UNIVERSITY OF CALGARY

Construction of the Gambling Cognitions Inventory

by

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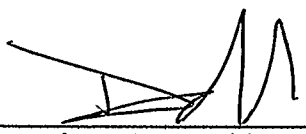

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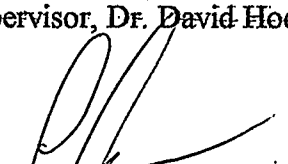

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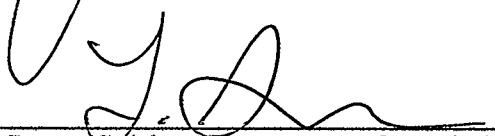

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TABLE OF CONTENTS

TABLE OF CONTENTS, CONTINUED

LIST OF TABLES AND FIGURES

Running Head: GAMBLING COGNITIONS INVENTORY

Construction of the Gambling Cognitions Inventory

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Key Words: problem gambling, pathological gambling, cognitive distortions, scale construction

ABSTRACT

Cognitive distortions regarding various aspects of gambling have been identified in research with healthy and disordered populations. Cognitive behavioural models of gambling hold that cognitive distortions are a significant factor in the development and maintenance of gambling problems. In recognition of this, treatment strategies for gambling disorders have increasingly focused on identifying and challenging erroneous cognitions (e.g., Ladouceur, Boisvert, & Dumont, 1994; Ladouceur, et al, 2001; Sylvain, Ladouceur, & Boisvert, 1997; Toneatto & Sobell, 1990). Currently, the gambling field is lacking a valid instrument for identifying the range of cognitive distortions important in problem gambling. The present study comprised the development of the Gambling Cognitions Inventory, a self-report measure of four categories of cognitive distortion: *Probability Errors*, *Magical Thinking / Luck*, *Information Processing Biases*, and *Illusion of Control / Skill.* Item development was based on a cognitive behavioural formulation of gambling (Sharpe, 2002; Sharpe & Tarrier, 1993), empirical findings, and expert review. In a second phase of research, support for the relatively unitary nature of the four categories of distortion was garnered from a university sample (N= 232). Item reduction was undertaken, resulting in a 40-item scale. In a third phase of research, pilot testing was conducted to evaluate the reliability and validity of the 40-item GCI using a sample of problem and pathological gamblers (N = 13). The scale had acceptable internal consistency and some preliminary support was found for the convergent and criterion-related validity of the GCI. It was concluded that a think aloud task holds potential for eliciting cognitive distortions in research, but ecological validity was limited in this study by not having participants gamble with their own money.

Introduction

Gambling is defined as any situation in which individuals attempt to win money by staking money or valuable goods on an uncertain event (Ladouceur, et al., 2001). Research suggests that 78-85% of individuals in North America have some experience with gambling (Shaffer, Hall, & Vander Bilt, 2001). Many of these people are at risk for developing gambling problems, including pathological gambling. Researchers have suggested that gambling behaviour exists on a continuum, from recreational gambling with no adverse effects to increasingly problematic gambling, to pathological gambling (e.g., Griffiths, 1994; National Research Council [NRC], 1999). Base rate estimates of pathological gambling range from 1.5% (NRC, 1999) to 3.4% (DSM-IV-TR; APA, 2000). Combined rates of problem and pathological gambling reach 5% for adults and 13% for adolescents (Shaffer, et al., 2001). Estimates of pathological gambling for the province of Alberta are similar at 3%, but inclusion of at-risk gamblers suggests that 15% of individuals are vulnerable to gambling problems in their lifetime (Smith & Wynne, 2002). Theoretical models posed for understanding gambling problems recognize that disordered gambling is associated with numerous social, behavioural and cognitive features. The present research is focused on the presence of distorted thinking.

Cognitive distortions related to gambling have been found in student populations, the general population, and individuals with gambling disorders. Current measures of cognitive distortions sample only a narrow set of cognitive errors, and tend to be behavioural rather than cognitive in focus. This project entailed constructing a scale to measure a diverse range of gambling specific cognitive distortions.

This paper will review the literature on the cognitive psychopathology of pathological gamblers and the role of cognitive distortions in the development of gambling problems. Second, a cognitive-behavioural model of pathological gambling will be presented, which will provide the theoretical rationale behind the proposed scale. Next, three phases of scale construction research will be described: scale item generation and evaluation; analysis of the structure of the scale; and a pilot scale validation study with problem and pathological gamblers. The nature of the four categories of cognitive distortion will be discussed, leading to the next steps in scale validation and the potential clinical implications of this research.

Literature Review

Pathological gambling is a disorder in which individuals exhibit impaired control over gambling. The disorder first appeared in the Diagnostic and Statistical Manual of Mental Disorders-III in 1980 under *Impulse Control Disorders, Not Otherwise Specified* and remains listed in the current DSM-IV. Current diagnostic criteria require five of ten symptoms representing three general areas – damage and disruption, loss of control, and physiological dependence (American Psychiatric Association [APA], 2000). The gambling behaviour interferes with the individual's social and occupational functioning, with potentially destructive results (e.g., job loss, divorce, bankruptcy, or suicide).

Models of Pathological Gambling

Etiological models of pathological gambling include biological, personality, social learning, information processing, and cognitive-behavioural formulations. No single pathway to pathological gambling has been identified; in fact, it is more likely that multiple pathways can lead to gambling problems. The factors that contribute to

disordered gambling are both external and internal in nature. External factors include family systems factors, the gambling environment and broader societal influences, while internal factors refer to personality traits, biological predisposition, coping skills, and cognitive style.

In the realm of external factors, learning theories postulate that classical conditioning leads to initiation of gambling behaviour by coupling excitement with gambling during a large win early in gambling (Ladouceur, Gaboury, Dumont, & Rochette, 1987; Rosecrance, 1986). Gambling behaviour is then maintained through operant conditioning, via a variable ratio reinforcement schedule (NRC, 1999). That is, wins in gambling occur randomly, and this unpredictable quality of games is thought to be central to the acquisition of gambling problems and to relapse (Turner, Littman-Sharp, Masood, & Spence, 2001). Another type of learning theory, social learning theory, emphasizes the role of the social environment in developing gambling problems (Maisto, Carey, & Bradizza, 1999). In social learning paradigms, gambling behaviour can be learned via differential reinforcement (e.g., friends reinforcing gambling behaviour and not reinforcing other forms of entertainment); vicarious learning (e.g., seeing others gamble and win), or cognitive processes (coping styles and cognitive errors). For many gamblers, the social aspects of gambling (e.g., friends at the casino) become an important factor maintaining their involvement in gambling (Rosecrance, 1986). Social learning theory is supported by the research finding that having peers and parents who gambled predicted gambling involvement in a sample of students (Browne & Brown, 1994).

In addition to learning from other gamblers and the influences of the gambling environment, family and social factors, such as stress, have also been linked to increased

gambling. Research on relapse has supported the role of negative mood states such as stress, depression, frustration, or anxiety as risks for relapse (Annis, 1990; APA, 2000; Hodgins & el-Guebaly, 2000; Sharpe & Tarrier, 1993). Such findings suggest that a stress-coping mechanism might account for gambling in some people. Consistent with findings in other addictive behaviours, pathological gambling has been linked to maladaptive strategies for coping with problems in life, as acknowledged by the diagnostic criterion, "gambles as a way of escaping from problems or of relieving a dysphoric mood" (APA, 2000; p. 674). Lack of effective coping skills might lead some gamblers to seek to escape from their problems via gambling. Research has revealed self-reported feelings of dissociation during gambling episodes (Diskin & Hodgins, 1999; Diskin & Hodgins, 2001), with pathological gamblers experiencing greater feelings of dissociation compared to non-problem gamblers.

In addition to external factors, internal factors related to neurotransmission, brain functioning, and personality have also been implicated in pathological gambling. Biological models suggest that neurotransmitter dysfunction, such as reduced dopamine, reduced epinephrine or increased serotonin levels, account for the drive for physiological arousal leading to problem gambling behaviour (NRC, 1999) and the development of physiological dependence (APA, 2000). In line with neurotransmitter models of substance dependence, biological theories of gambling postulate that individuals seek arousal or excitement resulting from endorphin release in the brain during gambling (Coventry & Norman, 1998; Leonard & Blane, 1999). As tolerance develops, individuals need to bet higher amount of money and take greater risks to achieve the desired stimulation, leading to increasingly problematic gambling behaviour. Biological theories

would predict that gamblers show general tendencies toward sensation seeking or risk taking, which have also been linked to increased arousal. However, high levels of sensation seeking and risk-taking behaviour have not been found in gamblers (Coventry & Norman, 1998).

Other neurobiological theories implicate organically-based deficits in executive functions in pathological gamblers, implicating the frontal cortex of the brain (Rugle & Melamed, 1993). As the frontal cortex is associated with such abilities as cognitive flexibility, forethought in behaviour planning, and self-regulation of impulses (Lezak, 1995), dysfunction in these executive domains could produce the pattern of poorly controlled gambling behaviour seen in pathological gamblers. For example, impaired decision-making on analogue gambling tasks has been found in individuals with pre-frontal cortex lesions (Manes, et al., 2002) and in functional neuroimaging studies of pathological gamblers (Cavedini, Riboldi, Keller, D'Annucci, & Bellodi, 2002). Further, poor decisions representing insensitivity to future consequences was demonstrated in patients with frontal lobe lesions and no history of pathological gambling (Bechara, Tranel & Damasio, 2000). Participants' choices revealed lack of forethought, in that despite later negative consequences, the immediate outcome of a gambling decision was the most important factor in decision-making. Finally, a study of evoked potentials in healthy, non-pathological gamblers (Gehring & Willoughby, 2002) implicated dysfunctional medial frontal cortex involvement. In that study, individuals were more likely to avoid an immediate loss than to pursue a future gain on a gambling task, suggesting a strong harm aversion effect. Thus, both direct and indirect support has been found for a role of frontal dysfunction in gambling behaviour. However, the nature of

executive dysfunction in the development of gambling problems has yet to be established. It is possible that frontal or executive dysfunction is related to other risk factors for gambling, such as impulsivity (Rugle & Melamed, 2000).

Based on the DSM-IV classification of pathological gambling as an impulse control disorder, the presence of impulsive and compulsive behaviours in problem gamblers, and the co-morbidity of gambling with other impulse control disorders, impulsivity has been proposed as a risk factor for developing gambling problems (e.g., APA, 2000; Specker, Carlson, Christenson & Marcotte, 1995). Pathological gamblers report a childhood history of Attention Deficit Hyperactivity Disorder at rates higher than base rates (Rugle & Melamed, 1993), and a body of research by Blaszczynski and others demonstrates elevated impulsivity traits in pathological gamblers (Blaszczynski, Steel & McConaghy, 1997; Steel & Blaszczynski, 1998; Vitaro, Ferland, Jacques & Ladouceur, 1998). Consistent with this, gambling problems co-occur with other disorders that feature impaired impulse control, including substance abuse and antisocial personality disorder (APA, 2000; Carroll & Huxley, 1994; Toneatto, Skinner, & Dragonetti, 2002), though Crockford and el Guebaly (1998) found some indication that anti-social behaviours tend to be acquired after initiation of gambling problems. Rates of co-morbid substance abuse problems in pathological gamblers range from 25 – 63% (Crockford & el Guebaly, 1998), suggesting that impulsivity may be a common risk factor for developing addictive disorders in general. Behavioural similarities between gambling and substance use are supported by the adoption of addiction-based criteria for pathological gambling in the DSM-IV (e.g., physiological tolerance, craving, and preoccupation; APA, 2000).

In addition to personality traits, clinical experience and research have pointed to the role of cognitive style in disordered gambling, such as locus of control and cognitive distortions. Research on locus of control has addressed the question of whether gamblers tend to attribute wins, losses, or other events related to gambling to external or internal factors. Hong & Chiu (1987) reported that a sample of gamblers in China exhibited external locus of control, suggesting that they attributed wins and losses to forces outside their personal control. However, this contrasts with most research in North America and Europe that suggests that gamblers tend to attribute the outcome of games to factors within their control such as skill (Browne & Brown, 1994; Carroll & Huxley, 1994; McCormick & Taber, 1988).

Much more research attention has been paid to the issue of distorted thinking in gambling. The types of cognitive distortions identified and studied include inaccurate judgments of probability, beliefs of control over gambling activities or luck, superstitious beliefs, and errors in information processing (e.g., biases in memory, misinterpretation of information). Whether maladaptive cognitions are present before gambling behaviour begins or appear as a result of gambling is unclear. Researchers have proposed multiple ways in which distorted cognitions may be related to gambling problems. How wins and losses are interpreted early in gambling may initiate and reinforce cognitive distortions. Subsequently, the distortions are thought to maintain the problematic gambling behaviour (e.g., rationalizing continued gambling despite negative consequences) and increase or moderate the risk of relapse (Griffiths, 1994; Sharpe & Tarrier, 1993).

Cognitive-Behavioural Formulation of Problem Gambling

Though each of the above models incorporating external and internal factors have garnered empirical support, a general criticism of the models is their failure to account for the diverse factors contributing to problem gambling, that is, their tendency to emphasize a single mechanism. To enhance understanding of all variables contributing to problem gambling, and to account for inter-relationships between biological, psychological, and social factors, a heuristic cognitive-behavioural model of problem gambling was developed by Sharpe and Tarrier (1993). Sharpe and Tarrier's model postulated that problem gamblers have a genetic predisposition to develop gambling problems, and that gambling is acquired via the principles of classical and operant conditioning. That is, a win early in gambling experience, leading to excitement, leads to the pairing of gambling with arousal. Internal cues (e.g., anxiety or stress) and external cues in the gambling environment (e.g., games, casinos, or friends who gamble) can become associated with heightened arousal, triggering gambling-specific cognitions and urges to gamble. Whether the individual gambles depends on whether or not they possess and use coping skills such as challenging cognitive errors and delaying gratification. Thus, in Sharpe and Tarrier's model, cognitive skills mediate the link between an urge to gamble and gambling behaviour. In the model, erroneous cognitions are reinforced by both wins and losses and operate outside of normal conscious awareness. The model was meant to stimulate research on the somewhat neglected topic of distorted cognition in gambling, and did not specify the origin of the cognitive distortions. The model was also tentative about the relationships between cognitive distortions and other variables, such as arousal, frequency of wins, and gambling stimuli. To integrate new empirical

knowledge about the biopsychosocial variables in Sharpe and Tarrier's original (1993) heuristic model, Sharpe (2002) presented a reformulated cognitive-behavioural model. Figure 1 presents a pictorial diagram of the reformulated cognitive-behavioural model. The reformulated model aims to account for the acquisition, development, and maintenance of gambling problems, and places a strong emphasis on the cognitive aspects of problem gambling. For example, the model states that cognitive distortions develop during early gambling experiences and become more entrenched over time. That is, distorted thoughts become automatic and self-perpetuating, and become strongly associated with the arousal inherent in gambling. Once the pattern of thoughts and arousal become entrenched, the individual is more likely to lose control over gambling. As shown in Figure 1, cognitive distortions are depicted as sharing a bidirectional relationship with gambling related arousal.

The strength of Sharpe's reformulated model of problem gambling lies in its integration of biological, psychological, and social theories of problem gambling with empirical research on the variables named in the model. The model is also relevant to treatment strategies that intervene at the cognitive and behavioural level to reduce problem gambling, and provides the most comprehensive account for the development of problem gambling to date.

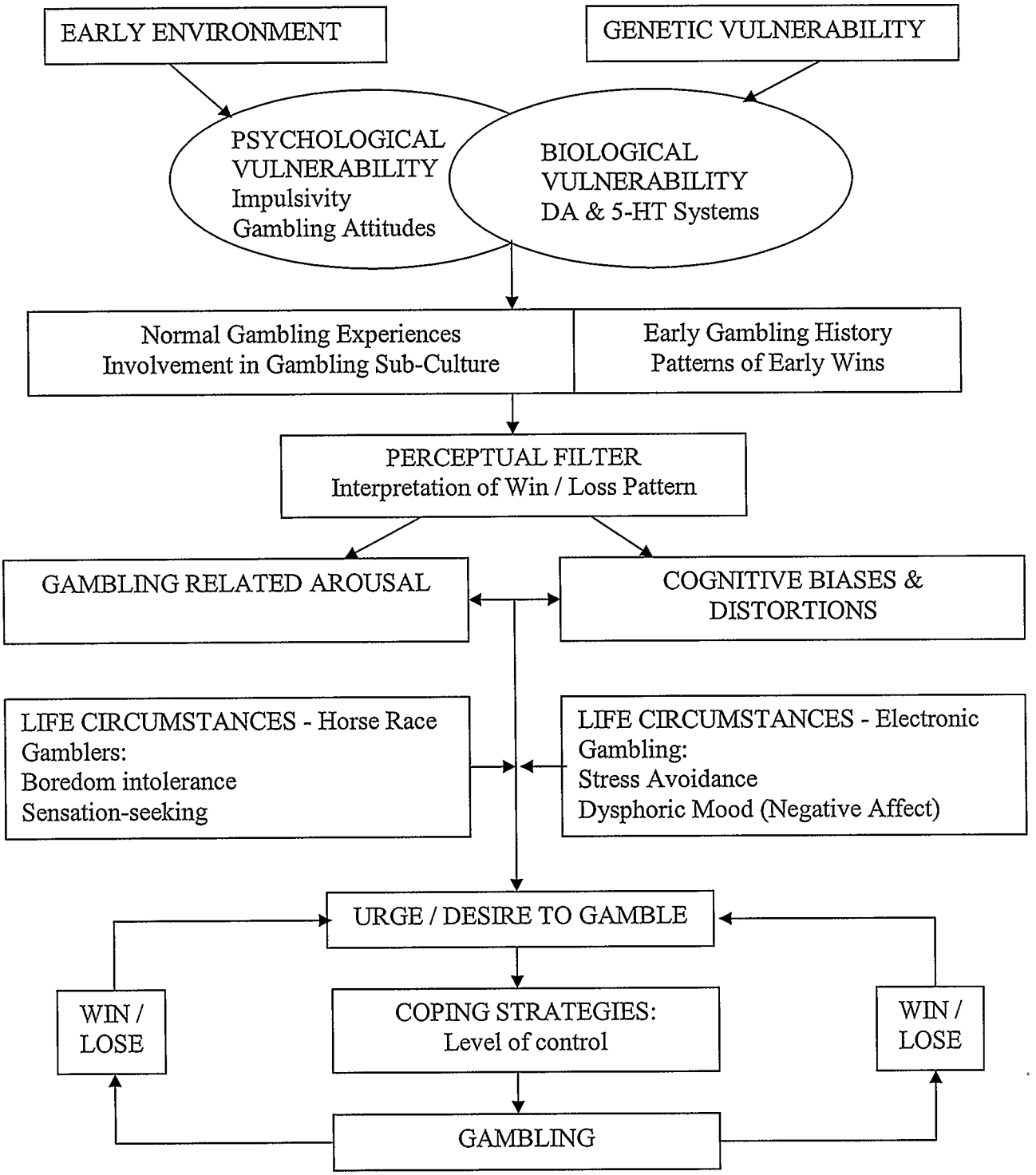

Figure 1: Sharpe's (2002) reformulated cognitive-behavioural model of problem gambling, integrating biopsychosocial variables.

Cognitive Distortions in Gambling

The DSM-IV diagnostic criteria for Pathological Gambling include some cognitive features, namely, preoccupation with gambling and engaging in chasing behaviour. Denial, superstitions, overconfidence and an enhanced sense of power are also listed as associated features of pathological gambling (APA, 2000). However, the DSM criteria are largely behavioural in focus, and a description of the cognitive profile of pathological gamblers is missing. Research on the cognitive psychopathology of pathological gamblers has identified several classes of irrational cognitions. In a comprehensive review of the literature on cognition in pathological gambling, Toneatto (1999) created a typology of seven classes of gambling related cognitions that had been consistently demonstrated in research with problem and pathological gamblers. Griffiths (1994) presented a detailed description of 15 distortions. The types of distortions reported in the literature are diverse, likely due both to individual differences in research participants (e.g., games, culture, general cognitive style) and in researchers' operationalization of constructs. Inspection of the reported cognitive distortions from a broader conceptual level suggests that four major categories of distortions can account for the majority of specific distortions reported. These four categories are summarized in Table 1.

One major class of distorted beliefs incorporates the idea that one has control over the outcome of gambling. Early empirical studies by Langer (1975) first identified the "Illusion of Control," which is defined as an expectancy of success that is greater than is warranted by objective probability (Griffiths, 1994). As all gambles are largely or completely random (e.g., poker, blackjack, roulette, slots, lottery), the belief that one can

control gambling outcome is objectively false. The illusion of control leads gamblers to adopt a skill-orientation. That is, the more that skill is believed to be important in a given gambling activity, the more likely it is that an individual will develop an illusion of control over the outcome (Letarte, Ladouceur & Mayrand, 1986). In Langer's studies (1975, 1983), a think aloud paradigm was used to assess gambler's thoughts during a gambling task. Subjects verbalized all thoughts that crossed their minds as they gambled, many of which were judged to be irrational. For example, the statement, "I'm winning because I am good at slot machines" would be judged as irrational, in that it reflects an incorrect belief that skill influences the outcome of a game of chance.

Consistent with Langer's findings, subsequent research in both naturalistic and lab-based settings has demonstrated that individuals with and without gambling problems ascribe to the notion that the outcome of games that are random (e.g., slot-machines, roulette or lotteries) require skill and can be controlled (Carroll & Huxley, 1994; Chau & Phillips, 1995; Holtgraves & Skeel, 1992; Hong & Chiu, 1988; Ladouceur, et al., 1995; Ladouceur, Gaboury, Dumont & Rochette, 1987; Ladouceur, Mayrand, Letarte & Tremblay, 1984; Letarte, Ladouceur & Mayrand, 1986).

The adoption of an illusion of control, accompanied by increased risk-taking, has been found to be more likely when the gambler had more frequent wins (Ladouceur, Gaboury, Dumont & Rochette, 1987; Letarte, et al, 1986) or if games involved choice, familiarity, or interpersonal personal competition (Griffiths, 1994). Moreover, the gambling industry itself contributes to the gambler's perception of control by including *hold* or *nudge* buttons on slot machines (Griffiths, 1994) or advertising return rates of 98% on games.

Table 1

Descriptions of the Four Categories of Cognitive Distortions Related to Gambling

Cognitive Distortion Category	Description
Illusions of Control Over Gambling Outcome / Skill Orientation	Believing that unrelated variables covary (e.g., rubbing dice actually caused the win); an expectancy of success that is greater than warranted by objective probability; or believing that winning at gambling requires skill.
Magical Thinking	Attributing human traits to the machine; superstitions; beliefs about luck (e.g., luck is contagious or controllable), or flexible beliefs (e.g., wins signify good luck and losing streaks mean good luck is imminent).
Errors in Estimating Probability	Thinking that the chance of winning increases after a series of losses; believing one will win within several hours, rather than months or years; or failure to see the independence of events.
Information Processing Biases	Believing that wins are due to internal factors (skill), while failures are blamed on external causes (e.g., bad luck); attributing losses to flukes or re-framing losses as *near wins*; discounting losses and recalling mostly wins; or viewing losses as choices that could have been foreseen.

Some problem gamblers hold what Toneatto (1999) termed *Illusions of Control Involving Luck.* Gamblers may believe luck is controllable or contagious, or that although

luck itself is uncontrollable, one can predict or recognize periods of good luck and optimize winning by only gambling during lucky periods. Wins may signify that luck is good and losing streaks are seen as signs that good luck is imminent (Toneatto, 1999). Other gamblers may believe that some people are naturally lucky overall, at specific games, or in only certain places. The latter belief may cause gamblers to return to gambling locations where s/he has won in the past (Toneatto, 1999).

A second major class of cognitive distortions involves errors in estimating probability. Ladouceur and colleagues (1995) conceptualized the fundamental cognitive error as failing to recognize that events are independent. In Ladouceur et al.'s (1995) study, volunteers from the public were asked to evaluate the chances of winning for lottery draws and roulette spins with sequences that appeared chaotic, regular, or unbalanced. Though all had an equal chance of winning, participants rated the chaotic series as most likely to win and wagered larger amounts on these types of number sets, suggesting that they failed to understand the principle of independence of events. Individuals violating the independence of events would also believe that after several results of *heads*, *tails* becomes more likely, or that after several reds in roulette, they should bet black. Thus, when gamblers calculate the probability of winning after only a few trials, their expectations are based on probability principles that would apply to a much larger number of trials. Failure to recognize independence of events is thought to account for the *Gambler's Fallacy*, the belief that as a series of ongoing losses occurs, the probability of winning increases (Griffiths, 1994; Holtgraves & Skeel, 1992). Due to the *Gamblers Fallacy*, gamblers tend to increase their bets after a series of losses, and expect to win within several hours rather than weeks, months or longer (Toneatto, 1999). Their

expectation that a win is due in the immediate future is termed temporal telescoping. Temporal telescoping may be fueled by the layout of machines in casinos. That is, machines are closely spaced and tend to pay out in a dramatic fashion (e.g., loud bells and flashing lights). As the drama makes it appear that the machines constantly pay out, the gambler becomes convinced a win will come soon. Temporal telescoping also leads to chasing losses (Toneatto, 1999). The DSM-IV acknowledges the significance of chasing in the presentation of disordered gambling by including the diagnostic criterion, "after losing money, often returns another day to get even" (APA, 2000). When chasing losses, the gambler reasons that there is a 0% chance of recouping losses when play is discontinued, but a non-zero chance of recovering losses if she or he continues playing. The error is that the gambler fails to account for the non-zero probability of incurring further loss with continued play (Ladouceur, et al., 1995). Cognitive distortions regarding probability have also been demonstrated in individuals without gambling problems. For example, Ontario's Responsible Gambling Council found that many individuals from the general population held erroneous perceptions regarding probability. For example, 51% of respondents to a telephone questionnaire incorrectly believed that staying at a single slot machine would improve chances of winning, an example of failing to account for the independence of events (Weibe, 2001).

A third category of cognitive distortions has been termed magical thinking (Toneatto, 1999). Magical thinking includes a variety of ideas that share the underlying belief that the gambler can engage in behaviours or thoughts that directly influence gambling outcome. How the lucky object, behaviour, or thought actually influences the outcome is unknown to the gambler, and takes on a magical quality (Toneatto, 1999).

Superstitious beliefs are an example of magical thinking, such as when gamblers must have a rabbit foot with them at the casino, only use certain lucky machines, or avoid playing certain numbers in the lottery. Such beliefs can reflect the error of illusory correlation, where gamblers believe that two unrelated variables covary (Griffiths, 1994; Toneatto, 1999), such as believing that because two "Hail Mary's" were said before winning a round of roulette, the Hail Mary's were related to the outcome. Magical thinking is also present when gamblers personify the machine. For example, the perception that the machine "likes" the gambler will lead the gambler to believe that the machine will pay out (Gaboury & Ladouceur, 1989). A number of magical thoughts revolve around the concept of luck. Some individuals believe that luck is controllable, that is, can be transferred between persons or be manipulated by the gamblers' actions (Toneatto, 1999). The various beliefs in luck lead gamblers to try to avoid bad luck, seek or create good luck, or otherwise identify and control their level of luck. The diversity of examples and descriptions of beliefs on luck across reports suggests that the beliefs regarding luck vary considerably between individuals.

The final category of irrational cognitions involves distorted information processing (e.g., Chau & Phillips, 1995; Corney & Cummings, 1985; Ladouceur, et al, 1995). In general, information-processing theories state that information is sensed or registered, held in a short-term store, encoded and interpreted, and stored for later recall (Searlemann & Hermann, 1994). Gamblers have evidenced attentional biases that direct what information is registered, that is, wins are more likely to be registered while losses tend to be ignored (Griffiths, 1994; Toneatto, 1999). Interpretive biases at later stages of processing are seen when gamblers use flexible attributions, attributing wins to personal

skill and losses to bad luck (Chau & Phillips, 1995; Gaboury & Ladouceur, 1989; Griffiths, 1994; Toneatto, 1999). Gamblers also tend to interpret losses as near-wins, further allowing them to rationalize continued gambling despite their losses outnumbering wins. At the retrieval stage of information processing, biases in memory are present in gambling disorders. Gamblers tend to remember wins rather than the many accompanying losses (e.g., Corney & Cummings, 1985; Griffiths, 1994), and as a result, individuals may actually believe that they always win or rarely lose. Alternatively, gambling may escalate because losses are re-framed as "near wins" (Griffiths, 1994; Toneatto, 1999) or as learning opportunities. Gamblers may view losses as situations that should and could have been foreseen (e.g., "I *knew* I should have held that Ace"). These thoughts lead gamblers to believe that practice will improve performance. Although it is generally true that practice leads to improved skill and better outcome, this principle is misapplied to chance events such as gambling (Ladouceur, et al., 1995). Information processing biases can also lead gamblers to make erroneous judgements of their likelihood of winning.

The cognitive distortions discussed in this section were identified in samples of pathological gamblers and in individuals without gambling problems drawn from both university and general populations. There is some indirect support for the idea that, although distorted thinking about gambling is present across all levels of gambling, cognitive biases are more significant in problem and pathological gamblers. For example, Atkins and Sharpe (2000) found attentional biases toward positive gambling-related words in problem gamblers but not social gamblers. These attentional biases could reflect

or reinforce distorted beliefs (e.g., illusion of control over gambling), but this question has not been studied to date.

As cognitive distortions are thought to operate outside conscious awareness (Sharpe & Tarrier, 1993; Toneatto, 1999), a major challenge inherent in research is determining the most reliable method to elicit and assess cognitive errors. An indirect approach consists of observing gamblers engaging in their usual gambling activities and making inferences about their cognitions based on their behavior. For example, noting that dice players coach novices to roll the dice harder for larger numbers and softer for smaller numbers and concluding that this use of strategy was indicative of an illusion of control in a game of chance. However, as observational methods require inferring cognitive processes from behaviour without directly assessing the cognition, inaccurate inferences could reduce the validity of the findings.

A more direct method of eliciting cognitive distortions is the *Think Aloud Method,* which has been used in many studies of distorted thinking in gambling (e.g., Delfabbro & Winefield, 2000; Gaboury & Ladouceur, 1989; Griffiths, 1994; Langer, 1975). In this paradigm, individuals are trained to say every thought that crosses their minds while they gamble. The statements are then classified or rated on their degree of rationality. Although this method is more direct than behavioural observation, its ecological validity is uncertain. For example, some have argued that the process of verbalizing thoughts is unnatural, and therefore might not accurately represent the gamblers thoughts during actual gambling (Delfabbro & Winefield, 2000). Rather, Delfabbro and Winefield (2000) suggested that verbalizations represent descriptions of behaviour because the cognitive errors function at a subconscious level and would be less accessible to consciousness

during think-aloud. In addition, verbalizations could be biased if participants edit the content of their speech to match the examiner's expectations (i.e., demand characteristics). Finally, conclusions based on think aloud tasks might be inconsistent if raters disagree on what is irrational. In contrast to the above, Ladouceur and colleagues have reliably used the approach across numerous studies, and have reported a high degree of confidence in its ecological validity (Ladouceur, Gaboury, Bujold, Lachance, & Tremblay, 1991). Although the validity of think aloud paradigms have been questioned, there are no alternative methods of eliciting cognitive distortion during gambling for the purpose of assessing convergent validity of the GCI. The think aloud task could therefore be used as a general estimate of cognitive distortion but more information should be gathered about its reliability and validity.

To avoid demand characteristics, analogue gambling tasks have been employed, where performance is used to determine whether or not distorted thinking was involved in the decision. Though analogue gambling situations have been criticized for their low ecological validity in studies of physiological arousal (Anderson & Brown, 1984), the criticisms might not extend to the assessment of thoughts. Analogue methods are more easily applied to identifying errors in calculating probability, but may be less reliable for identifying other distortions such as superstitious thoughts (Ladouceur, et. al., 1995). Thus, this method alone would be inadequate to measure the full range of cognitive distortions present in gamblers, but could provide convergent validity to support findings on probability errors derived from other methods.

As a result of the methodological problems in evaluating gambling-related cognitions with extant techniques, some efforts have been made to develop self-report

questionnaires. A few scales measuring gambling-specific thoughts or beliefs have been developed. For example, Breen and Zuckerman, (1999) developed a self-report scale to assess change in beliefs after treatment for pathological gambling. Their Gamblers Attitudes and Beliefs Scale (GABS) was able to distinguish gamblers from non-gamblers, but no investigation of the instrument's ability to distinguish between severity of gambling problems was reported. Further, it was found that the GABS items had limited face and content validity (e.g., "people who make big bets are very sexy") and loaded onto one broad factor termed *Affinity for Gambling*. Scales addressing one specific distortion may be too narrow to assess the complete range of cognitive distortions in gambling. Such scales would have limited utility for differentiating distortions and or identifying specific cognitions for restructuring in therapy.

Steenbergh, Meyers, May and Whelan (2002) described the development and validation of a scale measuring cognitive distortions in gamblers. As the authors had anticipated, the *Gambler's Beliefs Questionnaire* (GABS) was composed of two factors, representing Illusion of Control and Beliefs in Luck. This provides support for including two of the four major categories of distortions discussed above in a scale measuring cognitive distortions. Though preliminary psychometric data on the GABS was promising, a clinical sample of pathological gamblers was not used, thus the utility of the scale in a pathological gambling population has yet to be established.

Existing scales measuring cognitive distortions tend to be either too general to clarify the nature or origins of cognitive distortions or to inform treatment approaches; too narrow to identify the range of problematic cognitions; or largely behavioural in focus. Scales asking for self-reported behaviour may be confounded by demand

characteristics (i.e., social desirability), where respondents are reluctant to acknowledge engaging in certain behaviours. Furthermore, an interpretive step is taken, where underlying cognitions are inferred from reports of behaviour, making it an indirect measure of cognitive distortions. A scale more directly assessing cognitions by addressing actual thoughts could provide a different picture.

Objectives for Research

The present study was intended to build on prior scale development research and to develop a measure of the full range of gambling-specific cognitive distortions, within the four major domains of illusion of control/skill orientation, magical beliefs, probability estimation errors, and information processing biases. The ultimate purposes of the scale were threefold. First, the scale has the potential provide further empirical data to inform Sharpe's (2002) reformulated cognitive-behavioural model of problem gambling. Second, the scale could be applied to therapy, and used to identify cognitive errors to be restructured in cognitive therapy. Third, the scale has the potential to provide an objective assessment of treatment progress and cognitive risk for relapse.

This project was divided into three phases. The first phase comprised generating items for the Gambling Cognitions Inventory (GCI) based on a review of the empirical and theoretical literature on gambling-related cognitions. The goal of this phase was to create an item pool that represented a diverse range of gambling-specific cognitive errors. A focus group was used to evaluate the items before the scale was administered to a student population. The second phase involved administering the GCI items to a large sample of university undergraduates, assessing the factor structure of the scale, and reducing the number of items. Third, a pilot clinical validation phase involved

administering the revised scale to individuals with gambling disorders and comparing performance on the GCI with two alternate measures of cognitive distortions. Goals of the third phase were to collect initial data on the GCI, and to assess the utility of the think aloud method for eliciting distorted cognitions in laboratory gambling, as this has been a procedural issue in research.

PHASE ONE: ITEM DEVELOPMENT

Phase One Method

The empirical literature on cognitive distortions and the theoretical role of distorted thinking in gambling problems was reviewed in order to provide a foundation for the construct validity of the GCI items. Content for the GCI was derived from the types of gambling-related cognitive errors identified in empirical studies and case reports and was consistent with the role of distorted thinking within a comprehensive cognitive-behavioural model of problem gambling. That is, since distortions are believed to emerge in response to gambling-related cues, both within and outside gambling venues, and to be reinforced by both wins and losses (Sharpe, 2002; Sharpe & Tarrier, 1993). The items we developed contained scenarios of both wins and losses, and addressed beliefs about a variety of aspects of gambling venues and games. Items were generated within each of the four categories of cognitive distortions: errors in estimating probability; illusion of control/skill orientation; magical thinking/luck; and information processing errors. As a way to further enhance content validity, items from existing scales measuring cognitive distortions were used as checks that a broad range of distortions was included. Some items were worded so that they were reverse-scored, as an attempt to control for response biases. Specifically, reverse-scored items would force respondents to read the questions

more carefully, making it less likely that participants would provide the same response for every question (e.g., to complete the scale more quickly). A large item pool was generated to ensure all content areas were well represented (Clark & Watson, 1998).

The readability level of the items was objectively evaluated by the word processing program *Microsoft Word 6.0* (Flesch-Kincaid Grade Level formula) targeting a grade 8 level, as this is the average level attained in Canada. A focus group was then used to further assess content validity and readability of the items. Fourteen participants were recruited for the focus group. Members were clinicians, graduate students, and researchers in the field of gambling from the University of Calgary Gambling Interest Group; one cognitive psychology professor; and counselors from the Addiction Centre, Calgary and the Alberta Alcohol and Drug Abuse Commission (AADAC), Calgary.

Procedure

Focus group members were provided with background information on the role played by cognitive distortions in problem gambling and an overview of the goals of the research project. The focus group was told that the goals were to evaluate the readability and face validity of the scale items, assess content validity (category of distortion and breadth of distortions), and select appropriate response anchors. An item-by-item discussion was undertaken, and feedback was solicited regarding wording of the items and the appropriateness of content. Participants were also asked to identify content not covered by the scale. Content validity was also evaluated by asking focus group participants to back-translate the items onto the four hypothesized factors, a procedure suggested by Dawis (1998). Most items not categorized were excluded, unless it was agreed that there was some potential value for the question to be included. Members were

also asked to select the most appropriate anchors for the proposed Likert-type scale. Three alternative anchors for the five-point Likert-type response scale for the GCI were presented: 1) Almost Always – Often – Sometimes – Rarely – Almost Never; 2) Extremely – Quite a Bit – Moderately – Slightly – Not at All; 3) Strongly Agree – Somewhat Agree – Unsure – Somewhat Disagree – Strongly Disagree. The group was asked to choose the best anchors for the items that were written.

Phase One Results

Ninety-nine items were generated, covering a broad range of cognitive distortions within four categories: illusion of control/skill orientation, information processing biases, errors in estimating probability, and magical thinking/beliefs in luck. The readability level was rated at grade 7.8 by the Flesch-Kincaid Grade Level Formula (MS Word). Feedback from the focus group revealed that the wording of some items was confusing and these items were revised. Another main point of discussion was the behavioural focus of many of the GCI items. It was decided that items should written to be more cognition-oriented, addressing participants' beliefs, thoughts, opinions, or rules about gambling rather than asking respondents to report on their behaviour.

With respect to the class of distortion, there was a high level of agreement on the category or type of distortion in each retained item. Some items were worded for reverse scoring (e.g., "I lose because the probability of winning is very low"). Some focus group participants stated that these were not distortions. Since the items were intended to avoid a positive or negative response bias, the group agreed that reverse scored items should be retained.

Finally, the focus group decided on the response anchors for the GCI. Group members agreed that a five-point Likert-type scale should not be used, as this could lead to a central tendency response bias. Thus, a four-point Likert-type scale response format was chosen. The response anchors, *Strongly Agree, Somewhat Agree, Somewhat Disagree, and Strongly Disagree* were agreed upon by all members of the group. Feedback from the focus group was used to guide item revision. The resulting version of the GCI, used for phase two, contained 96 items and a four-point Likert-type style response format. Re-assessment of readability revealed a grade 7.9 level.

Phase One Discussion

Item development was a careful process, as the whole scale construction process would build on this early stage of work. Readability was assessed in two ways. The Flesch-Kincaid formula in *MS Word* provided an objective readability level of grade 7.9 after revision (96-item GCI). This level was judged to be appropriate for the intended population of problem and pathological gamblers. Readability was also subjectively evaluated by the focus group, and items that were judged to be confusing or difficult to read were revised to enhance clarity. Content not consistent with member's experience with gamblers was excluded, while missing relevant content was added. In all, few additions or omissions were made. The use of a focus group for item evaluation was intended to maximize the construct validity of the GCI by eliciting feedback from individuals familiar with the target population of problem and pathological gamblers, and one individual with expertise in cognitive psychology. This depth of assessment could not have been attained solely by literature review.

Construct validity was established by several means, since multiple aspects of validity provide information to support construct validity (Kazdin, 2003). The focus group commented that items worded in behavioural terms had high face validity. That is, respondents would be aware that the scale items were measuring maladaptive gambling behaviour. High face validity was a potential problem in that it could lead to biased patterns of responding, such as individuals presenting themselves in a socially desirable light by not endorsing behaviours they knew to be unreasonable. It was also decided that scale items that addressed cognitive distortions directly, rather than inferring cognitive distortions from behaviours would be more appropriate. That is, participants might be more apt to endorse opinions or beliefs about gambling than state that they actually engage in certain behaviours. Moreover, non- or infrequent gamblers would not be excluded from the student sample that completed the GCI during initial scale evaluation, as they were not asked to report on past gambling behaviour. An example of a re-written item is, "When I lose at gambling, I keep playing." This item was changed to, "If people lose at gambling, they should keep playing."

To further enhance the validity of the responses, attempts were made to control for other response tendencies. For example, a four point Likert-type scale format was used to avoid a central tendency response bias, and reverse-scored items were included to reduce positive or negative response biases. Inclusion of a variety of gambling games/activities was intended to decrease the possible effect of unfamiliarity with the games on participants' responses.

For each of the four categories of cognitive distortion identified, a variety of items, reflecting as many aspects of the category as possible, were generated. About 18

items were written for each category, with more in the category *magical thinking / luck* (36 items), as there was a much larger number of distortions in the literature that fit this category. Of the 99 items presented to the focus group, 96 remained after revision (see Appendix A for a list of items).

It was recognized that 96 items was a large number, and that a large sample would be needed if exploratory factor analyses were used to evaluate scale structure. The ultimate goal of the research was to create a practical scale for use in clinical settings; ideally, such scales should be short enough to be clinically practical, while containing enough items to reliably measure the construct (Dawis, 1998). The goal for the final version of the scale was between 30 to 40 items. However, there was limited information available for using the scale construction literature to guide item generation, particularly for the information processing sub-scale. Most measures of probability errors used true /false questions (e.g., Kelly, Skinner, Wiebe, Turner, & Noonan, 2001; Weibe, 2001). Moreover, no published scales reported aiming to measure a broad range of gambling cognitions, and it was unknown whether items that were included in the GCI were rejected by other researchers or not considered. As this work was considered an early step in an iterative scale construction process, it was not desirable to reduce the number of items before initial evaluation to identify the most reliable scale items. Further, the ultimate goal of item reduction and selection was to identify the cognitive distortions most characteristic of problem and pathological gamblers. Accordingly, additional revisions were anticipated after the pilot validation phase with problem and pathological gamblers (phase three).

PHASE TWO: EVALUATION OF SCALE STRUCTURE AND ITEM REDUCTION

The goals of the second phase were to explore the structure of the 96-item GCI and assess reliability. Information on structure and reliability would be used for item reduction. The GCI was administered to a large student sample. The purpose of this phase was to reduce the item pool to a reasonable but still relatively large size, such that evaluation with a sample of problem and pathological gamblers could be undertaken.

Phase Two Method

Participants

University students ($N = 232$), 88 males and 144 females, took part in the study. Mean age of the sample was 22.5 (SD = 5.1). University students were recruited via the University of Calgary Bonus Credit Research Participation program over three semesters. Students received a 1% credit toward any course in exchange for their research participation. Between winter and spring term, additional students were recruited by flyers posted throughout the University. The latter participants were entered in a draw for a $25 gift certificate to the University of Calgary bookstore.

Demographic characteristics of the sample are presented in Table 2. Participants' self-reported addictive behaviours indicated that 9.5% of the sample responded *yes* or *unsure* to having problems with gambling. The rates of these responses for smoking, alcohol abuse, or other drug abuse were 17.3%, 17.3% and 9.0%, respectively. One individual reported a history of manic symptoms (bipolar affective disorder).

Participants' gambling involvement is summarized in Table 3. As for gambling severity, there was a high degree of agreement across the three measures (Pearson *r*

ranged from 0.78 to 0.84, $p \leq 0.01$). Averaging across the measures, and 12.9% of the student sample ($n = 30$) met criteria for problem or probable pathological gambling.

Procedure

Informed consent was obtained. Students provided demographic information (age, sex, marital status, education, occupation, income, and urban/rural residence); history of gambling problems, substance use disorders, and psychotic disorders; and current gambling involvement. Three instruments were used to evaluate degree of problematic gambling; the South Oaks Gambling Screen (SOGS), the NORC DSM-IV Screen for Gambling Problems (NODS), and the Canadian Problem Gambling Index (CPGI) (see Appendices B to D). Each instrument provides total scores and qualitative categorizations of gambling behaviour: *No Problems*, *Low Risk*, *Problem Gambler*, and *Probable Pathological Gambler*.

To assess associations between cognitive distortions and intellectual functioning, a potential confound when evaluating cognitive distortion, students completed a measure of general reasoning ability, the Wonderlic Personnel Test (WPT). Participants also completed the 96-item GCI (see Appendix A).

All measures were administered in a group setting, and a researcher was present to answer questions. After the session, students were given a debriefing handout outlining the purpose of the study and providing educational information about scale construction.

Table 2

Summary of Demographic Characteristics of the Student Sample Used in Phase Two

Variable	Percent of Sample
Sex	
Male	37.9
Female	62.1
Residence	
Urban	93.1
Rural	6.9
Marital Status	
Single	86.6
Married/Common Law	12.9
Separated/Divorced	0.4
Degree	
None	85.3
Bachelor	12.9
Graduate	0.4
	Mean (standard deviation)
Monthly Income	$ 950.0 ($875.9)
Education in years	15.1 (1.4)
Intellectual Test Score[1]	28.4 (5.8)

1. Wonderlic Personnel Test (WPT; Wonderlic, 1999).

Table 3

Self-Reported Gambling Involvement in the Phase Two Student Sample

Type of Gambling	% of Sample Involved
Cards (non-casino)	73.8
Instant / Scratch Tickets	67.3
Raffles, Fund-raising	54.7
Lottery	53.3
Games of Skill: darts, pool, golf	36.9
Casino Slot Machines	32.7
Video Lottery Games	25.7
Casino Table Games (e.g., dice)	22.9
Sport Pools	19.6
Stocks / Investments	19.2
Bingo & Sport Select	17.3
Other (e.g., horse races; mah jong)	< 6

Instruments

South Oaks Gambling Screen (SOGS; Lesieur & Blume, 1987)

The SOGS is a 20-item self-report scale based on DSM-III criteria for pathological gambling. It is a widely used screen for pathological gambling in normal and clinical populations and has excellent internal consistency ($\alpha = 0.97$). SOGS scores have shown high correlations with a DSM-III-R diagnosis of pathological gambling ($r = 0.94$), and 98% of pathological gamblers were correctly identified by the SOGS cutoff of 5

points. The "past year" version was used in this study. The SOGS classifies gamblers as follows: No Problems, At Risk Gambling, Problem Gambling, and Probable Pathological Gambling.

NORC DSM-IV Screen for Gambling Problems (NODS; Gerstein et al, 1999)

The NODS is 17-item measure of gambling severity that corresponds to the ten DSM-IV symptom criteria for Pathological Gambling. A small reliability and validity study was conducted. Internal consistency scores were not reported, but test-retest reliability was excellent ($\alpha = 0.98$) and ninety five percent of confirmed pathological gamblers scored above the cutoff of 5 points on the NODS. A score of 5 indicates that the individual meets the minimum of five symptom criteria required for a diagnosis pathological gambling. In phase two, the past year version was used and in phase three, both lifetime and past year versions of the NODS were used.

Canadian Problem Gambling Index (CPGI; Ferris & Wynne, 2001)

The CPGI is a 17-item measure of gambling severity, sampling cognitions, behaviours, and consequences related to gambling involvement. A score of 8 of higher on the CPGI meets DSM-IV criteria for pathological gambling (APA, 2000). The CPGI shows excellent internal consistency reliability ($\alpha = 0.93$) and strong correlations with a DSM-IV diagnosis of pathological gambling ($r = 0.83$).

Wonderlic Personnel Test (WPT; Wonderlic, 1999)

The WPT is a 50-item timed test of general reasoning ability, normed on a large sample of US working adults, high school graduates, and college graduates. Research has demonstrated strong correlations (r = 0.85-0.92) between the WPT and a reliable and well validated standard measure of intelligence, the Wechsler Adult Intelligence Scale,

Revised (WAIS-R; Dodrill & Warner, 1988; Hawkins, Faraone, Pepple, & Seidman, 1990).

Phase Two Results

The reliability of the whole GCI was assessed. One scale item (item 73) was deleted because the meaning of the response would be unclear; that is, any response would indicate a distortion. A reliability analysis on the remaining 95 scale items revealed a Cronbach's alpha of 0.96. It was decided that the sample size of 232 was too small to factor analyze the structure of the 95-items on the GCI (e.g., Principal Components Analysis; Tabachnick & Fidell, 1996) and to reduce the number of scale items. Instead, data reduction for the GCI was approached with a combination of statistical methods and other criteria based on theoretical and research knowledge for decision-making. The distortions were initially conceptualized as falling into four broad categories, and items were written to represent each of the categories, based on those that appeared to be consistent in some form across reports (e.g., Griffiths, 1994; Ladouceur, Gaboury, Dumont, & Rochette, 1988; Letarte, Ladouceur, & Mayrand, 1986; Toneatto, 1999). Namely, categories represented personal control of outcome (illusion of control), memory or judgement errors (information processing biases), errors in estimating probability, and magical thinking (e.g. superstitious beliefs or anthropomorphizing). The 18 – 36 items that were initially written to represent each category of distortion were conceptualized as a sub-scale for the analyses.

A principal components analysis (PCA) was conducted on each sub-scale to determine whether the items represented a relatively unitary construct. This method was used because the scale construction process was in the exploratory phase. PCA was

chosen over Factor Analysis (FA) because PCA analyzes all of the variance in the data, rather than only shared variance as in FA, making PCA more appropriate at an exploratory stage of research (Tabachnick & Fidell, 2001). If one large component accounted for a significant portion of the variance in the sub-scale, it would suggest that the sub-scale items were measuring one major construct. We hypothesized that a large component would account for the majority of the variance in each analysis, but expected that there would be some heterogeneity within each sub-scale because of the variability in distortions reported in the literature and individual differences in cognitions. For this reason, a stricter cutoff of eigenvalue ≥ 2 was used and scree plots were inspected to determine structure of the sub-scale. The four principal components analyses provided some support for the unitary nature of each category, with variances accounted for ranging from 28% for Errors in Estimating Probability to 42% for Illusions of Control / Skill (see Table 4). Scree plots for each sub-scale strongly supported a one-component solution.

Item reduction was then undertaken. First, principal components analyses were used for item reduction. The ten items that loaded most strongly on the principal component were selected to form a 40-item version of the GCI (see Appendix H). Additional criteria also guided item reduction. Specifically, very similar items were deleted (correlations ≥ 0.75); items referring to games that are not common across geographic locations (e.g., VLT's) were excluded because the scale will be administered to gamblers at several sites in future research; and as many reverse scored items as possible were included, with the guideline that no item would load below 0.4 on the principal component. A total of 11% of the 40 items were reverse-scored.

The internal consistency reliability of each sub-scale was also inspected in terms of Cronbach's coefficient alpha. Reliability analyses were conducted for each sub-scale. Results revealed an alpha of 0.67 for information processing, which is in the unacceptable range (Cicchetti, 1994); alpha was 0.71 for probability errors (considered fair); alpha was 0.87 for illusion of control (considered good); and alpha was 0.95 for magical thinking (considered excellent).

Table 4

Results of Separate Unrotated Principal Component Analyses on Each of the Four Sub-Scales of Cognitive Distortion Comprising the GCI

Distortion Sub-scale	Variance accounted for by component 1	Initial eigenvalue
Probability Errors	28.1%	5.3
Information Processing Biases	31.2%	5.6
Magical Thinking	40.0%	14.4
Control / Skill	41.7%	7.5

Participants' scores on the GCI were examined. It was anticipated that students would exhibit some cognitive errors on the GCI relating to errors in judging probability, consistent with the research findings in university samples (Holtgraves & Skeel, 1992; Ladouceur, et al., 1995; Weibe, 2001). Overall however, we expected the degree of cognitive distortion identified in the student sample to be low, as few students were expected to have gambling problems. Scores ranged from 95 (greatest distortion) to 380

(least distorted). The mean score on the GCI was 309 ($SD = 42$), which is in the direction of having a mild degree of distortion. The relationship between intellectual ability and scores on the GCI was investigated using the Pearson r correlation. A weak, but statistically significant zero-order correlation was found ($r = 0.26, p \leq 0.05$), indicating that stronger reasoning ability was associated with fewer cognitive distortions.

Criterion-related validity was assessed by comparing scores on the GCI to the three measures of severity of gambling problems. As anticipated, significant negative correlations were found between GCI scores and the SOGS, NODS, and CPGI scores ($r = -0.60, -0.65$, and -0.58, respectively; $p \leq 0.01$). These results suggest that increased distortion is associated with a greater degree of gambling problems.

A weak, but statistically significant negative correlation was found between participant age and GCI scores ($r = 0.25, p \leq 0.01$), indicating that younger age was associated with increased cognitive distortion. Interestingly, weak correlations with age were also found with the three measures of gambling problems (r values ranging from -0.15 to $-0.18, p \leq 0.05$), suggesting that younger age was associated with greater degree of gambling problems.

Phase Two Discussion

A general rule of thumb, using a sample size of at least 300 for FA and PCA, was used as a loose guideline for recruitment (Tabachnick & Fidell, 1996). A stricter rule of thumb (ten participants per scale item) was noted, but a sample size of 960 was thought not to be attainable within the time constraints of the project. We expected that some students would score at or above the problem gambling range, but base rates led us to not expect a number large enough proportion of the sample (e.g., 50%) to permit meaningful

comparisons between problem and non-problem gambling sub-samples. For example, a meta-analysis estimate of the prevalence of disordered gambling in college populations (Shaffer, Hall & Vander Bilt, 2001) estimated the lifetime risk of pathological gambling at 5.05% and for problem gambling, 7.01% as measured by the South Oaks Gambling Screen (SOGS; Lesieur & Blume, 1987). We did not expect that half of the student sample would report significant problems.

Students reported low frequencies of problems with addictive behaviours (e.g., gambling, smoking, alcohol, and other drugs). These results suggest that the sample was psychologically healthy. With regard to intellectual functioning, the mean score on the Wonderlic Personnel Test (WPT) was 28.5 (SD =5.8). The mean score lies at the 87.5th percentile, indicating that the student sample was above average in general reasoning ability. We assessed the relationship between reasoning ability (WPT scores) and scores on the GCI. There was a small but statistically significant correlation between GCI scores and WPT scores ($r = 0.257$), suggesting that higher intelligence scores were associated with higher GCI scores (which indicate lower levels of distortion). It is possible that scores indicating higher levels of distortion are in fact elevated by lower intelligence, but a predictive relationship cannot be derived from correlational data. The small size of the correlation suggests that any effect of intelligence on GCI scores was not a major factor in the phase two sample. It is unknown whether a similar relationship would be found in the clinical sample, as variability in intellect might be greater in clinical samples than in the generally high functioning student sample.

Reliability analysis of the scale's 95 retained items using Cronbach's alpha was in the excellent range ($\alpha = 0.96$). However, alpha values are sensitive to the number of items

in the analysis, tending to increase as the number of items in the scale increases (Schmitt, 1996). With 95 items, the strong alpha value could be an overestimation of the true reliability of the scale as a whole. Reliability analyses were also conducted for the four sub-scales of the GCI. The reliability values were highest for the subscales measuring magical thinking and illusion of control / skill (good to excellent range), while the alpha values for the sub-scales measuring probability errors and information processing biases were weaker, with the information processing scale falling into the unacceptable range based on the traditional cutoff of 0.7 (Cicchetti, 1994; Schmitt, 1996). As the *Magical Thinking/ Luck* category contained the most items, number of items might have contributed to the larger alpha value for this category. The finding that the *Magical Thinking / Luck* and *Illusion of Control / Skill* scales were most reliable is consistent with research on scales for cognitive distortion, as these have been factors identified as important. Less research attention has been paid to information processing. The reliability of the information processing and probability error scales is an issue to be investigated further in future research.

At the first phase, items were written to avoid response biases. In the second phase, further efforts to reduce response bias were taken. To reduce the possibility that participants would present themselves in a favourable light (i.e., social desirability) during GCI administration, it was not indicated that distorted thinking was being assessed. Rather, participants were informed that the study was investigating the types of thoughts and beliefs people have about gambling. The participants were debriefed after they completed the GCI.

Ideally, it would have been desirable to perform principal components analysis on the 95 retained items of the GCI in order to determine the structure of the scale and reduce the number of items. However, the sample size of 232 did not afford us the necessary statistical power for such analyses. Instead, we used a combination of statistical techniques and conceptual decision-making for item reduction. Attention was paid to the clinical utility of the scale (forty items was considered a reasonable amount for clinical use); to reducing response tendencies by including reverse-scored items (11% of items); and to eliminating very similar items (inter-item correlation ≥ 0.80). Unrotated principal components analyses conducted for each sub-scale revealed one major component for each sub-scale, accounting for 30-40% of the total variance. Initially, the ten items that loaded most strongly on the first component were taken to form the revised GCI. We then identified reverse-scored items that loaded greater than 0.4 and added them to the revised scale in place of the lowest forward-scored item for that sub-scale. We also replaced items that focused only on VLT games, as it was expected that not all participants would be familiar with the game. This latter consideration was important because the ultimate goal was widespread use of the scale in clinical settings.

A problem of circularity was identified with using the same sample for doing a separate analysis on each of the four sub-scales of the GCI and subsequent PCA on the reduced scale. If these two steps were conducted with one sample, qualities unique to the sample could be driving the structure of the scale that might not reflect the true structure the scale. Thus, PCA was not conducted for the 40-item version of the GCI. As the GCI was designed for eventual clinical application, this latter step would be most appropriate with a sample of gamblers with clinically significant problems.

Some support was derived for the criterion-related validity of the GCI. Significant correlations were found between GCI scores and three measures of degree of gambling problems, indicating that increased cognitive distortion was associated with higher scores on the severity measures. It is possible that low method variance contributed to the strength of the correlations (i.e., the GCI and all severity measures were self-report scales). The research design did not allow for causal interpretations about the relationship between severity of gambling problems and cognitive distortion (i.e., observed, not manipulated, variables were correlated).

Age showed statistically significant but weak negative correlations with cognitive distortion on the GCI and with gambling severity scores. This finding suggested that younger individuals tend to show more problematic gambling and greater cognitive distortion. Several explanations for such a relationship are plausible. It is possible that younger students had more exposure to gambling activities in their social lives or that the older students sampled represented a group unlikely to have serious gambling problems (as they might be less likely to attend University). Another possibility is that another variable such as impulsivity played a role, as impulsivity has been found to be negatively correlated with age (Blaszczynski, Steel & McConaghy, 1997), and positively associated with severity of gambling problems.

PHASE THREE: PILOT VALIDATION STUDY

A student sample with relatively low frequencies of gambling problems was used for phase two, but the future aim for the GCI will be for clinical use. Thus, it would be most appropriate to evaluate the scale structure using a sample of problem and pathological gamblers, as such a sample would afford better ecological validity.

Validation of the reduced GCI and comparison with two alternative procedures for assessing cognitive distortions was initiated in a pilot validation phase of research.

The goal of this phase was to begin to examine the validity of the GCI with a representative sample of problem gamblers. This was also a step towards collecting an appropriate sample size of disordered gamblers for eventual factor structure analysis of the 40-item GCI. Scores on the GCI were compared to two alternate measures of cognitive distortion, a think aloud task and a gambling decisions task. As the ecological validity of the think aloud task has been questioned (Coventry & Norman, 1998; Delfabbro & Winefield, 2000), a second goal of phase three was to assess the utility of the think aloud method to elicit cognitive distortions in laboratory gambling.

Phase Three Method

Participants

Problem and pathological gamblers were recruited from the media, gambling treatment groups at the Addiction Centre at Foothills Hospital, Calgary, Alberta and contacted from a participant register from other ongoing gambling projects at the University of Calgary. Individuals scoring 3 or higher on the South Oaks Gambling Screen (Lesieur & Blume, 1987) at initial screening were eligible for the study, as scores of 3 to 4 are in the Problem Gambling range, and scores of 5 and above fall into the Probable Pathological Gambling range. Participants with active psychotic symptoms were excluded, as these individuals could hold cognitive distortions unrelated to gambling that might influence their responses.

Twenty-four individuals called about the study. Six were ineligible because they scored below 3 on the SOGS or did not gamble. Two others declined participation

because they had recently quit gambling and did not wish to be exposed to a VLT. Two participants did not show up for their appointment or cancelled. An additional individual was recruited via a psychologist working with gambling and other addictive behaviours. This participant completed the GCI only. In total thirteen individuals, 10 males and 3 females, participated in the pilot study.

Demographic characteristics of the pilot sample are summarized in Table 5. Participants' scores on the SOGS ranged from 4 to 17; three individuals scored in the problem range and ten scored in the pathological gambling range. Participants reported problems with a variety of types of gambling, including VLT's, slot machines, casino and non-casino cards, horse racing, and Sport Select; two people had problems with more than one game. Participants were involved in an average of 6.6 ($SD = 3.2$) types of gambling.

Procedure

Individuals interested in the study were screened by telephone using the SOGS. Those scoring 3 or higher were booked for a face-to-face appointment. For each participant, informed consent was obtained. Demographic data (see phase 2 method), objective self-report of gambling severity (the CPGI and lifetime and past-year versions of the NODS; see phase 2 method), and information on gambling involvement were collected. Participants then engaged in three tasks designed to measure cognitive distortions (self-report GCI, gambling decisions task, and the think aloud task). When participants finished the study, any of their questions were answered and they were given a $10.00 grocery store gift certificate in appreciation for their participation.

The order of administration of the think aloud task, lottery / probability decisions task, and GCI was counterbalanced. Effects pertaining to order of administration were tested using one way ANOVAs.

Table 5

Descriptive Statistics for the Phase Three Pilot Validation Sample (n = 13)

	n	Percent	
Residence			
Urban	12	92.3	
Rural	1	7.7	
Marital Status			
Single	3	20.0	
Married/Common Law	5	46.7	
Separated/Divorced	4	26.7	
Widowed	1	6.7	
	Range	Mean	Std. Deviation
Participant age	21 – 66	41.85	14.19
Net monthly income	$300 – $5,500	$2,027.27	$1,380.65
Years college	0 – 5	2.04	1.65
Years technical/other school	0 – 2	0.78	3.89
SOGS total score	4 – 17	7.8	3.88
CPGI total score	3 – 20	9.9	4.79
NODS total score past year	0 – 9	3.77	2.45
NODS total score lifetime	1 – 10	5.23	2.12
Number of errors on true/false	0 – 8	3.31	2.06

Measures

Think Aloud Task

For the think-aloud task, a video lottery terminal (VLT) was used for the gambling activity. The machine is identical to those found in establishments throughout Calgary, except that credits rather than money were used. Replicating the method employed by Delfabbro and Winefield (2000) and Ladouceur and colleagues (Gaboury & Ladouceur, 1989; Ladouceur, Gaboury, Dumont, & Rochette, 1988), participants were trained in the think aloud method. Participants were told that the goal was to verbalize all the thoughts that crossed their mind while they gambled on the VLT. Participants were told to: 1) say everything that crossed their mind, without censoring anything, even if the thoughts seemed irrelevant or repetitive; 2) speak as continuously as possible; 3) speak clearly and disregard grammar; full sentences were not necessary; and 4) not justify or analyze their thoughts. Participants were given five minutes of practice (or more if needed). If the individual stopped talking for 30 seconds, s/he was prompted to try to keep talking and say what s/he was thinking about the game. Once participants felt ready to continue, a 12- to 15-minute trial was conducted. Participants were encouraged to interact with the VLT as they normally would (e.g., add more money, change bets, or switch games). The researcher recorded all statements during the session, and also audiotaped the session for backup using a GE mini-tape recorder.

Based on a detailed categorization scheme used by Griffiths (1994), participants' statements were rated *Rational, Irrational,* or *Other*. Rational statements were defined as those reflecting realistic perceptions of gambling, or appropriate explanations for wins and losses (e.g., "the odds are against me"). The *Other* category was applied to comments

unrelated to winning, losing, or the gamble itself (e.g., "I've run out of money," or "I like the music"). Verbalizations rated as irrational were those that reflected the four categories of distortion; *Magical Thinking* (superstitious statements, personifying the machine, references to luck; e.g., "this machine doesn't want me to win"); *Illusion of Control / Skill* (references to personal skill or control over the game or mention of strategies used; e.g., "I've always been good at keno"); *Information Processing Error* (memory or attributional errors, inappropriate rationalizations of wins or losses; e.g., "I almost won there"); *Probability Error* (errors in estimating the chance of winning, believing that a win is imminent; e.g., "a win should be coming right up"); or *Other* (statements that were not rational, but could not be categorized). The percent of the total number of statements for each category (rational, irrational, or other) and sub-category of irrational cognitions was calculated. To estimate the representativeness of the verbalizations we asked participants the questions used by Delfabbro and Winefield (2000). Specifically, participants were asked to what extent the simulated VLT experience represented their real life VLT gambling; whether they had difficulty verbalizing their thoughts; and whether they thought the verbalizing procedure affected their gambling behaviour. The think aloud task worksheet appears in Appendix E.

Gambling Decisions Task

A gambling decisions task was used to assess participants' knowledge of probability. The task entailed two parts. The first part required participants to rate the probability of a series of numbers winning the lottery, a similar paradigm to that used by Ladouceur and colleagues (1995). Five number series, consisting of six numbers between 1 and 49 to mimic a popular lottery game in Alberta (Lotto 6/49), were presented.

Subjects were asked to indicate which series, if any, would be most likely and least likely to win the draw. Choosing any one series over another was considered an error, as all series had equal chances of winning. Participants were also asked whether or not they could modify the five number series to increase their chances of winning (see Appendix F). Any modification was considered an error, since no modification would actually change the probability of winning. In the second part, participants were asked to rate ten probability statements as true or false (see Appendix G), a similar approach to that used in the ORGC telephone survey (Kelly, Skinner, Wiebe, Turner, & Noonan, 2001; Wiebe, 2001). The number of errors was calculated.

Phase Three Results

ANOVAs were used to rule out effects of order of task administration on degree of cognitive distortion measured. There were no significant main effects of order of administration of the GCI (e.g., first, second, or third) on percent irrational verbalizations on the think aloud task, number of errors on the gambling decisions tasks, or degree of distortion on the GCI.

GCI Scores in the Phase Three Sample

Scores on the GCI for the pilot sample ranged from 83 to 135, with a mean score of 115.1 (SD = 15.7). A score of 40 would indicate the highest degree of distortion while 160 would be the lowest. In comparison, the phase two student sample's performance on the forty items used in phase three was examined. Phase two participants' mean GCI score was 136.7 (SD = 20.7). A t test was used to compare the performance on the forty GCI items for the phase two and three samples. The results indicated that the scores for the phase two and three samples were significantly different (t (196) = 2.94; p = 0.004),

indicating that the level of cognitive distortion was significantly greater in the phase three sample, as shown by lower GCI scores.

Other Measures of Cognitive Distortion

The GCI, the think aloud task and the gambling decisions tasks were used to identify cognitive distortion. A mean of 3.3 (SD = 2.0) errors of a maximum of 10 were made on the true / false questions assessing knowledge of probability principles, and 3.2 (SD = 1.9) of a maximum of 7 errors were made on the lottery decisions task. These two gambling decision tasks indicated the presence of some distortion in the domain of probability estimation.

A mean of 52.4 (SD = 19.8) statements were made in the think aloud task, amounting to approximately 3.9 statements per minute. Of these, averages of 35% were rated *Irrational*, 51% were rated *Rational*, and 15% were rated *Other*. Categorization of the irrational statements into the four main groups resulted in 21% *information processing*, 9% *probability errors*, 40% *magical thinking / luck*, 19% *illusion of control /skill*, and 10% *other irrational*. Verbalizations in the *Other* category were grouped into those representing symptoms or suggestions of gambling problems, such as, "I have no control over how much money I spend" or "usually I gamble when I'm stressed." These were not considered to be cognitive distortions.

Reliability

Reliability of the 40-item GCI was assessed using the pilot sample, resulting in a Cronbach alpha value of 0.84, which is in the Good range (Cicchetti, 1994) and suggests that a general construct (e.g., cognitive distortion) was being measured. However,

because the sample size was small, it would be premature to draw conclusions about reliability of the GCI in a problem gambling sample.

Reliability of the gambling severity measures with this sample was also assessed. Both the NODS and the CPGI evidenced good reliability ($\alpha = 0.85$ and 0.80 respectively), and reliability of the SOGS was considered fair ($\alpha = 0.79$). Four of the items on the SOGS (items 16 to 19) had zero variability. The items referred to highly problematic or criminal behaviour (e.g., loan sharks, writing bad cheques) and it was not surprising that no students endorsed these items.

Validity of the GCI

Concurrent (or criterion-related) validity was assessed by correlating self-report cognitive distortion with measures of gambling severity (CPGI, NODS, SOGS), anticipating a negative relationship, such that a greater degree of erroneous cognitions (low scores) would be related to increased gambling severity. Zero-order Pearson correlations were computed between gambling severity measures and the GCI. Correlation analyses revealed non-significant relationships between GCI total scores and scores on the SOGS, NODS, and CPGI. Inspection of the scatter plots and correlations revealed that they were in the hypothesized negative direction ($r = -0.20$ to -0.44).

Convergent validity was assessed by comparing the GCI results to the results of alternate measures of cognitive distortions. Correlation analyses were performed comparing GCI scores to the think-aloud results (percent irrational verbalizations, proportion of irrational statements in each of the four categories) and gambling decisions task scores (lottery errors and errors on true/false probability questions). A negative relationship was hypothesized between distortions on the GCI errors on the think-aloud

and decision-making tasks, which would indicate that high distortion (low GCI scores) is associated with increased errors. The correlations between GCI scores and number of errors on probability questions and between GCI scores and errors on the lottery questions were not significant (see Table 6). The results suggest the presence of a trend toward lower GCI scores being associated with more errors.

Relationships between gambling severity and the two measures of cognitive distortion, the decisions task and the think aloud task, were also investigated. For the think aloud task, significant correlations were found between irrational verbalizations representing *magical thinking / luck* ($r = 0.61, p \leq 0.05$) and scores on the SOGS; between verbalizations representing *illusions of control / skill* and scores on the NODS past year version ($r = 0.62, p \leq 0.05$); and between verbalizations referring to gambling symptoms and the NODS lifetime version ($r = 0.68, p \leq 0.05$), but not the past year version. The correlation between total irrational verbalizations and the NODS approached significance ($r = -0.50, p = 0.09$). These results indicate that increased severity of gambling problems was associated with increases in some classes of verbalizations on the think aloud task. Correlations between the severity measures and the decisions tasks (lottery errors and true / false errors) were all non-significant.

Qualitative Interpretations

One goal of the pilot study was to assess the utility of the think aloud task. The VLT used for the study was identical to those in use throughout the city of Calgary and was familiar to all participants, three of whom reported having the most problems with VLT's. To determine the representativeness of the verbalizations produced in the think aloud task, we assessed participants' reports of how the think aloud task went. About half

of the participants reported having some problems with the task. Several participants had difficulty verbalizing their thoughts. For example, some participants reported that it was difficult to think of things to say, since they did not normally speak while they gambled.

Table 6

Correlations between Selected Measures of Cognitive Distortion in Phase 3 (N = 232)

	GCI Score	T/F Errors	Lottery Errors	TAT Irrational	TAT – IP	TAT – PE	TAT – ML	TAT – CS
T/F Errors	-.44							
Lottery Errors	-.48	.50						
TAT Irrational	-.19	.39	.09					
TAT – IP	-.12	.38	-.28	.25				
TAT – PE	.31	.17	-.09	-.12	.51			
TAT – ML	.39	-.13	-.05	.16	-.16	-.09		
TAT – CS	-.57	.25	-.22	.11	.23	.16	-.31	
TAT - SX	.36	.01	-.61*	.39	.63*	.39	-.06	.11

Note. CS = illusion of control / skill; IP = information processing; ML = magical thinking / luck; PE = probability error; SX = symptomatic statement; TAT = think aloud task; T/F = true / false probability questions

* $p \leq 0.05$

Though participants who had little to say were periodically prompted by the researcher, some provided relatively few statements. A second issue for participants was their perception of gambling when using credits supplied by the laboratory VLT, rather

than their own money. That is, several participants stated that not actually having a threat of losing their money made VLT gambling boring. Some stated that they would have become more excited about the game if they were gambling with their own money, and one participant guessed that he would have had more to say if he was not so bored. A third problem identified by some participants was the use of only one machine. Several participants stated that they would normally move to another machine after a certain number of losses, and not being allowed to do so for the experiment made the gambling feel very contrived. Finally, one of the participants was not familiar with the games on the VLT machine and had only gambled on a VLT once before. This participant spent relatively more time using the help key and commenting on how to play the games, thus needing a longer practice session. Though he became familiar with the VLT during the session, he played very slowly during the 15 minute trial and commented several times that he hated the machine and was bored.

Phase Three Discussion

Goals of the pilot study were to collect information on performance of problem and pathological gamblers on the GCI and to evaluate the utility of the think aloud task for identifying cognitive distortions.

Participants' scores on the GCI tended toward the low to middle-range. A comparison with the predominantly non-problematic gamblers in the phase two sample revealed that the mean GCI score for the pilot sample was significantly lower, in the expected direction of more distorted cognition. These results provide some support for the presence of greater cognitive distortion in problem and pathological gamblers. These findings should be interpreted with caution, however, because the forty items within the

96-item version administered in phase two might not be equivalent to the 40-item version form administered in phase three. During phase two administration, the forty items used in the present comparison were embedded within the 96-item version of the GCI. The effects of the other items on participants subsequent responses to the 40 retained items cannot be determined (i.e., the item responses are not necessarily comparable).

The relationships between the severity scores and performance on the GCI were not significant, though there appeared to be trends in the expected direction. The lack of significant findings might be due to the small sample size and associated restriction of range in GCI and severity scores. Of the three comparison tasks, think aloud, lottery decisions, and true / false probability questions, significant associations with gambling severity were found for three groups of irrational statements on the think aloud task; those referring to *Magical Thinking / Luck*, *Illusion of Control / Skill*, and statements representing symptoms of gambling problems. The latter relationship makes sense because the NODS measures symptoms of gambling problems similar to the statements made. However, the lack of significant relationships between symptom-related statements and the SOGS and CPGI makes the interpretability of this correlation questionable. Each correlated with only one severity measure but not the others. It is difficult to make interpretations from this data. The results suggest that further study using the think aloud task with a larger sample of problem and pathological gamblers might find stronger associations with gambling severity.

Errors were made in the decisions tasks assessing probability knowledge, suggesting the presence of some degree of distortion. In a study aimed at assessing knowledge of gambling in Ontario residents, Kelly, Skinner, Wiebe, Turner and Noonan

(2001) found that errors in estimating probability in gambling activities were common in a sample of individuals taken from the general population, with about 50% of respondents making errors. Interestingly, the authors found that, in general, people who gambled had a somewhat better understanding of probability and randomness. In our sample, individuals scored an average of 70% correct, which is consistent with the notion that errors regarding randomness and probability were relatively mild. Consistent with the finding of a low error rate on probability knowledge, few statements representing probability errors (6.5% of irrational statements) were made in the think aloud task, and this type of error did not correlate in the expected direction.

The use of two comparison tasks was aimed at reducing biases in the results that might occur when using self-report only (i.e., common method variance), in which case agreement of findings across measures could be due to the use of similar methods rather than actual similarity. Comparisons were also meant to corroborate GCI scores in this study. The comparison tasks were associated with limitations regarding ecological validity and response biases, however, methods of identifying cognitive distortions are generally very limited. We did not find a significant relationship between the three measures of cognitive distortions in the pilot sample, but inspection of the data revealed that the correlations were in the expected direction. This could suggest that the methods are tapping into different constructs, but this is most likely an artifact of the small sample size and associated restricted range. The presence of errors on the decisions tasks suggests that there was some degree of distortion around probability.

We improved on the lottery modification procedure used by Ladouceur, Dube, Giroux, Legendre and Gaudet (1995) in an effort to minimize expectancy effects and

make errors easier to interpret. In Ladouceur and colleagues' study, participants were told that they could make as many changes to as many of the tickets as they wished, and asked what changes they would make. Such instructions could have led participants to believe they were expected to make a change, even if they did not believe a change would help their chances. Instead, we asked participants *whether* a change would improve their chances of winning, and if so, to make suggestions. Thus, by allowing participants to say that no changes would improve their chances, participants would be able to demonstrate a good understanding of probability.

The think aloud task in the pilot study resulted in a lower rate of distorted verbalizations than identified by other researchers (35% compared with 70% in the study by Ladouceur, Gaboury, Bujold, Lachance, & Tremblay, 1991). Further, ecological validity of the think aloud task for assessing cognitive distortions may have been limited in the pilot phase of this project. The laboratory was designed to resemble typical bars that house VLTs. The walls were painted dark green, liquor ads were placed on the walls, lights were dimmed and the radio was playing. The VLT machine and chair were identical to those found in Calgary establishments, as was the choice of games. However, some participants had difficulty generating verbalizations. The main problem appeared to be that the task did not seem realistic enough for them to become fully engaged into gambling as they would in a lounge. Feeling bored or uninterested and not being able to smoke were mentioned by some participants. The main reasons cited by participants were that they were not using their own money and could not change machines as they normally would.

The validity of the think aloud task has been questioned by other researchers. Though some have found support for the think aloud paradigm (Ladouceur, Gaboury, Bujold, Lachance, & Tremblay, 1991), other researchers have found otherwise (e.g., Delfabbro & Winefield, 2000; Griffiths, 1994). The difference might lie in the instructions given to participants. The instructions used in this study (see Appendix E) did not specify the types of thoughts that participants should verbalize. However, instructions used by Ladouceur and colleagues (1991) prompted participants to verbalize hunches, wild guesses, and strategies they used, which may have primed participants to verbalize more distorted types of thoughts. In the present study, participants reported having considerable difficulty verbalizing their thoughts or speaking continuously. Two other researchers specifically reported that their participants had difficulty verbalizing their thoughts during the think aloud task (Coventry & Norman, 1998; Delfabbro & Winefield, 2000). Ladouceur and colleagues (1991) investigated the validity of laboratory gambling tasks and concluded that the key element to establishing ecologically valid results was that participants should be gambling with their own money.

The generalizability of laboratory findings to real gambling situations has been questioned (Anderson & Brown, 1984), particularly concerning the variables of arousal. That is, cognitive distortions have been shown to increase during increased arousal during gambling, and if participants were not sufficiently aroused, it is possible that the think aloud method was unable to elicit the distortions that might be present during participants' usual gambling. Previous research investigating arousal in gambling questioned the ecological validity of laboratory studies. For example, Diskin and Hodgins (submitted) compared arousal during VLT gambling in a community sample of problem

and non-problem gamblers in laboratory and naturalistic settings. The investigators found significantly lower levels of arousal, using skin conductance and heart rate measures, in the laboratory setting than in gambling venues. In the present study, some participants in the pilot study stated the games were boring or that VLT gambling with credits provided in the lab was not as exciting as it would have been at the casino with their own money. As physiological measures were not taken, we cannot be sure of the participants' level of arousal during the laboratory gambling task. Possible limited arousal and participants' subjective difficulty with the task makes the value of the think aloud task questionable as a means of providing convergent validity to the GCI scores.

This is a pilot study to prepare for clinical validation studies, where a larger sample of problem and pathological gamblers will complete the scale and more information about the validity and psychometric properties of the GCI will be gathered. The results of the pilot phase suggest that the think aloud task could succeed in eliciting cognitive distortions, as 35% of the total verbalizations provided by the participants were irrational. Moreover, the significant correlations between gambling severity and irrational verbalizations (representing the constructs of *Magical Thinking / Luck* and *Illusion of Control / Skill*), support the idea that more distorted thinking should be associated with increased gambling severity. Participants' comments about their difficulty verbalizing their thoughts and lack of excitement during the task suggest that verbalizations might not be fully representative of their thoughts during actual gambling, which could limit the ecological validity of the think aloud paradigm. Future use of the think aloud task should involve participants gambling with their own money to maximize ecological validity.

GENERAL DISCUSSION

This research was intended to develop a scale, the Gambling Cognitions Inventory (GCI) to identify cognitive distortions about gambling for the purpose of furthering theoretical knowledge and for ultimate use as a treatment tool. The latter function of the GCI would be to aid in identify problematic cognitions in order to direct therapy strategies, as well as to serve as a measure of therapeutic progress and outcome. Three phases of scale construction research were undertaken. In the first phase, theory and empirical research guided item development. The theoretical basis for the GCI was Sharpe and Tarrier's (1993) model of problem gambling and Sharpe's (2002) reformulated theoretical model, which state that distorted cognitions are related to specific gambling experiences and are automatic processes. The empirical basis for the scale was derived from experimental research aimed at eliciting cognitive distortions (e.g., Gaboury & Ladouceur, 1989; Griffiths, 1994; Holtgraves & Skeel, 1992; Ladouceur, Dube, Giroux, Legendre, & Gaudet, 1995) and from a major review of the cognitive psychopathology of problem gambling (Toneatto, 1999). Scale items represented four categories of distortion termed *Information Processing Biases*, *Probability Errors*, *Illusion of Control / Skill*, and *Magical Thinking / Luck.*

Scale design was aimed at maximizing the reliability of the GCI. First, possible sources of response bias were identified and efforts were made to minimize their effects. For example, writing items in cognitive terms could prime respondents' cognitions and make them more accessible for self-report; a four point Likert-type response format would avoid a central response tendency; and reverse scored items would minimize positive or negative response biases.

Content and readability were evaluated by a focus group, which led to items being worded in cognitive terms, and yielded an acceptable readability level of grade 7.9. In the second phase of research, the GCI was administered to 232 university students (13% of the sample were problem or probable pathological gamblers). Phase two resulted in reduction of the scale to forty items based on statistical and theoretical considerations. A pilot study was then conducted, in which the GCI was administered to thirteen problem and pathological gamblers and compared to their performance on two other tasks designed to elicit cognitive distortions. It is difficult to draw conclusions about performance on the GCI in the pilot sample due to the small sample size, but correlations appear to be in the expected direction. The pilot phase also aimed to evaluate the utility of the think aloud task in eliciting distorted thinking. On average, about 35% of participants' verbalizations were irrational, predominantly in the category of magical thinking / luck. Few distortions representing probability errors were elicited. Because the sample reported marked difficulty generating verbalizations, and limited engagement in the gambling tasks, it was concluded that the think aloud task might not elicit a representative sample of distorted thoughts.

In addition to maximizing reliability at the scale design stage, maximizing construct validity was important during item generation. Items were written to represent four broad categories of distortions. Due to differences in assessment methods and labeling of distortions across studies, it was difficult to account for all individual variations of the more general distorted idea when writing items. Prior scale construction research has not specifically identified the four categories incorporated into the GCI on a single measure. However, past scale construction research has supported the existence of

two of the categories, illusion of control and beliefs about luck (e.g., Steenbergh et al., 2002). There was also some empirical basis for anticipating that probability errors would be relevant, as probability errors have been identified in survey and empirical studies (Ladouceur et al., 1995; Wiebe, 2001). Information processing errors have been identified using think aloud tasks (e.g., misinterpretation of losses as near misses in Delfabbro & Winefield, 2000), but to date, no self-report scale has assessed information processing biases specifically. However, it was unclear what range of distortions were initially included, and then rejected by other scale construction efforts, and therefore this project was considered exploratory rather than confirmatory.

Construct validity was pursued throughout the scale construction process by attending to the empirical findings and theoretical literature; by assessing content and face validity using a focus group familiar with pathological gambling; and by using comparison tasks for cognitive distortions in the pilot phase. However, there are likely individual differences in the interpretation of the constructs assessed, and self-report might not be the most valid measure of these distortions. For example, the interpretation of the concept of luck may have been problematic with the GCI. That is, whether participants were referring to good luck or bad luck was not specified in the GCI. Beliefs in luck could lead to behaviours aimed either at avoiding bad luck or seeking to create or attain good luck. Further, engaging in such behaviours might represent believing losses are due to bad luck (an information processing error) or magical beliefs about how luck can be increased (magical thinking). Similarly, items representing illusion of control could intuitively overlap with beliefs about luck. That is, individuals might not believe they have control over the outcome of the gamble per se, but believe they are able to

control their luck. The gambling behaviour resulting from these beliefs could very well be similar, thus behavioural means of differentiating the distortions may not be fruitful, and self-report items written in behavioural terms might similarly not yield clear information. A strength of the GCI is that items were written in cognitive terms, which could potentially eliminate the above source of error. However, individual differences in the interpretation of luck could still lead to problems in evaluating performance.

Limitations of this Research

Some statistical and methodological limitations were identified in this research. A major limitation was statistical power, as difficulties were encountered in obtaining a sufficient number of phase two participants. A bonus credit system was used to recruit undergraduate psychology students, and fewer than the anticipated number of students volunteered to participate. This was problematic because ninety-six scale items were initially written. The number of items was large because the distortions that might be the most important in problem gambling have not been established in prior research. As the number of participants needed to attain a ratio of ten per item would be 960, it was not feasible to attempt to recruit a sample of this magnitude. A rule of thumb of 300 participants was used as a rough guideline and 232 participants were collected. As a result, it was not appropriate to perform exploratory factor analysis on the entire item pool, which would have provided a stronger test of our assumption that cognitive distortions comprise four main categories. At the outset of the research, items generated represented four categories of cognitive distortions. Eighteen items represented errors in estimating probability, 20 for information processing errors, 22 for illusion of control, and 36 representing magical thinking. The groups of items belonging to these categories

were treated as separate scales and each subjected to principal component analysis. Though each analysis supported a large first component, the variance accounted for by those components ranged from 28% to 42%, suggesting that the structure of each sub-category was not simple.

A second limitation identified in this research is ecological validity of the phase two. The university student sample was young (mean age 22.5 years) and generally a well functioning population, with only 13% reporting problem or pathological levels of gambling behaviour. The use of a university undergraduate population limited the generalizability of the information to older individuals and to those with more severe gambling problems. Moreover, since many gamblers have co-morbid psychopathology (APA, 2000; Crockford & el Guebaly, 1998), their distortions might differ markedly from the predominantly healthy student sample. In phase two, only a minority of students reported having or questioned having a problem with cigarettes, alcohol, or other drugs, (17.3%, 17.3%, and 9% respectively); and one person reported a history of bipolar affective disorder. Diagnostic information about other problems commonly associated with gambling (e.g., depression, anxiety, or other impulse control disorders; Crockford & el Guebaly, 1998) was not collected.

The pilot study sample afforded stronger ecological validity for the future uses of the GCI in clinical research and practice. The sample for the pilot validation study was expected to produce a different pattern of performance on the GCI than did the student sample, but the small sample size precludes conclusions as yet. Inspection of pilot testing data suggests that the problem and pathological gamblers scored in the direction of more

distortion on the GCI compared to the student sample, but a larger sample size will be needed to confirm the presence of such an effect.

Low arousal during VLT gambling may have been a limitation for the think aloud task used for the pilot study. There is some evidence in the literature that cognitive distortions increase during times of arousal, i.e., during gambling (Anderson & Brown, 1989). Lack of similar arousal during assessment, whether by self-report, think-aloud, or decision making tasks, might make it difficult to elicit a representative sample of the individual's cognitive distortions. In the pilot study, several individuals reported feeling bored or not liking the game, suggesting that lack of arousal may have posed a problem in the study.

Limitations were associated with the design of the GCI. At the item generation stage, too few items were reverse-scored, and at the end of phase one, only 11% were reverse items, rather an ideal amount of close to 50% (Clark & Watson, 1998; Dawis, 1998). Thus, the presence of a positive or negative response tendency was possible. At the construct level, the accessibility of cognitive distortions to conscious awareness for the purpose of self-report might be low. Researchers in gambling agree that cognitive distortions function at a subconscious level (e.g., Sharpe, 2002; Sharpe & Tarrier, 1993). Using self-report to assess an unconscious or automatic process may therefore be limited by individuals' lack of insight about their cognitions. That is, participants may have had limited awareness of their underlying beliefs, and responded to questionnaire items at a superficial level. In efforts to avoid the problem of limited insight, scale items were worded as thoughts and beliefs and opinions, rather than asking whether they had any beliefs about gambling that they knew were not objectively true.

It is possible that some gamblers do not lack insight to their cognitive distortions. That is, individuals might be aware that their thinking is distorted and continue to use strategies or engage in rituals during gambling out of habit, despite knowing that their actions will not actually help them win. Moreover, there may be a discrepancy between individuals' self-reported beliefs and their actual behaviour during gambling. That is, individuals might report not believing in superstitions, but act as if they do while gambling. Thus, in clinical application of the GCI, awareness that insight to distortion might not correspond to actual behaviour is important.

Directions for Future Research

Clearly, the next step in scale construction research will be clinical validation. In the pilot phase, the participants difficulty in generating verbalizations and reports of feeling bored suggested that use of a think aloud task with researchers monetary credits was a limited tool for eliciting distorted thinking. However, research suggests that the ecological validity of the task may be improved by having participants gamble with their own money (Ladouceur et al., 1991). However, 35% of participants' verbalizations were distorted, suggesting that the task was able to elicit some distorted thinking. Correlations between the three measures of distorted thinking (the GCI, think aloud, and gambling decisions tasks), though not significant, were in the expected direction. Thus, it is conceivable that with the increased statistical power of a larger clinical sample of gamblers, meaningful relationships will be found.

Clinical validation is an important future research priority. Further evaluation of the GCI with problem and pathological gamblers will be the key next step in this scale construction process. A sufficient number of disordered gamblers should be recruited, so

that exploratory and confirmatory factor analyses could be used to support the four categories of distortion represented on the sub-scales of the GCI. Information on the concurrent validity of the GCI will also be sought. When a sufficient number of clinical participants are recruited, a regression analyses can be used to determine the ability of gambling severity (SOGS, NODS, or CPGI scores) to predict cognitive distortion.

A research question of interest would be determining the degree of discrepancy between individual's conscious awareness of cognitive distortions and their actual behaviour. The factors that influence the role of cognitive distortions in actual gambling behaviour would be valuable knowledge from the standpoint of treatment, as restructuring and challenging of cognitive distortions is a main therapeutic strategy (e.g., Ladouceur, Boisvert, & Dumont, 1994; Ladouceur et al., 2001; Sharpe, 2002; Sylvain, Ladouceur, and Boisvert, 1997; Toneatto & Sobell, 1990).

Factors affecting behaviour in general, such as attitudes, have been studied in social psychology. Cognitions, including those that are distorted, are a major component of attitudes. Research supports greater reliability and validity of direct methods to measure attitudes (i.e., using self-report) compared with indirect methods such as behavioural observation, supporting the inclusion of items measuring attitudes on the GCI. Research has consistently demonstrated that attitudes do not strongly correspond with behaviour. In fact, in a review of 33 studies, Wicker (1969) found that on average, the correlations were modest ($r \leq 0.30$). Corney and Cummings (1987) extended a social psychological theory about attitudes and behaviour (Fishbein's 1979 Theory of Reasoned action) to explain gambling. The authors proposed that gambling attitudes, as well as a number of other cognitive factors (e.g., locus of control, attributions, and information

processing biases) influence gambling behaviour. Whether gambling attitudes and cognitive distortions are distinct constructs or two aspects of a broader cognitive construct would be of interest in future research.

Comparisons among sub-groups of gamblers would also yield potentially important clinical information. Some research indicates no gender differences in overall cognitive distortion (Coventry & Norman, 1997). However, Kelly, Skinner, Weibe, Turner, and Noonan (2001) found gender differences in a specific area of distortion, knowledge of probability principles. Unfortunately, many studies did not report on gender differences (e.g., Ladouceur and colleagues, 1984, 1988, 1995; Chau & Phillips, 1995; Holtgraves & Skeel, 1992; Griffiths, 1994), making it unclear whether differences exist. Comparisons of male and female pathological gamblers on distortion on the GCI (overall distortion and for the sub-scales) could be enlightening, particularly since males consistently show higher rates of disordered gambling (Shaffer et al., 1997).

As the aim of this research is to develop a scale with good clinical utility, the usefulness of the scale as a progress and outcome measure for cognitive treatment for gambling problems should be assessed. The ability of the GCI to predict relapse after treatment should be investigated using longitudinal research designs (Kazdin, 2003). Further, information gathered about the predictive validity of the scale and its relevance to the cognitive distortions most problematic in gambling would lead to the potential use of the scale to design treatment and enhance the efficacy of cognitive therapy for gambling problems. Once the psychometric properties of the GCI are established, future research should focus on developing normative data for representative sub-groups of

gamblers, such as disordered gamblers with and without co-morbid psychopathology; gamblers of different educational levels; and age, gender, and ethnicity differences.

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Appendix A

96-Item Gambling Cognitions Inventory Generated in Phase One

1. A series of numbers such as 23-4-12-38 is more likely to win in a lottery than a series of numbers such as 1-2-3-4
2. After losing, people should go back to win back the money they lost
3. After losing, I know I can win back the money I lost
4. Although I am upset when I lose, I use it as a learning opportunity to improve my gambling
5. Chance has very little to do with whether I will win at gambling
6. Changing slot machines immediately after a win increases chances of winning, as the machine will not be due to win for some time.
7. Gambling is a good way to make a living
8. Gambling, if done well, is a good way to make money
9. It is best to play your lucky numbers in roulette or the lottery
10. It is a good strategy to play the same numbers in the lottery
11. I am a very skilled gambler
12. I am certain that my time for a big win is soon
13. People can be expert roulette or slot players
14. I am skilled at calculating my odds at winning
15. I am superstitious when it comes to gambling
16. I am surprised at how much money I seem to have spent gambling
17. I am very confident about my gambling ability
18. I analyze my wins to give me strategies to make me a better gambler
19. I should avoid certain places that I know are unlucky for me to gamble
20. People should avoid drinking alcohol while gambling
21. People should avoid gambling when they feel unlucky
22. I believe luck is important for gambling
23. I believe losses are a punishment for things I've done wrong
24. I believe wins are rewards for being a good person
25. I would buy lottery tickets from a lucky store
26. Calling out to my horse would help him or her win the race

27. I can feel it when I'm going to lose
28. I can sense when I am going to win
29. I can stay ahead or keep even by winning back money I have lost
30. I can tell when I am lucky or I am having a lucky day, and that is a good day to gamble
31. *Concentrating very hard on winning will help me win
32. I do not spend more time gambling than I intend to
33. I do not spend more money gambling than I intend to
34. I wouldn't like to leave my machine at the casino for fear that it would win while I am away
35. I expect to lose money when I go to the casino
36. When I gamble, I know my chances of winning are extremely low
37. I get mad at the machine or cards when they make me lose
38. *I go with my feelings when I gamble
39. I have a good understanding of probability
40. I have a lucky seat at the casino or bingo hall when I gamble
41. * When I gamble, I keep track of how much money I have spent so far
42. I know some of my beliefs about gambling may not be completely true, but I can't ignore them
43. *It is good to look for special signs that might help a person win
44. I lose because I am having a bad or unlucky day
45. Pulling the slot machine lever slowly will increase my chance of winning
46. I lose because the probability of winning is extremely low
47. I need to keep a positive attitude to help me win at gambling
48. I often have near wins when I gamble
49. I only gamble on lucky days of the week
50. Praying will improve my chances of winning
51. I lose because I am not good at gambling
52. I rarely lose at gambling
53. *Reading my horoscope will tell me whether I should gamble today
54. *Relying on my intuition will help me win
55. Repeating certain phrases or thoughts to myself will give me good luck
56. Rubbing or clapping my hands during the game increases my chance of winning

57. I seem to win all the time
58. I sometimes know it is a lucky day
59. People should take advantage of times when they have good luck, and gamble more
60. *I tell myself I'm losing because of bad luck
61. *I tell myself losing is my fault
62. It is best to try not to dwell on my losses and focus on my wins
63. I try to associate with people who win at gambling, who I think are lucky
64. *I try to figure out why I lost
65. *A winning attitude will improve my chances in gambling
66. I will be luckier if I place myself at a machine near someone who is winning
67. *I am able to predict whether I'll win or lose
68. *If I use special rituals, I can avoid bad luck
69. I will get better at gambling with practice
70. If I don't have good connection with the slot machine or VLT, I'm more likely to lose
71. If I forget a certain special item at home, I wouldn't be as lucky while gambling
72. If I have negative thoughts, it contributes to my bad luck and losses
73. If I lose at gambling, it is because I was unlucky, not because I am unskilled
74. The more I lose, the closer I am to winning
75. If you are having a losing streak, you should keep gambling
76. If you know what you are doing, you can make a living from gambling
77. In a lottery, all numbers have the same chance of winning.
78. In roulette, a good strategy is to bet on numbers (or suits or colours) that have not come up recently, as they are due to win.
79. It is easier to remember the times that I won than when I lost
80. Luck can be contagious
81. Luck has nothing to do with gambling
82. Skill and chance are equally as important in determining whether I will win
83. Some machines like to pay out more than others
84. Some people are just born lucky at gambling
85. Talking to my machine will help me win
86. Staying at the same machine increases my chances of winning

87. The more skilled at gambling I become, the more money I expect to win
88. There are certain strategies that can help people win on a slot machine
89. There are things I can do to help me do better at VLT/slots/roulette
90. There is no reason for winning; it is completely random
91. When I look back at my gambling, I am surprised by the number of times I lost
92. When I win at gambling, I know that it is just a fluke
93. *When I'm losing I try even harder to win
94. You have a better chance of becoming rich by gambling than by working
95. You must work hard at gambling to be able to do well
96. You should avoid playing a VLT that has recently paid out

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* = items adapted from other scales

Appendix B

SOUTH OAKS GAMBLING SCREEN (SOGS)

The following are 20 questions about your gambling in the **last year**.

1. In the past year, when you participate in the gambling activities we have discussed, how often do you go back another day to win back money you lost?

   Never / Sometimes (less than half the time) / Most of the time / Every time

2. In the past year have you claimed to be winning money from your gambling activities when in fact you lost?

   Yes / No

3. In the past year did you spend more time or money gambling than you intended?

   Yes / No

4. In the past year have people criticized your gambling?

   Yes / No

5. In the past year have you felt guilty about the way you gamble or about what happens when you gamble?

   Yes / No

6. In the past year have you felt that you would like to stop gambling, but didn't think you could?

   Yes / No

7. In the past year have you hidden betting slips, lottery tickets, gambling money or other signs of gambling from your spouse or partner, children, or other important people in your life?

   Yes / No

8. In the past year, have you argued with people you live with over how you handle money?

   Yes / No *(If "No", go to Question 9)*

   If 'yes' to question 8: Have these arguments ever centered on your gambling?

   Yes / No

9. In the past year have you missed time from work or school due to gambling?

   Yes / No

10. In the past year, have you borrowed from someone and not paid them back as a result of your gambling?

    Yes / No

11. In the past year, have you borrowed from household money to finance gambling?

    Yes / No

12. In the past year, have you ever borrowed money from your spouse or partner to finance gambling?

    Yes / No

13. In the past year, have you borrowed from other relatives or in-laws to finance gambling?

    Yes / No

14. In the past year, have you received loans from banks, loan companies, or credit unions for gambling or to pay gambling debts?

    Yes / No

15. In the past year, have you made cash withdrawals on credit cards such as VISA or MasterCard to get money to gamble or to pay gambling debts? (not including ATM cards)

    Yes / No

16. In the past year, have you received loans from loan sharks to gamble or to pay gambling debts?

    Yes / No

17. In the past year, have you ever cashed in stocks, bonds, or other securities to finance gambling?

    Yes / No

18. In the past year, have you sold personal or family property to gamble or pay gambling debts?

    Yes / No

19. In the past year, have you borrowed money from your chequing account by writing cheques that get bounced to get money for gambling or to pay gambling debts?

    Yes / No

20. In the past year, have you felt that you had a problem with betting money or gambling?

    Yes / No

Appendix C

NORC DSM-IV SCREEN FOR GAMBLING PROBLEMS (NODS)

The following are 17 questions about your gambling habits over the past year and over your lifetime. Each question has a "Yes" or 'No" answer.

1. Has there been any period lasting 2 weeks or longer when you spent a lot of time thinking about your gambling experiences or planning future gambling ventures or bets?

   Past Year: Yes / No

   Lifetime (Ever in your life): Yes / No

2. Have there been periods lasting 2 weeks or longer when you spent a lot of time thinking about ways of getting money to gamble with?

   Past Year: Yes / No

   Lifetime: Yes / No

3. Have there been periods when you needed to gamble with increasing amounts of money or with larger bets than before in order to get the same feelings of excitement?

   Past Year: Yes / No

   Lifetime: Yes / No

4. Have you tried to stop, cut down, or control your gambling?

   Past Year: Yes / No

   Lifetime: Yes / No

5. On one or more of the times when you tried to stop, cut down or control your gambling, were you restless or irritable?

   Past Year: Yes / No

   Lifetime: Yes / No

6. Have you tried but not succeeded in stopping, cutting down or controlling your gambling?

   Past Year: Yes / No

   Lifetime: Yes / No

7. In a year, has this happened 3 or more times?

   Past Year: Yes / No

   Lifetime: Yes / No

8. Have you gambled as a way to escape from personal problems?

Past Year: Yes / No

Lifetime: Yes / No

9. Have you ever gambled to relieve uncomfortable feelings such as guilt, anxiety, helplessness or depression?

   Past Year: Yes / No

   Lifetime: Yes / No

10. Has there ever been a period when, if you lost money gambling on one day, you would often return on another day to get even?

    Past Year: Yes / No

    Lifetime: Yes / No

11. Have you lied to family members, friends, or others about how much you gamble or how much money you lost on gambling?

    Past Year: Yes / No

    Lifetime: Yes / No

12. Has this happened 3 times or more in a year?

    Past Year: Yes / No

    Lifetime: Yes / No

13. Have you written a bad check or taken money that didn't belong to you from family members or anyone else in order to pay for your gambling?

    Past Year: Yes / No

    Lifetime: Yes / No

14. Has your gambling caused serious or repeated problems in your relationships with any of your family members or friends?

    Past Year: Yes / No

    Lifetime: Yes / No

15. ANSWER ONLY IF YOU ARE IN SCHOOL: Has your gambling caused you any problems in school, such as missing classes or days of school or getting worse grades?

    Past Year: Yes / No

    Lifetime: Yes / No

16. Has your gambling caused you to lose a job, have trouble with your job, or miss out on a important job or career opportunity?

    Past Year: Yes / No

    Lifetime: Yes / No

17. Have you needed to ask family members or anyone else to loan you money or otherwise bail you out of a desperate money situation that was largely caused by your gambling?

    Past Year: Yes / No

    Lifetime: Yes / No

Appendix D

CANADIAN PROBLEM GAMBLING INDEX (CPGI)

Think about the **last 12 months**. Circle the best answer for each question.

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

Never

Sometimes

Most of the time

Almost always

Don't know

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

Never

Sometimes

Most of the time

Almost always

Don't know

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

Never

Sometimes

Most of the time

Almost always

Don't know

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

Never

Sometimes

Most of the time

Almost always

Don't know

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

Never

Sometimes

Most of the time

Almost always

Don't know

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

Never

Sometimes

Most of the time

Almost always

Don't know

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

Never

Sometimes

Most of the time

Almost always

Don't know

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

Never

Sometimes

Most of the time

Almost always

Don't know

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

Never

Sometimes

Most of the time

Almost always

Don't know

10. Have you lied to family members or others to hide your gambling?

    Yes / No

11. Have you bet or spent more money than you wanted to on gambling?

    Yes / No

12. Have you wanted to stop betting money or gambling, but didn't think that you could?

    Yes / No

Appendix E

THINK ALOUD TASK

Introduction:

For this task, you will be asked to verbalize your thoughts while gambling on a Video Lottery Terminal (VLT). You will be given 5 minutes to practice this process, after which you will engage in a 10-15 minute session. I will audiotape what you say during the session.

Instructions:

While you play the VLT, please say all thoughts that come to mind out loud:

(1) Say *everything* that comes to mind, without censoring anything, even if the thoughts seem irrelevant. That is, there are no right or wrong comments; just speak freely.

(2) Talk as continuously as possible.

(3) Speak clearly; do not worry about grammar or wording.

(4) Do not justify or analyze your thoughts during the procedure.

Do you have any questions about what to do?

Questions following the procedure:

1. Did the simulated VLT represent your usual interaction with VLTs in bars or casinos?
2. How easy did you find it to verbalize your thoughts while playing?
3. Do you think that the process of saying your thoughts out loud affected your gambling behaviour?

Appendix F

Gambling Decisions Task: Lottery Decisions

The following are numbers that have been drawn for the Lotto 6/49:

a. 1 2 3 47 48 49

b. 4 16 22 36 40 48

c. 2 10 11 27 34 41

d. 5 10 15 20 25 30

e. 6 7 8 9 10 11

Please answer the following questions:

1. Which of the lotto numbers above do you think has the best chance of winning the draw?
   Circle: a b c d e none

2. Which of the lotto numbers above do you think has the lowest chance of winning?

   Circle: a b c d e none

3. Can you make changes to the lottery numbers so that the chances of winning are better? If yes, write the changes on the lines next to the numbers.

   a. 2 3 47 48 49 .....Changes: no / yes: _____

   b. 16 22 36 40 48.....Changes: no / yes: _____

   c. 10 11 27 34 41.....Changes: no / yes: _____

   d. 10 15 20 25 30.....Changes: no / yes: _____

   e. 6 7 8 9 10 11.....Changes: no / yes: _____

Appendix G

Gambling Decisions Task: True / False Questions

True or false:

1. You have a better chance of becoming rich by gambling than by working hard. true / false
2. In a lottery, all numbers have the same chance of winning. true / false
3. Staying at the same slot machine will not improve your chances of winning. true / false
4. A series of numbers such as 23 – 4 – 12 - 38 is more likely to win in a lottery than a series of numbers such as 1 – 2 – 3 - 4. true / false
5. In roulette, a good strategy is to bet on numbers, suits, or colours that have not come up in recent trials, as they are due to win. true / false
6. If a person has lost 100 times in a row in the lottery, the chances of winning the next draw will be the same true / false
7. Rolling six's with the dice three times in a row is less likely than rolling 4, 5, and 6 over three trials. true / false
8. Changing slot machines immediately after a win increases chances of winning, as the machine will not be due to win for some time. true / false
9. If a person won 5 hands of blackjack in a row, they would have a lower chance of winning the next hand. true / false
10. There is nothing a person can do that will change his or her chances at winning on a slot machine true / false

Appendix H: 40-Item Version of the Gambling Cognitions Inventory

Gambling Cognitions Inventory

Responses: Strongly Agree, Somewhat Agree, Somewhat Disagree, Strongly Disagree

1. After losing, people should go back to win back the money they lost
2. I am certain that my time for a big win is soon
3. Although I am upset when I lose, I use it as a learning opportunity to improve my gambling
4. I am a very skilled gambler
5. I can sense when I am going to win
6. I am surprised at how much money I seem to have spent gambling
7. I am very confident about my gambling ability
8. I can analyze my wins to give me strategies to make me a better gambler
9. I lose because the probability of winning is extremely low
10. After losing, I know I can win back the money I lost
11. I can stay ahead or keep even by winning back money I have lost
12. I can tell when I am lucky or I am having a lucky day, and that is a good day to gamble
13. When I gamble, I know my chances of winning are extremely low
14. *It is good to look for special signs that might help a person win
15. I lose because I am having a bad or unlucky day
16. I need to keep a positive attitude to help me win at gambling
17. Repeating certain phrases or thoughts to myself will give me good luck
18. People should take advantage of times when they have good luck, and gamble more
19. *I tell myself losing is my fault

20. I try not to dwell on my losses and focus on my wins
21. I try to associate with people who win at gambling, who I think are lucky
22. *I try to figure out why I lost
23. *A winning attitude will improve my chances in gambling
24. *If I use special rituals, I can avoid bad luck
25. I will get better at gambling with practice
26. If I don't have good connection with the slot machine or VLT, I'm more likely to lose
27. If I forget a certain special item at home, I wouldn't be as lucky while gambling
28. If I have negative thoughts, it contributes to my bad luck and losses
29. The more I lose, the closer I am to winning
30. If you are having a losing streak, you should keep gambling
31. In roulette, a good strategy is to bet on numbers (or suits or colours) that have not come up recently, as they are due to win
32. Staying at the same machine increases my chances of winning
33. The more skilled at gambling I become, the more money I expect to win
34. There are certain strategies that can help people win on a slot machine
35. There is no reason for winning; it is completely random
36. When I look back at my gambling, I am surprised by the number of times I lost
37. When I win at gambling, I know that it is just a fluke
38. You have a better chance of becoming rich by gambling than by working
39. You must work hard at gambling to be able to do well
40. In a lottery, all numbers have the same chance of winning

* = items adapted from other scales