dimension of “self-transcendence”, $r = .239, p < .001$, a character trait defined as the “willingness to see oneself as part of a larger whole” and a “willingness to entertain spiritual or mystical considerations”. This effect mostly likely is tapping into the superstitious beliefs about luck and fate. We also found strong negative correlations, $r = -.515, p < .001$, between problem gambling and “self-directedness” (defined as “mature; purposeful and goal directed; realistic in self-perceptions”) and “persistence” or willingness to work hard ($r = -.186, p < .05$). Higher scores on novelty seeking, harm avoidance and self-transcendence, coupled with low scores on self-directedness and persistence all indicate a desire to escape personal responsibility.

Table 21: Correlations between the TCI and problem gambling.

TCI Subscales	DSM-IV	SOGS 1 year	SOGS Life	HARM	Aggregate Problems
Novelty Seeking	.318***	.308***	.349***	.214**	.330***
Harm Avoidance	.318***	.296***	.243**	.349***	.352***
Reward Dependence	-0.099	-0.065	-0.118	-0.009	-0.092
Persistence	-.164*	-0.154	-.188*	-0.131	-.186*
Self Directedness	-.552***	-.459***	-.404***	-.410***	-.515***
Cooperativeness	-.302***	-.239**	-.215**	-0.125	-.262**
Self Transcendence	.252**	.199*	.178**	.231**	.239**
Personality Disorder	.508***	.412***	.366***	.341***	.467***
Consistency of Responses	-.277***	-.286***	-.209*	-0.156	-.271***
Vigilance to Opposite Quests	-.290***	-.291***	-.278***	-.267***	-.327***
Rare Responses	.327***	.354***	.323***	.291***	.375***
Acquiescence	.487***	.367***	.338***	.324***	.429***
Authenticity	-.143	-.106	-.064	-.192*	-.148
Integrity of Char Dimensions	-.113	-.074	-.097	-.157	-.131
Distorted Represent/Temp'mnt	.105	.058	-.008	.098	.072

*** Correlation is significant at the 0.001 level (2-tailed); ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed).

Coping

The finding from the TCI suggested that problem gamblers have a strong tendency to want to escape. Further evidence for this was found using the Ways of Coping Questionnaire (WCQ) (Folkman & Lazarus, 1988). Participants were given a list of coping strategies and asked to rate how often they used each strategy. Table 22 presents the relationship between styles of coping and problem gambling. The strongest effect found in this scale was that problem gamblers rely on escape and avoidance coping. This scale is made up of items such as “hoping for a miracle”, “drinking”, “wishing the problem would go away”, “eating”, or “sleeping” in order not to think about the problem, $r = .589$, $p < .001$. This correlation is the largest correlation reported in this paper so far. Other WCQ scales that were correlated with problem gambling were distancing (detaching oneself and minimizing the significance of the situation), $r = .384$, $p < .001$, and confrontation (aggressive efforts to alter the situation), $r = .341$, $p < .01$. However, we were somewhat surprised to find that problem gamblers also scored high on taking responsibility, $r = .466$, $p < .001$, and self-control, $r = .300$, $p < .001$. A close examination of the items on the taking responsibility scale, such as “I realized that I had brought the problem on myself” or “I promised myself that things would be different next time” suggests that this scale more accurately measures the self-blame that is typical of problem gamblers, who feel guilty about their gambling and promise themselves and others that they will not to do it again. Similarly, the self control items such as “I kept others from knowing how bad things were” and “I tried to keep my feelings to myself” seem to be more about hiding the problem than dealing with it.

Table 22: Correlations between coping strategies with gambling problems and random events knowledge.

Coping Strategies	Aggregate Problems	Random Events Knowledge
Distancing	.384***	-.127
Self controlling	.300***	-.134
Seeking social support	.139	-.137
Accepting responsibility	.466***	-.142
Escape avoidance	.589***	-.227**
Planful problem solving	.088	-.129
Positive reappraisal	.160	-.183*
Confrontation	.341***	-.242**

*** Correlation is significant at the 0.001 level (2-tailed); ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed).

Reliance on escape as a way of coping was strongly related to depression, $r = .480$, $p < .01$, anxiety (as measured by the Zung), $r = .545$, $p < .01$, and stressful life events prior to having a gambling problem, $r = .327$, $p < .01$, and was negatively related to positive affect during one's youth, $r = -.355$, $p < .01$. These findings confirm our view that the use of escape as a coping strategy is associated with feeling miserable.

It is interesting to note that a poor knowledge of randomness was also correlated with the tendency to use escape-avoidance ($r = -.277$, $p < .01$) and confrontation ($r = -.242$, $p < .01$) as coping mechanisms, both favoured strategies of problem gamblers. These findings, in addition to others discussed in the narrative, permitted the inference that while gamblers may have a great deal of knowledge about odds ratios specific to certain games of chance, their knowledge of randomness is poor.

Interestingly, escape coping was also found to be associated with impulsivity, $r = .395$, $p < .01$, ADHD symptoms before the age of 7, $r = .228$, $p < .05$, and current ADHD symptoms, $r = .451$, $p < .01$. These findings suggest that there is a strong interrelationship between emotional, cognitive and physiological aspects of problem gambling. The model that is emerging is that negative life experiences, depression, impulsivity, and erroneous beliefs all lead people to adopt escape as a way of coping. It is argued that these other causal variables may be mediated through escape coping. The link between misery and escape is not surprising, as people who see no way out of a situation may rely on fantasy. Perhaps a poor understanding of how random events work leads people to view escape, such as winning the big prize, as a plausible fantasy. Perhaps escape appeals to people who are impulsive because it is a quick fix.

Another measure of coping skills, the PSI, (see Table 23) also showed evidence of poor coping skills amongst problem gamblers. Responses to the PSI indicated that a tendency to avoid problem solving was associated with the likelihood of having a gambling problem ($r = .349$, $p < .001$). PSI scores on avoidance behaviour and poor personal control were also associated with gambling problems ($r = .275$, $p < .001$ and $.422$, $p < .001$).

Table 23: Correlations of the PSI and problem gambling

PSI Subscales	Aggregate Problems
Psiprobs: Does not solve problems.	.349***
Psiavoid: Avoidance behaviour	.275***
Psicntrl: Poor personal control	.422***
Psitotal: Total score	.369***

*** Correlation is significant at the 0.001 level (2-tailed); ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed).

Symptoms of ADHD and Problem Gambling

Correlations between current symptoms of ADHD, Oppositional Defiant Disorder (ODD), and Conduct Disorder (CD) were all highly correlated with the probability of having a gambling problem (Table 24). Attention Deficit Hyperactivity Disorder, which affects 3-5% of the school aged population, and which is now known to extend into adulthood, is characterized by impulsivity, an inability to persist at tasks requiring sustained attention, and high levels of motor activity. Eighteen percent of the problem gamblers reached the DSM-IV critical value for adult ADHD, compared to only 5.9% of the non-problem gamblers and 10.7% of the borderline problem gamblers. However, these figures likely underestimate the relationship between ADHD and problem gambling because a large number of problem gamblers had elevated, but sub-clinical, scores for either childhood or the adult ADHD (see “Pathing the Sample” below).

Table 24: Correlations of ADHD symptoms and problem gambling.

Symptoms before age 7	DSM-IV	SOGS 1 year	SOGS Lifetime	Harmful Consequences	Aggregate Problems
atten1	.095	.100	.154	.178	.160
hypr1	.200*	.190*	.231*	.172	.219*
opp1	.178	.152	.132	.161	.170
cond1	.105	.052	.070	.160	.103
Current Symptoms					
atten2	.308***	.320***	.406***	.335***	.404***
hypr2	.331***	.336***	.375***	.262**	.367***
opp2	.431***	.328***	.319***	.296***	.387***
cond2	.293***	.244**	.227*	.196*	.272**

*** Correlation is significant at the 0.001 level (2-tailed); ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed).

Conduct disorder is a pattern of severe, repetitive, acting-out behaviour with frequent episodes of belligerence and destructiveness. Closely related to CD is ODD, a pattern of negativistic, hostile, and defiant behaviour. Although considered independent entities, these conditions frequently overlap. All of these conditions, as well as severe problem gambling, are classified in DSM-IV as impulse control disorders. Therefore, the pattern of high correlations with current symptoms is not surprising.

The comparatively fewer correlations between childhood ADHD, ODD, and CD with gambling problems may be an artefact of the difficulty of the testing technique, which asks respondents to recall events from the earliest period in their lives. If the smaller effect were simply due to a lack of an ability to recall childhood events, fewer symptoms on the “before age 7”

measures would be expected. However, the number of responses on the “before age 7” questionnaire is actually greater than the “current symptoms” questionnaire. This suggests an alternative explanation: People who recover from ADHD symptoms are unlikely to develop a gambling problem, but those in whom symptoms persist may have a greater vulnerability to problem gambling. This may be important information for advocating increased intervention with cognitive therapy at an earlier age to help people avoid problem gambling. However, first we need more research to examine the life experiences of ADHD individuals in order to determine whether those who have “recovered” from ADHD had any form of treatment or they simply grew out of it.

Genetics Data

Three genes (DRD4, COMT NlaIII, DAT VNTR) were examined to determine if they were associated with problem gambling. These genes have been shown to be related to ADHD and/or problem gambling in previous studies. We tested the extent to which variations of these genes were related to problem gambling. None of these gene variations or combinations of variations was correlated with problem gambling. This does not rule out the role of these genes in terms of problem gambling, but sets an upper limit on their importance. The sample size had sufficient power to detect a correlation of .24 or just below 6% of the variance. Given the sample size, we can be 80% confident that these specific genes contribute less than 6% of the variance of problem gambling. Of course, such null results need to be replicated. In the near future we plan to expand our data base of genetic samples of problem gamblers and turn our attention to a number of other genes to see if we can find a better genetic model of problem gambling.

Dissociative Experiences

A number of items on the survey measured dissociative states, which consisted of five items ranging from simply losing track of time to blacking out. These questions were phrased in terms of two different contexts: Gambling and non-gambling situations. A sixth item was added to this survey which we have not included in previous studies which asked about feeling pain in one’s body. The relationship of this pain item to the other items is unclear. We would have expected it to be negatively related to the other items. Our reason is that feeling pain suggests the absence of escape. However, it was positively related to scores on the other items, suggesting that it measures some other factor such as somatization of anxiety. Perhaps people who are suffering physical pain feel they need to dissociate in order to escape. More work is needed to explore the relationship between physical pain and dissociation. Due to this conceptual problem, we have not included it in our gambling and non-gambling dissociative experience scores. However, we will examine the correlations of this item as it related to problem gambling.

Compared to non-problem gamblers, problem gamblers were more likely to report having dissociative experiences, $F(2, 137) = 20.8, p < .001$, but there was still a strong interaction between problem gambling status and dissociative context, $F(2, 137) = 23.5, p < .001$. This interaction was shown by the very large difference ($d = 1.4$) between the scores on the dissociative experiences scale in a gambling context of the problem (2.83, $SD = 0.90$) and non-problem gamblers (1.68, $SD = 0.73$). In contrast, there was only a moderate difference ($d = 0.5$) between problem (2.12, $SD = 0.68$) and non-problem gamblers (1.76, $SD = 0.63$) in a non-gambling context. On both variables the borderline line gamblers fell somewhere in-between the problem and non-problem gamblers.

Dissociation plays an important role in the general theory of addiction (see Jacobs, 1986; Gupta and Derevensky, 1998), so we examined how this variables is related to several other variables. Game activities were regressed onto gambling-related dissociation, and two variables predicted a significant percentage of the variance. In particular, people who played slots, $b = .007, t = 2.4, p < .05$, and those who played bingo, $b = .002, t = 2.4, p < .05$ were most likely to report

dissociation. This finding is consistent with many informal reports of people being mesmerized in front of slot machines. Game activities were also regressed onto non-gambling-related dissociation, and only one variable was significant: People who play other table games (e.g., craps, roulette, the big wheel) were more likely to dissociate in non-gambling activities, $b = .003$, $t = 2.5$, $p < .05$. This finding is not particularly noteworthy except perhaps in that it suggests that gambling and non-gambling related dissociation are different in nature.

Dissociation in a gambling context was associated with higher levels of anxiety (Zung Self-Rating Anxiety Scale), $r = .51$, impulsivity, $r = .50$, current hyperactivity, $r = .48$, depression, $r = .43$, use of escape as a coping strategy, $r = .38$, current attention deficits, $r = .38$, and hyperactivity before age 7, $r = .38$. For the TCI variables, dissociation was most strongly associated with self-directedness, $r = -.43$, harm avoidance, $r = .32$, novelty seeking $r = .30$, and cooperativeness, $r = -.25$. Dissociation while gambling was associated with both current and childhood (before age 7) hyperactivity and other ADHD symptoms, but the association with current hyperactivity was much stronger (e.g., $r = .48$, $p < .001$ vs $r = .38$, $p < .001$). In terms of coping, dissociation while gambling was most strongly associated with escape, $r = .43$, confrontation, $r = .32$, distancing, $r = .35$, taking responsibility, $r = .26$, and self control, $r = .21$ (See our discussion above for the meaning of the self control and responsibility scales). Dissociation during non-gambling activities was related to distancing, $r = .29$, and escape, $r = .27$, $p < .01$.

Dissociation while doing something else was correlated with impulsivity, $r = .39$, boredom, $r = .36$, depression, $r = .31$, and anxiety, $r = .31$. Dissociation while doing something else was also negatively related to self-directedness, $r = -.33$, $p < .01$ and cooperativeness, $r = -.19$. Therefore, dissociation in a gambling and non-gambling context was associated with similar variables. However, the effects in the non-gambling context were consistently smaller than those in the gambling context. These smaller correlations are perhaps due to the fact that depression, boredom, and anxiety are related to negative life events. The evidence points repeatedly to an association between problem gambling and negative life events.

Dissociation while doing something other than gambling was negatively correlated with age, $r = -.264$, $p < .01$. In particular, older participants were less likely to report losing track of time, $r = -.238$, $p < .05$, entering into a trance-like state, $r = -.290$, $p < .01$, or blacking out, $r = -.189$. Curiously, the older adults were also less likely to report feeling pain while engaging in something they really liked to do other than gambling, $r = .18$, $p < .01$. This was surprising since it goes against the usual view of older people suffering from more pain. Perhaps this effect speaks to the issue of the use of pleasant activities to help escape pain, but this is contradicted by the correlation of pain with the other dissociative items. In contrast, the only effect of age on gambling related dissociation was that older adults tended to be less likely to report entering into a trance-like state, $r = .235$, $p < .01$. Also, dissociation while gambling, but not while engaging in some other activity, was found to be related to negative affect during one's youth ($r = -.248$) and negative affect currently ($r = -.170$, $p < .05$).

These findings are consistent with the hypothesis proposed by Gupta and Derevensky (1998) that dissociation while gambling is an attempt to escape from negative emotions. The weaker effects for dissociation in a non-gambling context suggest that dissociation is a relatively context specific phenomenon. These findings strongly support the view that dissociation is a means of escaping from stress or other negative moods. The strong interaction found between context and problem gambling group suggests that the dissociation of problem gamblers is specific to gambling rather than being a generalized phenomenon. As such, it is possible that at least in some cases, gambling related dissociation may be a learned behaviour rather than an overall characteristic of the person.

Inventory of Gambling Situations (IGS) and Problem Gambling

Table 25 shows the correlations between problem gambling and the Inventory of Gambling Situations (IGS). Since this scale measures heavy gambling behaviour, all subscales are significantly correlated with problem gambling status. The table shows that a wide range of both pleasant and unpleasant personal experiences were likely to be associated with severe gambling problems. Despite the fact that problem gamblers felt that all of the life experiences identified in the IGS triggered their urge to gamble, it was the negative experiences that were somewhat more important in this regard. Worries about Debts ($r = .808, p < .001$), Urges and Temptations ($r = .780, p < .001$), Winning and Chasing ($r = .768, p < .001$), and Negative Emotions ($r = .742, p < .001$) headed the list of experiences associated with heavy gambling. The smallest correlations on the IGS were found for more positively valenced feelings, such as Confidence in Skill ($r = .596, p < .001$), Social Pressure to Use ($r = .506, p < .001$), and Pleasant Emotions ($r = .452, p < .001$). However, these are all still fairly strong correlations, and thus suggest that problem gamblers are influenced by a complex motives, as discussed below.

Table 25: Correlations between items from the IGS and gambling problem severity.

IGS Subscale	N	Gambling Problems
Negative Emotions	141	.742***
Conflict with Others	141	.682***
Urges and Temptations	141	.780***
Testing Personal Control	141	.686***
Pleasant Emotions	141	.452***
Social Pressure to Use	141	.506***
Need for Excitement	141	.657***
Worried about Debts	141	.808***
Winning and Chasing	141	.768***
Confidence in Skill	141	.596***
Need to be in Control	141	.681***

*** Correlation is significant at the 0.001 level (2-tailed); ** Correlation is significant at the 0.01 level (2-tailed); * Correlation is significant at the 0.05 level (2-tailed).

Table 26 shows the means and standard deviations on the IGS subscales. It is important to note that problem gamblers are likely to gamble during both positive and negative mood states. In fact, the average score on the Pleasant Emotions scale for problem gamblers is slightly higher (55) than their average score on the Negative Emotions scale (48) for problem gamblers, suggesting that even amongst problem gamblers, positive moods are as important, if not more important, a trigger for gambling than are negative moods. In contrast, for non-problem gamblers there is a fairly substantial difference between the scores on the Pleasant Emotions scale (35) and the Negative Emotions scale (9). To test the significance of this difference we examined the Pleasant Emotion and Negative Emotion scores in a repeated measures analysis, with two levels, and tested for an interaction with problem status (problem vs. non-problem). The interaction was significant, $F(111,1) = 13.9, p < .01$. This finding suggests that both problem and non-problem gamblers gamble when happy, but only problem gamblers gamble when they are unhappy.

Table 26: IGS subscale scores broken down by problem gambling group.

IGS Subscale	Non-Problem (n=55)		Borderline (n=31)		Problem (n=55)	
	Mean	SD	Mean	SD	Mean	SD
NEIGS: Negative Emotions	9.0	12.3	20.3	20.5	47.7	25.4
COIGS: Conflict with Others	3.3	8.1	13.1	22.8	33.9	23.9
UTIGS: Urges and Temptations	17.1	17.3	27.8	17.4	54.4	21.4
TPCIGS: Testing Personal Control	9.1	15.4	20.8	21.5	41.0	20.4
PEIGS: Pleasant Emotions	35.2	29.6	44.5	25.6	55.4	20.2
SPIGS: Social Pressure to Use	22.2	22.4	35.5	26.0	42.7	22.1
EXIGS: Need for Excitement	24.6	22.6	37.8	21.3	57.3	22.6
DBIGS: Worried about Debts	3.9	7.8	19.0	22.1	44.7	22.8
WCIGS: Winning and Chasing	15.1	20.6	32.3	22.1	58.4	22.5
SKIGS: Confidence in Skill	25.8	28.4	34.5	22.4	55.5	21.9
NCIGS: Need to be in Control	7.0	11.3	17.5	20.3	37.6	23.1

Subgroups of Problem Gamblers: Depression and Negative Affect

Above we showed that depression was strongly correlated with problem gambling. We now turn to the issue of subgroups of problem gamblers in order to see if we can sub-divide problem gamblers into separate groups (see Table 27a). The average score on the depression scale was 39.1 (SD = 17.1). There was a substantial correlation between depression and problem gambling, $r = .43$, $p < .01$. Non-problem gamblers had an average score of 32.5 out of 100, almost equal to an average score of “rarely” on the questionnaire. Borderline and recovered gamblers also scored “rarely” (34.2 & 31.3) on average. Problem gamblers scored an average of 46.1, which is mid-way between a score of “rarely” and a score of “frequently”. The mid-point between “rarely” and “frequently” (a score of 50) is also nearly exactly 1 standard deviation above the mean for the non-problem gamblers. Therefore, this was used as a cut-off to group people into those who exhibit negative affect and those who do not (see Table 27b). This cut-off point does not equate with clinical depression but is useful as a means of comparing the number of people who have depression-like symptoms in the different groups. We see that 47.3% of problem gamblers fall above this cut-off point compared to only 14.5% of the non-problem and 16.1% of the borderline gamblers.

Table 27a: Average depression scores broken down by group.

GTYPE2	Mean	N	Std. Deviation
1.00	32.5273	55	15.3150
2.00	34.2581	31	14.7873
3.00	46.0909	55	17.2340
4.00	31.3333	3	17.5594
Total	38.0556	144	17.0756

Table 27b: Depressed vs. non-depressed people by problem gambling groups using 1 standard deviation above the non-problem mean as a cut-off score.

Group	Non-Problem	Borderline	Problem	Recovered
Not Depressed	85.5%	83.9%	52.7%	100.0%
Depressed	14.5%	16.1%	47.3%	

However, depression is not the only negative emotion that arises from gambling. We also measured stress and anxiety in the survey. From the scores on these traits an aggregate “misery index” score was computed and used as a second means to determine how many people are unhappy. Again, 1 standard deviation above the average score of the non-problem gamblers was used as a cut-off score. As expected, 16.3% of the non-problem gamblers scored above this cut-off point (this percentage presents the number who are expected in the upper tail of a distribution when 1 standard deviation is used as a cut off). The borderline group actually shows a slightly lower rate of stress (13%), but amongst the problem gambler group, over 50% (56.3%) fell 1 standard deviation or more above the non-problem gamblers. This suggests that a substantial number of problem gamblers are unhappy and anxious.

It is interesting to note that some problem gamblers and most borderline problem gamblers do not show any evidence of negative mood, suggesting that they perhaps have not suffered substantial negative consequences of problem gambling. An examination of differences between problem gamblers who were happy versus those who were not unhappy indicated that the unhappy group scored significantly higher on the aggregate measure of problem gambling, $t = 2.1$, $p < .05$, but this effect just barely reached the threshold for significance. Interestingly, in terms of life consequences, the unhappy and happy problem gamblers did not differ. On other variables, such as the amount of money lost gambling, there were no differences between non-problem and problem gamblers. They also did not differ in terms of the frequency with which they played various games. However, they did differ in terms of current ADHD symptoms, $t = 3.0$, $p < .01$. The miserable problem gamblers reported more ADHD symptoms than the less miserable problem gamblers. In addition, the less miserable problem gamblers scored higher in terms of sociability. That is, they liked to be with other people. They also scored substantially lower on the dissociation scales for both gambling and non-gambling activities, $t = 2.5$, $p < .5$, and $t = 2.8$, $p < .5$, respectively. Apparently, some people who develop gambling problems do not feel particularly anxious or depressed. This group tends to include those who are less severe, do not have an impulse control disorder (other than problem gambling), and do not dissociate while gambling. The less miserable problem gamblers may be examples of what Alex Blaszczynski calls “normal” problem gamblers. Although we appear to be able to separate out people who fit into the ‘normal’ pathway, these measures did not provide a distinction between Blaszczynski’s two other paths. Emotional and physiological vulnerability appear to be strongly linked together.

Life Charts

The data on depression and negative mood have clearly shown that there is a strong relationship between depression and problem gambling. However, as shown above, only around half of the problem gamblers we examined were suffering from negative moods. This is consistent with the findings and views advanced by Alex Blaszczynski in his pathways model of problem gambling. However, this conclusion is based on *current* mood. To determine if a person had a pre-existing mood disorder, we needed to measure their mood at various times throughout their life. Having the participants complete a depression questionnaire for each period of their life would be

unmanageable, so instead we had them draw a chart illustrating how their mood and other variables have changed over their life span. A simple version of this procedure was used by Hanninen and Koski-Jannes (1999) which focused on turning points. Our approach was to expand this measure by having people complete seven separate charts of changes in their mood and gambling across their lifespan. Respondents were asked to draw a line on a scaled chart to represent their attitudes or feelings (e.g., “happiness”, “feeling lucky”, “stress”, “hopes”, etc.) from the age 10 years to present date. We must note that the data is retrospective and potentially biased by a person’s current mood. By having the participants fill out seven separate charts on related topics, we hoped to obtain a somewhat more accurate view than we would obtain from a single chart.

Due to the lack of pre-existing norms, the life charts of our non-problem gamblers were used for comparative purposes. To analyze the data we first aggregated four of the life charts (happiness, hopes, ability to cope, stress) into a single variable called “total affect”. We then segmented their life charts data into five time periods to produce eight aggregate scores, including current affect, affect over the past 5 years, affect between 5-10 years ago, affect during adolescence, and affect during early adulthood. We also added three gambling related time periods that we computed based on their frequency of gambling before they started gambling, during the early stage of their gambling career, and after they had taken up gambling regularly. To segment their gambling career we did a very careful study of each person’s life chart to identify stages in their lifetime gambling experience and then entered the timeframe of these stages into the SPSS data base. The life period variables were computed for all participants, while the gambling periods were only computed for those who had a definite period in which they took up regular gambling. It should be noted that for this analysis, some case ratings of mood for “10 years ago” may overlap with data regarding mood during one’s early adulthood or youth, since 19.4% of the participants were under the age of 30.

The life charts are very informative about the participant’s past. Many features of their charts are consistent with their report throughout the survey. One particularly important use of these charts is to determine if there are different life courses for different types of problem gamblers.

Figure 1 illustrates the life course of a person who appears to be from the “normal” problem gambling group (Blaszczynski, 1998). Based on the chart, he does not appear to have been depressed before his problem started. However, he appears to have suffered a severe drop in mood as a result of his gambling. There is no evidence in this chart for a pre-morbid mood disorder. His scores on impulsivity and boredom susceptibility put him very close to the average, suggesting that he is not overly impulsive. In contrast, the life chart of the respondent shown in Figure 2 tells a very different story. This person had a miserable youth. She was abused as a child. She started to feel better about her life during her early adulthood and around the time of the birth of her first child. Her mood took a turn for the worse again in her mid twenties, as she was first abused, then divorced, and then began to suffer a number of physical health problems. At this point, she took up gambling and very rapidly became a problem gambler. Her data clearly place her into the category of the “emotionally vulnerable” problem gamblers.

Figure 1: Life Charts data from a “normal” problem gambler.

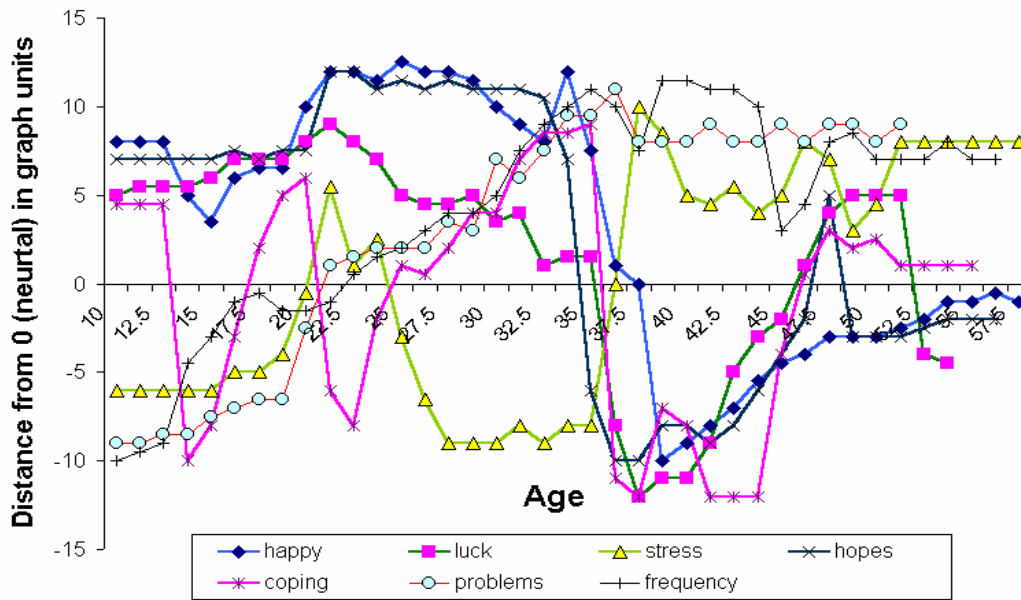
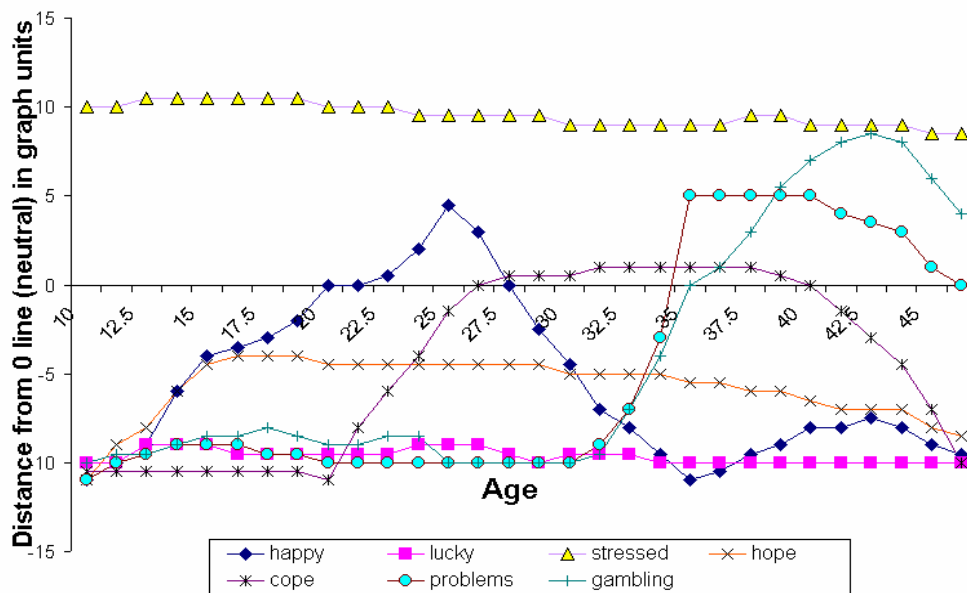


Figure 2: Life Charts data from an “emotionally vulnerable” problem gambler.



The early life experiences of the problem gambler in Figure 1 appear fairly normal. He reported being happy, having lots of hope and little stress for most of his youth. His gambling gradually increased and was soon followed by the development of a gambling problem. Around the age of 35 his life falls apart. The participant reported that this drop in positive affect was the result of “big money troubles and marriage fails”. These problems appear to be consequences of his gambling. Blaszczynski calls this type of gambler a “type 1” or “normal” problem gambler because of the absence of any emotional predisposition. It should also be noted that this participant had an average score on measures of anxiety and impulsivity. Contrast this case with Figure 2, which shows a person with considerable unhappiness during her childhood due to poverty and abuse. Her mood improved gradually as she reached adulthood, had children and got married. Then her life fell apart again due to poverty, a past that haunted her, separation from her husband, and problems with her physical health. As her mood became more depressed, she reports taking up gambling in the hope of a miracle. This person belongs to the “emotionally vulnerable” group of problem gamblers.

Table 28 illustrates the change in mood of problem and non-problem gamblers across their life span. Analysis of the data from the life charts revealed that problem gamblers were much more likely to be unhappy at all periods of their lives, $F(1,99) = 11.2$ $p < .001$. As can be seen in Table 28, problem gamblers generally started out significantly less happy than non-problem gamblers. Interestingly, both problem and non-problem gamblers report a fairly steady decrease in their positive affect throughout their lives. Curiously, there was no interaction with gambler type (i.e., the decrease in positive affect appears to have been equal for both groups). The control group dropped by 2.2 points, while the problem gambling group dropped by 2.8. However, this difference was not significant.

Table 28: Aggregate affect scores (happiness, ability to cope, hopes, absence of stress) from life charts.

Gambler	Time Period	Mean	Std. Error	95% Confidence Interval	
				Lower Bound	Upper Bound
Non-Problem Gamblers	During Youth (10-18)	3.562	.601	2.369	4.755
	Early Adulthood (18-22)	2.570	.446	1.686	3.455
	10 years ago	3.300	.535	2.239	4.361
	5 years ago	1.418	.544	.339	2.497
	Current	1.378	.603	.182	2.574
Problem Gamblers	During Youth (10-18)	1.386	.601	.194	2.579
	Early Adulthood (18-22)	.409	.446	-.475	1.293
	10 years ago	1.172	.535	.111	2.234
	5 years ago	-.212	.544	-1.291	.867
	Current	-1.455	.603	-2.651	-.259

Note: This analysis includes gender as a covariate, but gender was non-significant.

In addition, both groups seem to have become less happy across their life span. This might be related to the “golden years phenomenon” (Howes and Katz, 1992), in which people looking back on the past have a bias towards recalling more positive events than negative events.

Premorbid Misery

One of the key goals of this part of the study was to divide people into those who were basically happy prior to having a gambling problem and those who were unhappy. An examination of Table 28 may lead the reader to conclude that the problem gamblers were uniformly unhappy throughout their lives, but when we look at the standard deviations for the aggregate affect for problem (3.5) and non-problem gamblers (2.8) we noticed that problem gamblers were more varied in their mood. We argue that this is because there are distinct sub-populations of problem gamblers, some of whom were unhappy before developing a gambling problem and others that were not particularly unhappy before gambling became a problem. The best means to illustrate this contrast is to examine the individual life charts. As described above, Figure 1 and 2 illustrate two very different patterns of gambling behaviour. However, reading information off the charts is very time consuming and biased to some extent by subjectivity. In order to make this process more rigorous, we used the total affect scores and computed a measure of premorbid affect. We computed an average affect score based on their affect during adolescence, during early adulthood, before they started gambling, and during their early stages of their gambling career. An average score of 0 (somewhat happy) is a convenient cut-off point to look for negative affect. This score also happens to be nearly 1 standard deviation below the average for the non-problem gamblers on the aggregate affect measure.

Table 29 shows that about one-third of the problem gamblers in our sample were on average unhappy in their youth. Only 11.3% of the non-problem gamblers were unhappy during the same time period.

Table 29: Percentage of people that were miserable in their youth broken down by gambling type.

Miserable?	Non-Problem	Borderline	Problem	Recovered
No	88.7%	76.7%	66.0%	33.3%
Yes	11.3%	23.3%	34.0%	66.7%

Interestingly Table 27b shows that none of the recovered problem gamblers report being depressed currently, but 2 out of the 3 of the recovered gamblers (Table 29) report being unhappy during their youth. Again, the small number of recovered problem gamblers (n=3) makes generalization of these results impossible. Overall, these findings illustrate that pre-morbid unhappiness is associated with problem gambling in a substantial number of problem gamblers, but that premorbid unhappiness does not explain all, or even most, problem gambling.

Cluster Analysis

Another issue we wished to address was the importance of character and temperament (personality) variables for differentiating problem and non-problem gamblers, and to determine if problem gamblers were made up of subgroups of individuals with distinctive personality traits. To do this, we used cluster analysis. In cluster analysis a large number of variables are analyzed with a computer program (e.g., SPSS-quick cluster) that identifies subgroups amongst the people in the sample. The subgroups are therefore aggregates of individuals who possess a number of traits in common. Cluster analysis is an inherently exploratory method and rarely provides an unambiguously perfect fit to the data. The four cluster solution was chosen because all four clusters were reasonably large and similar in size (ranging from 26-45). Secondly, the four cluster solution was the one that most clearly separated problem and non-problem gamblers. Two of the clusters are predominantly problem gamblers (cluster 1 and 3) and two are predominantly non-problem gamblers (cluster 2 and 4). The borderline problem gamblers were scattered across all four groups.

This four cluster solution is particularly satisfying because problem gambling (or any other gambling related measure) was not used to create these four groups (see Table 30).

Table 30: Cross tabulation of problem gambling group and cluster groups.

Problem Gambling Group based on DSM-IV & SOGS	1 Depressed & Anxious	2 Sociable & Happy	3 Superstitious & Thrill Seekers	4 Skill Oriented	Total
Non-Problem	6	25	8	15	54
Borderline	4	10	11	6	31
Problem / Pathological	21	9	21	4	55
Recovered	1	1		1	3
Total	32	45	40	26	143

Having selected this four cluster solution, we then examined the specific features of each cluster. To interpret the clusters, we first went through the variable means for each cluster to get a sense of each one's unique profile. We also computed four contrasts using the one-way procedure to examine key group differences: group 1 vs. group 3 (how the two groups of problem gamblers differ); group 2 vs. group 4 (how the two groups of non-problem gamblers differ); group 1 and 3 vs. group 2 and 3 (how problem and non-problem gamblers differ); and, group 4 vs. groups 1, 2, and 3 (what is unique about group 4).

The contrasts indicated by the cluster analysis procedure should be interpreted cautiously. The large number of contrasts virtually guarantees that some of the effects presented are type-1 errors. However, what we should focus on is the nature of the variable as it fits into an overall profile of the cluster to help us understand the distinct nature of that cluster. The interpretation of the cluster should centre around the overall profile rather than each variable individually. We will examine the two problem gambling clusters first. Means, standard deviations and contrast results are shown in Table 31a (cluster variables) and 31b (external validation variables).

Table 31a: Primary cluster variables

Scale	Cluster 1		Cluster 2		Cluster 3		Cluster 4		Contrasts b/w Clusters			
	Depressed & Anxious (n=321)		Sociable & Happy (n=452)		Superstitious & Thrill Seekers (n=403)		Skill Oriented (n=264)		1	2	1&3	1,2,3
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	vs. 3	vs. 4	vs. 2&4	vs. 4
TCI Sub scales												
Novelty Seeking	63.0	24.8	40.9	23.9	71.6	19.4	53.4	22.6		*	***	
Harm Avoidance	85.3	13.6	51.1	25.4	48.5	21.0	13.8	10.9	**	***	***	***
Reward Dependence	26.3	18.2	60.1	19.9	52.3	25.0	30.6	26.0	***	***	**	**
Persistence Self	23.2	20.9	38.2	23.7	34.5	23.2	70.2	17.6	*	***	***	***
Directedness Self	16.3	18.9	64.8	21.0	21.8	16.6	63.5	25.3			***	***
Cooperativeness Self	20.4	19.6	65.0	14.9	33.6	21.8	40.8	30.3	*	***	***	
Transcendence Self	29.2	21.7	30.2	23.1	60.2	26.3	37.2	28.2	***		*	
Ways of Coping Questionnaire												
Confrontation	2.2	0.7	1.9	0.6	2.3	0.7	2.2	0.7				
Distancing	2.1	0.6	1.9	0.5	2.2	0.6	1.9	0.5			*	
Self Control	2.1	0.6	2.1	0.5	2.4	0.5	2.3	0.6	*			
Social Support	1.9	0.7	2.0	0.6	2.2	0.6	2.1	0.7				
Taking Responsibility	2.3	0.8	1.9	0.7	2.5	0.8	2.1	0.7			***	
Escape	2.3	0.7	1.6	0.5	2.3	0.7	1.8	0.5			***	
Problem Solving	2.1	0.7	2.3	0.7	2.4	0.6	2.5	0.6	*			
Other Scales												
Re-Appraisal	1.8	0.6	2.0	0.7	2.3	0.7	2.0	0.7	***			
Boredom	45.2	15.0	45.7	13.0	53.7	13.8	57.5	14.2	**	***		**
Susceptibility												
Thrill Seeking	15.4	13.4	16.2	17.8	36.1	21.7	44.5	19.4	***	***		***
Impulsivity	52.7	15.8	39.4	15.3	52.6	15.2	42.4	11.5			***	
Social Ability	51.6	22.7	67.0	16.5	66.4	20.5	66.6	21.4	***		**	
Depression	51.4	17.7	30.0	12.5	42.5	14.3	29.0	15.0	*		***	***

* p < .05; ** p < .01; *** p < .001

Table 31b: Secondary or validation variables across clusters

Scale	Cluster 1		Cluster 2		Cluster 3		Cluster 4		Contrasts b/w Clusters			
	Depressed & Anxious (n=321)		Sociable & Happy (n=452)		Superstitious & Thrill Seekers (n=403)		Skill Oriented (n=264)		1 vs. 3	2 vs. 4	1&3 vs. 2&4	1,2,3 vs. 4
	Mean	SD	Mean	SD	Mean	SD	Mean	SD				
Random Events	0.62	0.17	0.67	0.13	0.63	0.17	0.63	0.15				
Dissociative experiences while gambling	2.58	1.12	1.84	0.74	2.50	0.90	1.85	0.83			***	*
Dissociative experiences not gambling	1.97	0.54	1.71	0.55	2.22	0.81	1.74	0.61			***	*
ADHD Before the age of 7	1.97	0.57	1.65	0.44	1.88	0.48	1.68	0.42			***	
ADHD Currently	1.80	0.59	1.34	0.30	1.75	0.36	1.32	0.20			***	***
Total Stressful life events	2.56	2.17	1.53	1.74	2.98	2.46	1.00	1.60			***	***
Total support	1.47	1.76	2.29	2.44	1.65	2.17	2.69	2.45			*	
PSI sub scales												
Does not problem solve	33.97	9.13	24.96	7.42	28.60	7.97	22.90	8.03	***		***	**
Avoidance coping	55.50	10.06	44.71	10.71	48.95	11.04	42.90	8.25	*		***	**
Poor personal control	20.78	4.75	15.02	5.57	19.21	4.60	15.30	5.06			***	**
PSI Total	110.25	21.34	84.69	20.18	96.28	21.40	81.10	18.19	***		***	**
ICS: Total clinical stress	48.22	19.25	24.28	11.08	39.34	15.59	28.40	13.16	*		***	**
Total erroneous beliefs	2.53	1.05	1.98	1.20	3.26	2.04	2.27	1.49	*		**	
Are you a lucky person?	2.23	0.72	2.48	0.73	2.78	0.89	2.77	0.71	**			
Prefer skill games	2.87	1.18	3.13	1.10	3.35	1.00	3.65	0.98		*		*
Usually know when you're due for a win?	2.00	0.82	1.86	0.70	2.40	0.81	2.42	0.99	*	**		

Table 31b: Secondary or validation variables across clusters, *continued...*

Scale	Cluster 1 Depressed & Anxious (n=321)		Cluster 2 Sociable & Happy (n=452)		Cluster 3 Superstitious & Thrill Seekers (n=403)		Cluster 4 Skill Oriented (n=264)		Contrasts b/w Clusters			
	Mean	SD	Mean	SD	Mean	SD	Mean	SD	1 vs. 3	2 vs. 4	1&3 vs. 2&4	1,2,3 vs. 4
Even though you may lose in the end, do you think it's still fun to GAMBLE?	3.53	1.17	3.47	1.10	3.42	1.01	3.96	1.00				*
Do you set yourself a spending limit?	2.90	1.40	3.93	1.01	3.38	1.21	3.80	1.12			***	
Gamble with other people?	3.23	1.18	3.60	1.18	3.20	1.14	3.69	1.12			*	
Can make luck happen	0.09	0.30	0.07	0.25	0.13	0.34	0.42	0.50		**	*	**
Luck and chance different	0.44	0.50	0.62	0.49	0.75	0.44	0.73	0.45	**			
Current affect from life charts	-1.55	4.71	1.40	4.47	-0.47	3.47	1.69	3.09			***	*
Affect during youth from life charts	0.31	5.55	3.42	3.47	2.65	3.56	4.28	3.16	**		***	*
Affect during early adulthood	-0.19	4.17	2.55	2.80	1.32	2.56	3.06	2.15	*		***	***
Age	40.47	11.96	48.89	13.80	37.72	12.81	37.10	10.23		*		***
Year they started gambling	22.6	10.1	30.1	15.5	21.7	12.3	20.9	9.1		**		

* p < .05; ** p < .01; *** p < .001

Cluster 1: Unhappy Problem Gamblers

People in cluster 1 avoid harm, are not reward-dependent, and are more likely to be depressed or anxious. They are also impulsive and use escape as a way of coping. This group scores high on the problem gambling questionnaires and appears to represent escape and avoidance oriented problem gamblers.

Consistent with the above scores on the external correlates, they are shown to be poor problem solvers (a high score on the PSI problem solving scale which indicates a poor problem-solving ability), have a greater degree of clinical stress, and compared to other groups, generally consider themselves' to be unlucky. Interestingly, they are the least likely of all four groups to consider chance different from luck. Both cluster 1 and 3 report being currently unhappy, but cluster 1 reports being significantly less happy during adolescence and/or young adulthood. The

characteristics of this group most closely resemble those of the emotionally vulnerable problem gambler, as discussed above.

Cluster 2: Non-Problem Gambling Clusters

People in this group are reward-dependent, but are also self-directed, co-operative and sociable. They are not thrill seekers or novelty seekers, and they are not impulsive. They are generally not currently depressed and report having the happiest adolescence and young adulthood of the four groups. However, this group includes a substantial number of borderline gamblers, so the meaning of this cluster should be interpreted cautiously.

Cluster 3: Superstitious Thrill Seekers

This group can be described as superstitious thrill seekers. They score high on impulsivity and escape coping compared to clusters 2 and 4, and are more cooperative and sociable than cluster 1. However, the most striking characteristic of this group is their score on self-transcendence. This scale measures belief in miracles and spiritual acceptance and it is likely that this effect is tapping into superstitious beliefs. This interpretation is also supported by their score on the reappraisal subscale of the ways of coping, which includes a spiritual component (an item on prayer). On the external correlates this group checked off more strategies of winning (e.g., looking for patterns) than the other groups, suggesting that they have more erroneous beliefs than other groups. Interestingly, we did not find any differences in the games that people in cluster 1 and 3 played. However, there was no difference in random-events knowledge between the four clusters.

Interestingly, we also found the majority of problem gamblers in cluster 1 reported having no intention of changing their gambling, whereas the problem gamblers in group 3 usually reported either intending to cut back or having already cut back on their gambling (see Table 32). We are not sure whether this represents a change in their actual behaviour or if they are engaging in some degree of self-deception.

Table 32: Cross tabulation of self reported readiness to change and cluster grouping for problem/pathological and recovered gamblers.

Self Reported Readiness to Change	Cluster 1 Depressed & Anxious	Cluster 2 Sociable & Happy	Cluster 3 Superstitious & Thrill Seekers	Cluster 4 Skill Oriented	Total
I have no intention of stopping or reducing my gambling	12		3		15
I am seriously considering stopping or reducing in the next 6 months	3	3	7	3	16
I plan stopping /reducing in next 30 days	2	2	1	1	6
I have stopped /reduce in last 6 months	3	2	5		10
I stopped /reduced more than 6 months ago & maintained the chance	2	3	2	1	8
I don't gamble			1		1
Total	22	10	19	5	56

Cluster 4: Non-Problem Gamblers who Work Hard

This group seems to value hard work and persistence. They might be characterized as skill-oriented gamblers since they are mostly men and prefer skill games more than group 2, but they do not appear to differ from the other groups in terms of the games they play. They score high on persistence and thrill seeking, and score low on harm avoidance, reward dependence, and depression. Cluster 4 also scored higher on the chance and patterns subscales of the Random Events Knowledge Test (REKT) compared to cluster 2 ($t = 2.3, p < .05$, & $2.8, p < .05$), but they did not differ on the REKT on any other knowledge question. Thus, they appear to know more about chance than the other group of non-problem gamblers, but not more than the problem gamblers.

Cluster Summary

This cluster analysis suggests that problem gamblers can be subdivided into at least two groups. The analysis presented above is a preliminary analysis that needs to be explored further, perhaps using a different set of variables, or by conducting an analysis looking only at the problem gamblers.

Regression Analysis

Having completed the preliminary analyses we can now turn to an overall modelling of the data. The ultimate goal was to develop and test a pathways model of the data. We had originally hoped to examine the influence of genes, but the non-significance of the genetic effects means that we cannot include the genetics data in this analysis.

As a first step we also needed to look for the presence of interactions between the variables. The simplest way to accomplish this was to use the general linear model analysis available in SPSS, enter the variables of interest as covariates, and use the model building tools to test for interactions. Using Type I sums of squares we found only one significant 2-way interaction and no higher order interaction. This suggested that the variables operate in a linear, cumulative manner rather than in an interactive manner. The one effect we found suggested that the combination of support and positive life experiences prior to having a gambling problem and positive affect in one's youth was associated with less problematic gambling than the two factors by themselves. As this effect was small, we did not include it in any of the subsequent models. We conclude that problem gambling risk factors primarily function in an additive manner.

Structural Modelling of the Data

Unfortunately, the absence of the genetic effects weakens the value of this analysis and we are left primarily sifting through the variables (as described above) to determine which are the most important. In the model that we constructed, we identified problem gambling using the SOGS lifetime, SOGS current, DSM-IV, and the harmful consequences score. We tested a number of different models of the data to try to illustrate the separate emotional, cognitive and physiological pathways to gambling. However, after extensive analysis we have come to the conclusion that these paths are not separate, but intimately linked together.

Model 1

The goal of this analysis was to determine the extent to which we could account for problem gambling from a combination of physiological, experiential, cognitive, and emotional factors. We were particularly interested in variables that would predate the gambling problem. The variables we selected for this analysis were ADHD symptoms before the age of 7, family history of gambling problems, total stress in the year prior to the gambling problem, total support in year prior to the

gambling problem, total affect during youth (age 10-22) from life chart, size of first win (in log units), correct understanding of one's real chance of winning, and game related knowledge of probability. We have no way of proving that the last two variables (knowledge of one's real chance of winning and knowledge of game related probability) actually predate problematic gambling, but it is reasonable to argue that erroneous beliefs are at least partly a cause of problem gambling rather than a consequence. We also included escape coping as an endogenous regressor (one that is partly caused by other variables in the model). The goal of this first analysis was to explore the interrelationship of these variables. Each of these variables was entered into the analysis as a factor with the residual set to zero.

We argue that escape coping is at least partly the consequence of stressful life events. People who experience a lot of distressing life events will resort to escape as a means of coping. We also assert that reliance on escape coping may be the critical variable for turning a person who is under stress into a problem gambler (a mediating effect). This model is speculative and will need to be studied further. For the time being, we cannot prove the causal relationship between escape coping and stressful life events.

As you can see in Table 33, a number of these factors predict problem gambling. Other variables predict the use of escape coping. Of the exogenous variables, the most important predictors are total stress and a family history of problem gambling. In addition, there was a marginally significant effect of the size of one's first win. This effect is significant if assessed with a one-tail analysis. This is an appropriate measure since this is a predicted effect, although the effect is rather small.

Table 33: Gamma weights (regression coefficients) of separate predictors onto escape coping and problem gambling from LISREL Model 1.

Exogenous Regressors	Escape	Problems
ADHD before the age of 7	--	--
Family history of gambling problems	--	0.19 *
Total stress in year prior to gambling problem	0.23**	0.19 *
Total support in year prior to gambling problem	--	--
Total affect during youth from life chart	-0.29 **	--
Size of first win (in log units)	--	0.13+
Correct understanding of one's chance of winning	-0.20 *	--
Chance knowledge	0.19 *	--
Endogenous regressors		
Escape coping		0.53**

+ marginally significant; * $p < .05$; ** $p < .01$

Total affect is the strongest predictor of escape coping, followed by total stress. Interestingly, knowledge of one's real chance of winning and knowledge of game related probability have opposite effects on escape coping. Taken together, these findings suggest that a person who gambles

as a means of escape coping has a relatively good understanding of the probabilities of the games they play (they know the odds), but they hold erroneous beliefs about their ability to win. They know the odds, but think they can beat them. This model is also interesting in terms of effects that do not reach significance. Symptoms of ADHD prior to the age of 7 had no direct effect on problem gambling or on escape coping, but were related to total affect and stress (see Table 34). It seems that in this study we were unable to separate out the physiologically vulnerable pathway from the emotionally vulnerable pathway.

There were also a number of correlations between the predictors, especially between total stress, total affect, and symptoms of ADHD prior to the age of 7. This suggests that the variables really make up a smaller set of factors. Table 34 shows the correlations matrix from the LISREL analysis. The standardized residual (PSI) for escape coping was .755, and for gambling problems was .513. This suggests that with a relatively small number of variables we can account for nearly half of the variance of problem gambling. Chi-square (df = 89) 111, $p = .06$, GFI = .908, and the non-normed fit index = .965, suggesting a good fit for the model.

Table 34: Correlation of variables from LISREL Analysis: Model 1

Variables	1	2	3	4	5	6	7	8	9	10
1 Escape coping	1.00									
2 Gambling problems	0.62	1.00								
3 ADHD before age 7	0.12	0.10	1.00							
4. Family history of gambling problem	0.07	0.26	--	1.00						
5. Total stress in year prior to gambling problem	0.31	0.41	0.18	0.15	1.00					
6. Total support in year prior to gambling problem	-0.06	-0.08	--	--	-0.24	1.00				
7. Total affect during youth from life chart	-0.35	-0.26	-0.28	--	-0.26	--	1.00			
8. Size of first win (in log units)	0.13	0.24	--	--	0.25	--	-0.24	1.00		
9. Correct understanding of one's chance of winning	-0.20	-0.14	--	-0.18	--	--	--	--	1.00	
10. Chance knowledge	0.19	0.10	--	--	--	--	--	--	--	1.00

Model 2

Based on the results of this analysis, we reorganized the various stress and life experiences predictor variables into a single factors called "emotional vulnerability". We also added measures of current negative affect (depression, anxiety, etc.) and current physiological problems (impulsivity and current ADHD) as endogenous variables. Our goal was to test the model that negative life experiences and stress at an early age, coupled with erroneous knowledge, are related to escape coping, and that escape coping causes problem gambling. This model was supported, but we found no additional impact of problem gambling on current negative mood, or vice versa. All the variance between current negative mood and problem gambling was accounted for by the "emotional vulnerability" factor. Similarly, the model found no link between either past ADHD symptoms or current ADHD symptoms. However, it should be noted that both past and current ADHD symptoms are indirectly linked to problem gambling through "emotional vulnerability".

"emotional vulnerability" was primarily defined by two variables; total stressful events in the year prior to one's gambling problem and total negative affect during one's youth. However, this

variable was also linked to a family history of gambling problems, the size of one's early win and ADHD symptoms before the age of 7. This suggests that the various elements that lead people to develop problem gambling do not operate as separate pathways, but are intimately combined in some manner. Perhaps it is only through the combination of these factors that people develop problems. More research is needed on the necessary and sufficient conditions for the development of a gambling problem.

When a direct path from the "emotional vulnerability" factor onto problem gambling is added to the model, the relationship between escape coping and problem gambling drops substantially compared to the previous analysis, $r = .27$, $p < .01$. This suggests that pre-morbid misery has a direct effect on problem gambling, as well as an effect mediated through escape coping.

Again, we found no direct link from knowledge of randomness to problem gambling, but rather an indirect path through escape coping ($r = -.178$). Attention Deficit Hyperactivity Disorder symptoms prior to age 7 had no direct effect on problem gambling, but ADHD symptoms were correlated with "emotional vulnerability" $r = .322$, $p < .01$. The findings regarding knowledge of randomness suggest that the effect of knowledge is mediated through escape coping. Interestingly, escape copers also have a greater knowledge of game related probability. Erroneous beliefs about winning lead people to rely on gambling as a way of coping with stress. It is argued that erroneous beliefs about randomness combined with accurate knowledge of the games is a dangerous combination.

This is not surprising since individuals with ADHD can be very stressful and limit school and career success. Current ADHD symptoms were predicted by ADHD symptoms prior to age 7, $r = .341$, $p < .01$, and by "emotional vulnerability", $r = .601$, $p < .01$. The residual for problem gambling was .451, suggesting that this model accounts for slightly more than half of the variance of problem gambling. The chi-square for this model was 360.2 ($df=249$), the GFI was .839 and the NON-NORMED FIT INDEX was 0.895, suggesting a reasonably good fit of the model to the data. Overall, this model suggests that a large percentage of problem gambling can be explained by early negative life experiences, including those related to ADHD and the use of escape coping. Escape coping, in turn, is to some extent coupled with erroneous beliefs.

The pre-morbid "emotional vulnerability" factor is somewhat problematic since it is also linked to physiological (ADHD) and behavioural (wins) variables. In fact, in one analysis we found that if we loaded ADHD and first win directly onto "emotional vulnerability", knowledge about one's true chances of winning lotteries was also loaded on this factor ($r = -.19$, $p < .05$). If all of these changes were made, the factor can no longer be called "emotional vulnerability" because it includes too many other variables. A better term would simply be "vulnerability". Thus, rather than being three separate pathways, the variables operate in a cumulative manner. The more variables, the greater the chance a person would have a gambling problem. Further work needs to be carried out to tease apart these issues.

How Many Risk Factors?

Above, we have shown that there are a number of factors that appear to be involved in the development or maintenance of problem gambling. Another issue is the number of risk factors needed to develop a problem. We took eight of our key variables, including impulsivity, negative affect during youth, stress before one's gambling problem started, poor scores on the random events knowledge, use of escape coping, the size of one's first win, winning the first time one gambled, and ADHD symptoms prior to the age of 7. We did not use anxiety or depression because they are measures of current mood, and are thus contaminated by negative gambling experiences. Each variable was dichotomized using a median split, except for winning the first time one gambled, which was simply scored based on a "yes" or "no" scale (yes=1, no=0). A median split is probably

not the best way to divide this sort of data, but serves the current purposes adequately. We then added up the scores to get a single estimate of the number of variables that the person scored at the problematic end of the spectrum. The distribution of scores is shown in Table 35. As you can see, very few of the problem gamblers scored less than 3 and most scored 4 or more. In contrast, most of the non-problem gamblers scored 4 or less. There was no evidence that any specific variable was necessary or by itself sufficient to produce a gambling problem. Furthermore, there was no evidence that a person had to achieve a minimum number to be problematic. Instead, it appears that the more risk factors one has, the more likely one is to have a gambling problem.

Table 35: The number of risk factors required to produce problem gamblers. The number in the cell indicates the number of people in each group that report each number of risk factors.

Number of risk factors	Non-Problem	Borderline	Problem	Recovered
0	4	1	1	
1	13	4	1	
2	15	6	7	
3	8	6	10	1
4	11	6	13	2
5	2	2	11	
6	1	2	7	
7		2	4	
8		1	1	
Total	54	30	55	3

Pathing the Sample

Thus far we have provided evidence in support of Blasczynski's (1998) model. Now we turn to an examination of path-membership. Three discriminant function analyses were conducted in order to examine how well the variables related to each of Blasczynski's (1998) pathways could differentiate problem and non-problem gamblers. These analyses were conducted in conceptually related blocks that are directly related to each of the three pathways in Blasczynski's (1998) model. Note that the discriminate function analysis did not include the borderline people when estimating the functions for the analysis, but estimated which category they belonged to in the output. We did not include WCQ's escape coping measure or the TCI's self-directedness measure in these analyses because these two variables do not help us differentiate which path an individual may have taken. We also did not include any variable that could be construed as a consequence of problematic gambling (e.g., depression and anxiety). These variables will be used in a final discriminant analysis for comparison, but were not used in our attempt to determine the paths for the individual problem gamblers in our sample.

The first analysis examined variables related to beliefs about winning, knowledge about the nature of randomness, and experiences of wins. This analysis is intended to identify people who, other than having a gambling problem, are essentially 'normal' (i.e., hold erroneous beliefs, or have experienced a lot of positive reinforcement from their gambling experience). This analysis correctly classified 78.2% of the problem gamblers into the problem group, but also classified 23.6% of the non-problem gamblers into the problem gambler group, for an overall accuracy rate of 76.1%

The second analysis examined "emotional vulnerability" and was conducted using only three retrospective variables related to this factor, including total stressful situations in the year before one started gambling, total positive life situations in the year before one started gambling, and a measure of affect during one's adolescence derived from the life charts. This analysis correctly identified 63.6% of the problem gamblers and had an overall accuracy rate of 67.3%.

The third analysis focused on variables that could indicate an attention deficit or hyperactivity disorder, including childhood ADHD symptoms, adult ADHD symptoms and impulsivity. These variables are related to Blaszczynski's (1998) physiological vulnerable pathway. This analysis correctly identified 50.9% of the problem gamblers and had an overall accuracy rate of 66.4%.

A final analysis combined all three of these general areas of interest together and was able to accurately classify 77.9% of the people as either problem or non-problem gamblers. When two other variables (escape coping and self directedness) were added, this figure rose to 84.1%. Of the three separate analyses, the cognitive and behavioural analysis had the highest correct placement of problem gamblers into the problem gambler group, but also the largest number of false positives. The impulse control analysis placed only half of the problem gamblers into the problem gambling group, but also placed very few non-problem gamblers into that group.

Relative Size of the Paths

As a final analysis we wanted to examine the overlap of these three pathways. It is important to consider that in order to do this, we constructed a variable that was a composite of the three pathways variables. Using this variable we could determine, for example, how many problem gamblers fit into the normal, emotional vulnerability, and physiological vulnerability (impulsive) pathways, and how many people have combinations of these factors. Note that physiological vulnerability is treated here as a more serious condition so that all people who were identified by the impulse control discriminant function analysis are classed into this category. The "complications" column indicates those people who were identified by more than one analysis.

Table 36a and Table 36b illustrate the number of problem and non-problem gamblers who fit into each gambling category and combination of categories. The largest single group turned out to be people who were correctly identified as having a problem in all three analyses (27.3%). Only about half of the non-problem gamblers were correctly classified as having a problem in all analyses, however, none of the non-problem gamblers were grouped as having a problem by all three analyses. The borderline problem gamblers fall neatly between the problem and non-problem groups. The majority of problem gamblers we identified by at least two of the analyses. Only relatively small numbers of people were classified in only the "emotional vulnerability" or only the impulsivity analysis (5.5% each).

Table 36a: The accuracy of three discriminate functions analyses to correctly classify people as having a gambling problem.

Type of Gambler	Cognitive/Behavioural	Emotional Vulnerability	Impulsivity (e.g., ADHD)	Overall
Non-Problem	23.6%	29.1%	16.4%	12.7%
Borderline	51.6%	29.0%	22.6%	41.9%
Problem	78.2%	63.6%	50.9%	70.9%
Recovered	33.3%	66.7%	33.3%	33.3%

Note: The percentage listed for non-problem gamblers represents false positives.

Table 36b: Breakdown of the number of people classified as having a problem in cognitive, emotional and impulse discriminate functions.

Pathway	Complications (other factors)	Non-Problem	Borderline	Problem	Recovered
Normal	No known predisposition	47.3%	29.0%	3.6%	
	Cognitive & experiential	14.5%	32.3%	16.4%	
Emotional Vulnerability	No complications	14.5%	12.9%	7.3%	33.30%
	With cognitive & experiential	7.3%	3.2%	21.8%	33.30%
Physiological Vulnerability (includes ADHD)	No complications	7.3%	3.2%	3.6%	33.30%
	With cognitive & experiential	1.8%	6.5%	12.7%	
	With “emotional vulnerability”	7.3%	3.2%	7.3%	
	All three risk factors		9.7%	27.3%	

These results support Blaszczynski's (1998) model of problem gamblers. However, it is clear that there are few people who belong to only one path. Instead, the majority of people seem to have moved along two or more paths. This fact is not inconsistent with Blaszczynski's (1998) model, but adds a great deal of clarity to our understanding of the relationship between these paths.

Discussion

The two primary objectives of this study were to determine the role of ADHD in the development of problem gambling and to test Alex Blaszczynski's pathways model of how people develop problems with gambling. More specifically, we were interested in the relative contributions of normal states, emotional vulnerabilities and physiological vulnerabilities (e.g., ADHD) as potential pathways in the development of problem gambling. In general, the data do support Blaszczynski's hypothesis regarding the multiple pathways nature of problem gambling development. Evidence was found for emotional, cognitive, and behavioural contributions. The study also made a number of new discoveries concerning the relationships among variables that are important to problem gambling development. While no evidence was found in support of the genetic models, we did find evidence in support of the general notion that impulse control is an important factor in problem gambling, suggesting that physiological models of problem gambling need to be further explored. In addition, we have evidence that some people have no pre-existing disorder, but are basically 'normal' people. We also have found evidence for some of the factors that contribute to the development of gambling problems amongst those who are neither physiologically nor emotionally vulnerable.

We originally hypothesized that impulsivity would account for 10-20% in the path analysis used. As it turned out, it was difficult to determine the exact role of impulsivity. Problem gamblers are definitely impulsive. The correlation between impulsivity and problem gambling is $r = .354$, $p < .01$ or 12.5% of the variance of problem gambling. This confirmed our estimate of the variance accounted for by impulsivity. However, impulsivity was also correlated with escape coping,

depression and anxiety. After controlling for depression, anxiety and escape coping, the partial correlation of impulsivity and problem gambling, was not significant ($r = .09$). This suggests that impulsivity, depression and other variables operate in conjunction with each other. Our findings are consistent with those of other studies showing links between depression and impulsivity in impulse-spectrum disorders (Hollander et al., 1994; Brown et al., 1982; Meltzer et al., 1981). We also found elevated levels of attention deficit disorder amongst the problem gamblers. Amongst the non-problem gamblers, 5.9% of the participants met criterion for attention deficit disorder, of either the hyperactive-impulsive or inattentive subtype. In contrast, 18.3% of problem gamblers reached criterion for ADHD. These findings suggest that ADHD may play an important role in the development of problem gambling in nearly 20% of cases. However, it is also interesting to note that it is primarily adult ADHD symptoms that matter. The correlation between ADHD symptoms before the age of 7 (reported retrospectively) and adult problem gambling was fairly weak ($r = .172$), whereas the correlation for current ADHD symptoms was quite strong ($r = .457$). Interestingly, when we used childhood ADHD, adult ADHD and impulsivity as continuous variables in a discriminate function analysis, we were able to correctly classify 50% of the problem gamblers. This suggests that sub-clinical levels of impulsivity may play a role in as many as 50% of problem gambling cases. However, it is important to note that a lot of this effect is due to current ADHD symptoms and impulsivity, not childhood ADHD. Therefore, we cannot make firm statements about causality. The absence of the genetic effects that we tested means that we cannot prove that this impulse control effect pre-dated the gambling problem.

One of the most interesting findings in this study is that adult ADHD symptoms are much more strongly related to problem gambling than childhood ADHD. In our structural equation model we did not find a direct relationship between childhood ADHD and problem gambling. However, childhood ADHD was correlated with retrospectively reported pre-gambling stress and negative affect, and pre-gambling negative affect was strongly linked to problem gambling. We will consider three interpretations. First, perhaps the non-problem gamblers in our sample overestimated their childhood ADHD symptoms. This interpretation would require an explanation of why non-problem gamblers would be less accurate than problem gamblers on the childhood questions, but not on the adult questions. Second, it is possible that adult impulsivity may to some extent be a result of problematic gambling. Anecdotally, problem gamblers do report a shift in their enjoyment of other activities. More than one problem gambler has noted that gambling is better than sex. Perhaps the intense experience of gambling shifts the baseline arousal level of the brain to mimic ADHD symptoms. And finally, having a miserable adolescence might preserve ADHD symptoms. That is, people who have happier life experiences learn to live with their arousal level and grow out of their ADHD symptoms, while people who live an unhappy life are unable to adjust. More research is needed on this issue.

While we found support for our hypotheses that cognitive, social, emotional and physiological factors would significantly explain the variance associated with problem gambling, the overlap among the variables was considerable. For example, we found that knowledge of randomness was correlated with escape coping (an emotional variable), and after controlling for escape coping we found no additional influence of knowledge on problem gambling. In addition, having a family member who gambled, and/or experiencing a win were also associated with emotional variables. As a result, we did not find evidence in support of this hypothesis, but instead found evidence in support of the idea that it is the combination of factors that leads to problematic gambling.

Our finding that a number of variables were separately related to problem gambling failed to support our original hypothesis that the combined effect of the variables on overall variance would be greater than their influence separately. The effect of these variables appeared to be linear and additive. In other words, there was little evidence of interaction among the variables. The one

exception was that the combination of positive experiences and support in one's life interacted with emotionality during one's youth, such that people who were happier and had social support were less likely to develop a gambling problem. No other 2-way, 3-way or 4-way interaction was found. When we conducted separate discriminate function analyses of cognitive, behavioural (beliefs and positive reinforcement, e.g., wins), and emotional risk factors, as well as impulsivity, we found that the majority of problem gamblers were identified in at least two of these analyses, suggesting that most problem gamblers have elevated scores in at least two of these areas (cognitive, emotional and impulse related risk factors).

In the results section we made several estimates of the relative number of people who followed different pathways. For example, based on our examination of adolescent affect from the life charts we estimated that around 34% of problem gamblers were unhappy prior to having a gambling problem. However, 50% of the self identified problem gamblers reported either that their life was going nowhere or that they had suffered a stressful life event just before their problem started. The discriminate function analysis identified 63.6% of the problem gamblers based on pre-gambling mood related variables. Similarly, the role of ADHD (based on diagnostic criteria) estimated that it was found in 18% of the sample, whereas the discriminate function analysis identified 50.9% of the sample. The most statistically justifiable estimates were the ones that used the discriminate function analysis. However, we suspect that these analyses may have overestimated the effects because they were based partly on current measures (e.g., impulsivity & adult ADHD). With current impulsivity, the cause-and-effect path is unclear because it is possible that repeated stimulation from excessive gambling may alter a person's normal brain arousal level. We recommend that these different estimates be treated as upper and lower bound estimates of the importance of these variables. For example, impulsivity (e.g., ADHD) plays an important role in somewhere between 20-50% of problem gamblers.

These discriminate analyses also allowed us to determine which factors or pathways were important for our participants. The analyses showed that cognitive and behavioural factors were primary influences for the largest number of problem gamblers (78.2%), followed by emotional factors (63.6%), and then factors related to impulse control (50.9%). Thus, the cognitive-behavioural pathway would appear to be the most important. However, this inference is somewhat inconsistent with Blaszczynski's (2000, March) model, which emphasizes the cumulative nature of the factors (i.e., that people who are physiologically vulnerable can, and often are, also emotionally or cognitively vulnerable). About 20% of the sample did not appear to have any physiological or emotional vulnerability. Most of this group were identified as problem gamblers based on their lack of knowledge about randomness, their beliefs, or their experience of winning. This group fits in well with Blaszczynski's model definition of the "normal" problem gambler. The majority of the borderline problem gamblers appeared to fit into the normal pathway group. The pre-problem emotional analysis identified 29%, and most were also identified in the cognitive analysis. The impulse control analysis identified 50.9% of the problem gamblers, but again most were also identified in the other two analyses. In fact, it would appear that a person is relatively unlikely to develop a gambling problem if they have only an emotional or physiological vulnerability (5.5% each). In each of these analyses, some non-problem gamblers were identified, but most of them were only identified in one analysis. This finding suggests that one risk factor is usually not sufficient to lead to a gambling problem. Rather, the presence a critical mass of several risk factors working in combination is required.

We also hypothesized that the genetic component would influence gambling behaviour only indirectly, with the principal action being its effect on impulsivity. Unfortunately, we did not find a significant effect related to the genetics of problem gambling, so we could not test this hypothesis. Problem gamblers were not significantly more likely than non-problem gamblers to have had an

early history of gambling involvement, a finding that runs counter to the widely held conception that exposure to gambling during the teenage years (or earlier) predisposes individuals to acquire a gambling problem later. What appears to be more important in the development of an interest in gambling is the actual experience of winning itself. Both the timing and the size of the win were associated with problem gambling. The definition of what constituted “big” varied among gamblers, but there was very little difference on average between what problem and non-problem gamblers felt was a big win.

We also found evidence of distorted self perceptions. Many problem gamblers tended to diminish the meaning and significance of their gambling behaviour. More than half of the surveyed problem gamblers (30 out of 54) considered themselves to be social gamblers while only 22 correctly identified themselves as problem gamblers.

Certain activities showed highly significant correlations with gambling problem severity. Gamblers with the most severe gambling problems were most likely to be spending time playing slot machines, casino table games, bingo, or purchasing lottery and scratch tickets. The most popular forms of gambling were lottery and scratch tickets. This activity was among the most frequently mentioned by gamblers irrespective of the severity of their gambling involvement. Results from the REKT suggest that few people appreciated the overwhelming odds against winning, even in an entire lifetime. The fact that some problem gamblers listed lottery, scratch tickets and bingo as being among their most favoured activities runs counter to the stereotype that these are benign forms of gambling.

Consistent with findings from our previous research efforts, problem gamblers said that they tended not to set limits on the amount of time they gambled. They also reported that they did not usually set spending limits on themselves, although those who did report doing this also said that they rarely adhered to them. They reported that they did not quit at a set time and often gambled until closing time, or as long as possible. They reported that they often gambled even beyond the point when they were tired or bored and reported that they usually preferred to play alone rather than in the company of friends or family.

The study also found evidence for the effect of early big wins. Gamblers who experienced sizeable wins early in their gambling careers were likely to develop gambling problems later on. The experience of a loss followed by a big win also increased the likelihood of developing a gambling problem later. Although a big win early in one’s gambling career was a prominent feature in problem gamblers, there was evidence that psychological factors (i.e., attitudes toward the entire experience of gambling) were also important in the development of a gambling problem. People who are likely to have a gambling problem are convinced that they can beat the odds and will win big again. We asked the respondents about a number of factors that might encourage them to gamble more or less including wins, losses, and seeing other people win. Based on these results it appears that continued gambling is reinforced not only by winning, but also by losses, and even by breaking even. However, based on their responses to these questions, it seems that the most important factors are the first big win, wins in general, and losses in general. In contrast, the largest single day loss barely reached significance. These findings support a behavioural-learning model of problem gambling.

Big wins by themselves may sometimes be sufficient to produce a gambling problem, although the majority of the respondents appear to have several risk factors. Also, the greater number of risk factors, the more likely the individual will acquire a gambling problem.

One interesting result is that problem and non-problem gamblers have similar reactions to winning. Winning is a positive experience for most gamblers irrespective of the severity of their gambling problems. All groups reported that winning made them feel happy (91.7% of the total sample), excited (91.0%), and gave them a rush (54.9%). Compared to non-problem gamblers,

problem gamblers were a little less likely to say winning made them feel happy (96.4% vs. 87.3%), but this difference was not significant. However, compared to non-problem gamblers, problem gamblers were significantly more likely to report that wins raised their self-esteem (29.1% vs. 45.5%).

One of the strongest effects found in this study was that problem gamblers relied on escape as one of their primary coping styles. Escape coping was also negatively correlated with knowledge of randomness, suggesting a close relationship between erroneous beliefs and escape coping. In addition, escape coping was positively correlated with impulsivity. These correlations suggest that there is an interrelationship among cognitive, emotional and physiological factors.

The data from the REKT showed that problem gamblers tended to have a limited understanding of the nature of random events. The effect found in this study was somewhat weaker than the effects found in a previous study, but still persistent. Subsequent analysis using structural equation modelling suggested that knowledge of randomness has an indirect effect on problem gambling. Poor knowledge and erroneous beliefs may lead people to believe that they can beat the odds. It is argued that this belief leads to an over reliance on escape as a way of coping with stress. Since both the REKT and the WCQ are current measures, our assumptions about the direction of this effect is pure speculation. We cannot say with any certainty that beliefs lead to reliance on escape or that reliance on escape is justified by adopting erroneous beliefs. However, we argue that the negative correlation between escape and knowledge does help to us understand the relationship between escape coping and problem gambling. Escape coping is strongly related to problem gambling. Problem gamblers appear to have a reasonably good understanding of the odds of winning (higher scores on the chance test) but believe they can beat them (lower scores on the REKT). This belief gives them the idea that escape is possible.

There was strong evidence that problem gamblers tend to be anxious, impulsive and depressed. Psychometric testing revealed positive correlations among various personality traits and problem gambling. Problem gamblers had elevated profiles on impulsivity, depression, and several measures of stress and anxiety. High scores on these traits were associated with more serious gambling problems. These variables were highly correlated with each other and together accounted for about 40% of the variance in problem gambling. However, these variables measured current affect and anxiety which was confounded with gambling related losses. To examine pre-morbid mood, we also had people plot their mood on a graph across their lifespan, and confirmed that problem gamblers were more likely to have been unhappy in their youth. About a third of the problem gamblers were found to have been miserable during their youth. We also found evidence showing that for many problem gamblers life stress was a precursor to their difficulties. Problem gamblers tended to have more stressful life experiences in the year before they started to gamble. They were also more likely than other gamblers to report histories of personal and family drug abuse or alcohol abuse, having difficulty at school, having "lots of stress", or having a problematic romantic relationship (or no romantic relationship at all). Problem gamblers also tended to report fewer positive experiences in their pre-gambling life. Pre-morbid stress was therefore not the only precursor. In another question we asked people to report what was going on in their life just before gambling became a problem for them. The results showed that 31% of the respondents acknowledged that there had been significant stress in their lives, but 23% reported that everything was going well. Therefore, stress plays an important role in problem gambling but does not explain all cases of problem gambling. When combined, "stressful life events" and "life going nowhere" equate to a total of 50%. That is, the evidence suggests that 50% of the participants were unhappy before their problem began, leaving 50% that were apparently happy.

Correlations among current symptoms of ADHD, ODD, and CD were all highly significant with the probability of having a gambling problem. However, the correlations among these impulse

control symptoms during one's youth (before age 7) and current problem gambling were relatively weak. Slightly less than 20% of the problem gamblers were found to reach criterion for ADHD. We also examined the influence of three genes on problem gambling (DRD4, COMT NlaIII, DAT VNTR) but failed to find any relationship of these genes to problem gambling. In future studies we plan to pursue this question by examining more genes. While we are strongly convinced that problem gambling involves some genetic influence, we have yet to find genes that explain significant variance of problem gambling.

Problem gamblers report having more dissociative experiences than non-problem gamblers. However, the experience of dissociative states interacted with context. Problem gamblers were a great deal more likely to report dissociating while gambling, but only a little more likely to report dissociating during a non-gambling activity. Borderline gamblers fell somewhere in-between the problem and non-problem gamblers in terms of the frequency of reporting this experience. Overall, dissociation is more common amongst problem gamblers, but it is primarily gambling related activities that bring out these symptoms.

We found that problem gamblers scored higher on impulsivity, but not on thrill seeking. On the TCI, problem gamblers scored much lower on self-directedness and cooperativeness, but much higher on harm avoidance, novelty seeking and self-transcendence. The trait self-transcendence appears to be related to superstitious beliefs, possibly including concepts such as luck or fate. These findings were fairly consistent for all problem gamblers as a group, but a closer analysis also pointed to the existence of certain divergences in personality traits. We used the personality measures to conduct a cluster analysis and found that there are at least two distinct groups of problem gamblers. One subgroup of problem gamblers is superstitious and seeks thrills. Another group is depressed, anxious and harm-avoidant. Still, others are within the "normal" range on most of these variables. These findings perhaps explain why previous attempts have failed to find an addictive or gambling personality. Problem gamblers are not a unitary group, but rather consist of different subgroups. These clusters may tie in with the pathways model to some extent. The depressed anxious and harm avoidant gamblers might fit in with the emotionally vulnerable group. More work needs to be done in this area before we can determine if different paths are associated with different clusters or subtypes of gamblers.

Finally, structural equation modeling was used to test different models of problem gambling. Total affect was found to be the strongest predictor of escape coping followed by total stress. Interestingly, knowledge of one's real chance of winning and knowledge of game related probability have opposite effects on escape coping. Taken together, these findings suggest that a person who gambles as a means of escape coping has a relatively good understanding of probabilities of the games they play (they know the odds), but they hold erroneous beliefs about their ability to win. They know the odds, but think they can beat them. This model is also interesting in terms of effects that do not reach significance. Symptoms of ADHD prior to the age of 7 had no direct effect on problem gambling or on escape coping, but were related to total affect and stress. It seems that in this study we were unable to separate out the physiologically vulnerable pathway from the emotionally vulnerable pathway.

A second model found that "emotional vulnerability" was primarily defined by two variables, including total stressful events in the year prior to one's gambling problem and total negative affect during one's youth. However, this variable was also linked to a family history of gambling problems, the size of one's early win, and ADHD symptoms before the age of 7. This suggests that the various elements that lead people to develop problem gambling do not operate as separate pathways, but instead are intimately combined in some manner. Perhaps it is only through the combination of these factors that people develop problems. More research is needed on the necessary and sufficient conditions for the development of a gambling problem.

Overall, the findings suggest that about half of the variance of problem gambling can be explained by the combination of escape coping and pre-morbid misery. Random-events knowledge was found to operate through escape coping, rather than having a direct effect on problem gambling. An additional analysis was run to examine the number of key variables required to develop a gambling problem. This analysis confirmed that problem gamblers range from none to eight of these variables. Also, most problem gamblers scored in the upper half of the distribution on four or more of these risk factors, while most non-problem gamblers had scored in the upper half on four or less of these factors.

This study has demonstrated that there are in all likelihood at least several pathways which can lead an individual into problem gambling. The results are largely in support of the pathways model, but we found little evidence for 3 distinct pathways. Rather, individuals seem to vary continuously in terms of their scores on variables. The cluster analysis of the TCI comes the closest to demonstrating distinct pathways. In that analysis we found some evidence for a distinction between problem gamblers who were depressed (emotional vulnerable) and those who were superstitious thrill seekers. However it is unclear if the superstitious thrill seekers belong to the 'normal' or physiologically vulnerable group. It should also be pointed out that the depression used in that analysis was current depression not past depression.

The single most important factor appears to be reliance on escape as a way of coping with stress. Problem gambling is used by a large portion of problem gamblers as an escape. Use of escape coping is also strongly tied to depression and stressful life events, but we also found an intimate link between "emotional vulnerability" and erroneous beliefs. These results are consistent with those of Boyd (1995) who found that, out of a number of variables, escape coping was the most strongly correlated with the number of substance abuse problems (drug abuse and alcoholism) reported by poverty level women. Also noteworthy in the Boyd (1995) study was the finding that the substance abusers and depressed subjects differed from healthy controls in experiencing more victimization, more recent stressful events, and perceptions of greater health and mental health impairment. Our findings also fit well with the general model of addiction (Jacobs, 1986; Gupta & Derevensky, 1998) which views problematic gambling as a maladaptive coping strategy. Knowledge of randomness was negatively correlated with escape coping. This suggests that escape as a way of coping is a key element for both emotional vulnerable and 'normal' pathways.

This study has confirmed a number of the important insights and hypotheses of Alex Blaszczynski (2000). People who are emotionally vulnerable in terms of stress, depression, affect during one's youth, anxiety, negative life experiences, and a lack of social support, are more likely to have a gambling problem. Secondly, people who have elevated levels of impulsivity or suffered from ADHD symptoms are more likely to have a gambling problem. However, the correlations among the impulse control variables and the emotional vulnerability control variables suggests that these two paths are not distinct.

This study has also provided several important discoveries. We have seen that personal vulnerability is an important factor, although by no means the only contributor to the development of a gambling problem. We have also seen that certain types of gambling games are far more closely associated with problem gambling than previously thought. These findings have important implications for social policy. It is important that those who are potentially susceptible to becoming problem gamblers be identified early, and that the risks of gambling be made known to counselors, psychiatrists, psychologists, and others who are charged with the responsibility of providing therapy to these special populations.

Theoretical Models

Throughout this study we found evidence in support of several theoretical models of problem gambling. First, evidence about the importance of early wins is consistent with Skinner's (1953) behavioural model. In particular, the timing and the size of the win are important. We also found evidence in support for Jacob's (1986) general model of addiction. In particular, a lot of problem gamblers are physiologically impulsive and have had stressful life experiences. Our findings regarding coping skill are consistent with research by Rina Gupta (Gupta and Derevensky, 1998) regarding the link between poor coping and problem gambling. It should also be noted that the link between stress, escape coping, and problem gambling also fits well under the rubric of behaviourism, since escape coping is a form of negative reinforcement.

We did not find evidence in support of a purely physiological model of gambling addiction. Our genetics measures failed to find any significant relationships. However, since we only examined three genes sites, we need to conduct further research in this area. We are confident that there are genes that help explain the increased impulsivity amongst problem gamblers.

In addition, we also found some evidence in support for a cognitive model of gambling addiction (e.g., Ladouceur & Walker, 1996). Specifically, problem gamblers have erroneous beliefs about their ability to win.

These findings fit well within the pathways model (Blaszczynski, 2000). It is argued that the main process by which people develop a gambling problem is based on positive (wins, social approval) and negative (escape from misery) reinforcement. However, people who have a particularly miserable life are much more vulnerable to the reinforcing effects than are other people. Furthermore, people who have some kind of physiological problem in the reward system (e.g., those with ADHD) either in the pleasure centre of the brain or in the pre-frontal lobes, that regulate impulses and rational thinking, are also particularly vulnerable.

Theoretically, there is no one that is invulnerable to developing a gambling problem. However, people who have experienced wins, believe they can beat the odds, have experienced a lot of stress, are unhappy, anxious or depressed, use escape to cope with problems, or are impulsive (e.g., ADHD), are substantially more at risk for developing a gambling problem. The more of these risk factors a person has, the greater their chances of developing a gambling problem.

Implications

It is obvious that much remains to be done in the area of public education. An agenda for further consideration should include:

1. Educating young people about the nature of randomness as well as the importance of a balanced approach to coping and stress management.
2. Educating the public about the actual probabilities of winning involved in gambling and helping them understand concepts such as the independence of events.
3. Educating patients in therapy and providing information to the public about the psychological dimensions of the experience of winning. Also, taking cues from efforts in this regard to mount in other anti-addiction campaigns. For example, demythologizing alcohol's putative benefits regarding increased self-esteem or reduced anxiety.
4. Identifying people with poor impulse control and emotional coping problems as high risk individuals, and possibly designing interventions for them.
5. The fact that risk factors combine to produce gambling problems recommends the strategy of tackling one or two of these factors (e.g., coping strategies or beliefs about winning) which are common to the largest proportion of gamblers.

References

- Abell, N (1991). The Index of Clinical Stress: A brief measure of subjective stress for practice and research, *Social Work Research and Abstracts*, 27, 12-15.
- Barkley, R.A., Fischer, M., Fletcher, K.E., Smallfish, L. (1993) The adolescent outcome of hyperactive children; predictors of psychiatric, academic, social and emotional adjustment. *J Am Acad Child Adolesc. Psychiatry*, 32(2), 324 – 332
- Barrat, E.S. (1987) Impulsiveness and anxiety: information processing and electroencephalograph topography. *Journal of Research in Personality* 21:453-463.
- Blaszczynski, A. (1998) *Overcoming Compulsive Gambling*. London: Robinson Publishing.
- Blaszczynski, A. (2000, March). Pathways to pathological gambling: Identifying typologies. [31 paragraphs]. *Electronic Journal of Gambling Issues*, #1 [On-line serial]. Available: <<http://www.camh.net/egambling>>.
- Blum, K., Sheridan P.J., Wood R.C., Braverman E.R., Chen, T.J., Comings, D.E. (1995). Dopamine D2 receptor gene variants: association and linkage studies in impulsive-addictive-compulsive behaviour. *Pharmacogenetics*, 5 (3), 121-141.
- Boyd, Mary Ruth. Substance abuse and depression in rural women of Virginia: A comparative study. *Dissertation Abstracts International: Section B: the Sciences & Engineering*. Vol 56(4-B), Oct 1995, 1933, US: Univ Microfilms International.
- Brown GL, Ebert MH, Goyer PF, Jimerson DC, Klein WJ, Bunney WE, Goodwin FK (1982). Aggression, suicide, and serotonin: relationships to CSF amine metabolites. *American Journal of Psychiatry*. 139(6):741-746.
- Buss, A. H., & Plomin, R. (1984). *Temperament: Early developing personality traits*. Hillsdale, NJ: Erlbaum.
- Carlton, P.L., Goldstein, L. (1987). Physiological determinants of pathological gambling. In Galski, T., *A Handbook of Pathological Gambling*. Springfield (IL): Charles C. Thomas, 111-122.
- Carlton, P.L., Manowitz, P. (1994). Factors determining the severity of pathological gambling in males. *J. Gambling Studies*, 10 (2), 147-157.
- Carlton, P.L., Manowitz, P., McBride, H., Nora, R., Swartzburg, M., Goldstein, L. (1987). Attention deficit disorder and pathological gambling. *J. Clin. Psychiatry*, 48, 487-488.
- Comings DE, Rosenthal RJ, Lesieur HR, Ruge LJ, Muhleman D, Chiu C, Dietz G, Gade R.A (1996). Study of the dopamine D2 receptor gene in pathological gambling.
- Comings, D.E., Gonzalez, N., Wu, S., Gade, R., Muhleman, D., Saucier, G., Johnson, P., Verde, R., et al. (1999). Studies of the 48 bp repeat polymorphism of the DRD4 gene in impulsive, compulsive, addictive behaviors: Tourette syndrome, ADHD, pathological gambling, and substance abuse. *Am. J. Med. Genet.*, 88(4), 358-368.
- Derevensky, J.L., Gupta, R., Herman, J. (1997, June). Children's cognitive perceptions of gambling using a 6/49 task. Paper presented to the 2nd Bi-Annual Ontario Conference on Problem and Compulsive Gambling, Toronto.
- Diagnostic and Statistical Manual, Fourth Edition. (1994). Washington DC: American Psychiatric Association.
- Eisen, S.A., Lin, N., Lyons, M.J., Scherrer, J.F., Griffith, K., True, W.R., Goldberg J, Tsuang, M.T. (1998). Familial influences on gambling behavior: an analysis of 3359 twin pairs. *Addiction*, 93(9), 1375-1384.
- Faraone, S.V., Biederman, J. (1998). Neurobiology of attention-deficit hyperactivity disorder. *Biol Psychiatry*, 44(10), 951-8.

Faraone, S.V., Doyle, A., Mick, E., Biederman, J. Meta-Analysis of the Association between the Dopamine D4 Gene 7-repeat Allele and Attention Deficit Hyperactivity Disorder, *Am J Psychiatry*, in press.

Folkman, S., Lazarus, R.S. (1988). *Ways of coping questionnaire manual*. Consulting Psychologists Press: Redwood City, CA.

Gillis, J. J., Gilger, J. W., Pennington, B. F., DeFries, J. C. (1992). Attention deficit disorder in reading-disabled twins: evidence for a genetic etiology. *J Abnorm Child Psychology*. 20(3):303-315.

Goldstein, L., Manowitz, P., Nora, R., Swartzburg, M., Carlton, P.L. (1985). Differential EEG activation and pathological gambling. *Biol. Psychiatry*, 20, 1232-1234.

Goodman, R., Stevenson, J. (1989). A twin study of hyperactivity--II. The aetiological role of genes, family relationships and perinatal adversity. *J Child Psychol Psychiatry*, 30(5), 691-709.

Griffiths, M.D. (1995) *Adolescent Gambling*. London & New York: Routledge.

Gupta, R., Derevensky, J. L. (1998). An empirical examination of Jacobs' General Theory of Addictions: Do adolescent gamblers fit the theory? *Journal of Gambling Studies*, 14(1) 17-50.

Hanninen V. Koski-Jannes A. Narratives of recovery from addictive behaviours. *Addiction* 1999;94(12):1837-1848.

Heppner PP and Petersen CH (1982) The development and implications of a personal problem-solving inventory. *Journal of Counseling Psychology*, 29, 66-75.

Hollander E, Stein DJ, DeCaria CM, Cohen L, Saoud JB, Skodol AE, Kellman D, Rosnick L, Oldham JM. (1994) Serotonergic sensitivity in borderline personality disorder: preliminary findings. *American Journal of Psychiatry*. 151(2):277-280.

Howes JL. Katz AN. Remote memory: recalling autobiographical and public events from across the lifespan. *Can J Psychol* 1992;46(1):92-116.

Ibanez, A., de Castro, I.P., Fernandez-Piqueras, J., Blanco, C., Saiz-Ruiz, J. (2000). Pathological gambling and DNA polymorphic markers at MAO-A and MAO-B genes. *Mol Psychiatry*, 5(1), 105-109.

Jacobs, D.F. (1986). A general theory of addictions: A new theoretical model. *Journal of Gambling Behavior*, 2, 15-31.

Jacobs, D.F. (1988). Evidence for a common dissociative-like reaction among addicts. *Journal of Gambling Behavior*, 4, 27-37.

Jones, P. (1994). *The basics of winning lotto/lottery*. New York: Cadoza Publishing.

Koski-Jännes, A. Turner, N.E. (1999). Factors influencing recovery from different addictions. *Addictive Behaviors*, 7, 469-492

Koski-Jännes, A. Turner, N.E. (1999). Factors influencing recovery from different addictions. *Addictive Behaviors*, 7, 469-492

Ladouceur, R. Walker, M. (1996). A cognitive perspective on gambling. In P. Salkovskis (Ed.) *Trends in Cognitive and Behavioural Therapies* (pp. 89-120) U.K.: John Wiley and Sons.

Ladouceur, R., Gaboury, A., Bujold, A., Lachance, n., and Tremblay, S. (1991). Ecological validity of laboratory studies of videopoker gambling. *J. Gambl. Stud.* 7: 109-116.

Lassaline ME. Logan GD. Memory-based automaticity in the discrimination of visual numerosity. *Journal of Experimental Psychology: Learning, Memory, & Cognition*. 19(3):561-81, 1993 May.

Leary, M. R. (1983). Social anxiousness: The construct and its measurement. *Journal of Personality Assessment*. 47, 66-75

Lesieur, H.R. and Blume, S.B. (1987) The South Oaks Gambling Screen in different settings, *Journal of Gambling Studies* 9, 213-233.

Lesieur, H.R. and Blume, S.B. (1987) The South Oaks Gambling Screen in different settings, *Journal of Gambling Studies* 9:213-233.

Levy, F., Hay, D.A., McStephen, M., Wood, C., Waldman, I. (1997). Attention-deficit hyperactivity disorder: a category or a continuum? Genetic analysis of a large-scale twin study. *J Am Acad Child Adolesc Psychiatry*, 36(6), 737-744.

Macdonald, J., Turner, N.E. (2000, Oct.). The prevention of problem gambling using education, modeling and drama. Paper presented to the 14th National Conference on Problem gambling. Philadelphia, PA.

Meltzer HY, Arora RC, Baber R, Tricou BJ. (1981) Serotonin uptake in blood platelets of psychiatric patients. *Archives of General Psychiatry*. 38(12):1322-1326.

Mercugliano, M. (1999). What is attention-deficit/hyperactivity disorder? *Pediatr Clin North Am* 46, 831-843.

Muglia, P., Jain, U., Kennedy, J., L. (2000b). A quantitative TDT analysis of DRD4 and attention and activity measures in adult ADHD. *Am. J. Med. Genet.*, 96(4), 488

Muglia, P., Jain, U., Macciardi, F., Kennedy, J. L. (2000a). Adult attention deficit hyperactivity disorder and the dopamine D4 receptor gene. *Am. J. Med. Genet.*, 96(3), 273-7.

Muglia, P., Jain, U., Pereira, M. N., Byam, J., Kennedy, J. L. (2000c). DAT and Adult ADHD: combining data from case-controls and nuclear families. *Am. J. Hum. Genet.*, 67(2), 211.

Perez de Castro, I., Ibanez, A., Saiz-Ruiz, J., Fernandez-Piqueras, J. (1999) Genetic contribution to pathological gambling: possible association between a functional DNA polymorphism at the serotonin transporter gene (5-HTT) and affected men. *Pharmacogenetics*. 9(3), 397-400. *Pharmacogenetics.*, 6(3), 223-234.

Radloff, L. S. (1977). The CES-D scale: A self-report depression scale for researcher in the general population. *Applied Psychological Measurement*, 1, 385-401.

Robinson, J. P., Shaver, P. R., and Wrightsman, L. S. (1991). *Measures of Personality and Social Psychological Attitudes*. Toronto; Academic Press Inc.

Room, R. Turner, N.E., Ialomiteanu, A. (1999) Community effects of the opening of the Niagara Casino: A first report. *Addiction*, 94, 1449-1466.

Rugle, L., Melamed, L. (1993). Neuropsychological assessment of attention problems in pathological gamblers. *J. Nerv. Ment. Disease*, 181, 107-112.

Shaffer, H., Hall, M., Vander Bilt, J. (1997). *Estimating the prevalence of disordered gambling behaviour in the United States and Canada: A meta-analysis*. Boston: Harvard Press.

Skinner, B.F. (1953). *Science and Human Behavior*. New York: Free Press.

Spanagel, R., Weiss, F. (1999) The dopamine hypothesis of reward: past and current status. *Trends Neurosci.*, 22(11), 521-527.

Specker, S.M., Carlson, G.A., Christenson, G.A., Marcotte, M. (1995) Impulse control disorders and attention deficit disorder in pathological gamblers. *Ann. Clin. Psychiatry*, 7, 175 – 179.

Thapar, A., Holmes, J., Poulton, K., Harrington, R. (1999). Genetic basis of attention deficit and hyperactivity. *Br J Psychiatry*, 174, 105-111.

Turner, N.E. (1998) Doubling vs. constant bets as strategies for gambling. *The Journal of Gambling Studies*, 14, 413-429.

Turner, N.E. (2000). Randomness, Does It Matter? *Electronic Journal of Gambling Issues*. Available at <http://www.camh.net/egambling/issue2/research/>

Turner, N.E. (2002). Random Events Knowledge Test. Unpublished psychometric test of knowledge of randomness.

Turner, N.E. Fritz, B. (2001). The effect of skilled gamblers on the success of less skilled gamblers. In press, *The Electronic Journal of Gambling Issues*. <http://www.camh.net/egambling>

Turner, N.E., Fritz, B., Mackenzie, B. (2000) Information and misinformation about gambling. Paper presented at the conference of the National Council on Problem Gambling, Pennsylvania, Oct.

Turner, N.E., Ialomiteanu, A., Room, R. (1999) Checkered expectations: predictors of approval of opening a casino in the Niagara community. *The Journal of Gambling Studies*, 15, 45-70.

Turner, N.E., Liu, E. (1999, Aug). The naive human concept of random events. Paper presented at the 1999 conference of the American Psychological Association, Boston.

Turner, N.E., Liu, E. (1999, Aug). The naive human concept of random events. Paper presented at the 1999 conference of the American Psychological Association, Boston.

Turner, N.E., Liu, E. (2000). Odds, Strategies, Beliefs and Problem Gambling. Manuscript currently under review.

Turner, N.E., Toneatto, T., Stanovich, K. (1999, Feb.) Cognitive Biases in Problem Gamblers. *New Directions in Gambling Research* conference of the National Center for Responsible Gaming.

Van Es, R. (2000). Identifying problem and compulsive gamblers. *Can. Fam. Physician*, 46, 1323-1331.

Ward MF, Wender PH, Reimherr FW. (1993). The Wender Utah Rating Scale: an aid in the retrospective diagnosis of childhood attention deficit hyperactivity disorder. [erratum appears in *Am J Psychiatry* 1993 Aug;150(8):1280.]. *American Journal of Psychiatry*. 150(6):885-90, 1993 Jun.

Weiss, G., Hetchman, L.T., Milro, T., Perlman, T. (1985). Psychiatric status of hyperactives as adults; A controlled prospective 15-year follow-up of 63 hyperactive children. *J. Am. Acad. Child Psychiatry*, 24, 211-212.

Zuckerman, M. (1979) *Sensation Seeking: Beyond the Optimal Level of Arousal*. Hillsdale, New Jersey: Lawrence Erlbaum Associates.

Zung, WW. (1971). The differentiation of anxiety and depressive disorders: a biometric approach. *Psychosomatics*. 12(6):380-384.