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Gambling Risk Perception and Decision Making

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Thesis submitted in fulfilment of the requirements for the degree of Doctor of Clinical
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LIST OF ABBREVIATIONS

- AGFI: Adjusted Goodness of Fit Index
- APA: American Psychiatric Association
- ATGS: Attitude Towards Gambling Scale
- CAGES: Chinese Adolescent Gambling Expectancy Scale
- CBT: Cognitive Behavioural Therapy
- CFA: Confirmatory Factor Analysis
- CFI: Comparative Fit Index
- CI: Confidence Interval
- CPGI: Canadian Problem Gambling Index
- DBC: Gamblers' Beliefs about Chance Inventory
- DBS: Drake Beliefs Scale
- DF: degrees of freedom
- DOSPERT: Domain Specific Risk Taking Scale
- DSM: Diagnostic and Statistical Manual
- EFA: Exploratory Factor Analysis
- EGAQ: Effects of Gambling Advertising Questionnaire
- EGM: Electronic Gaming Machine
- GABA: Gamma-Amino Butyric Acid
- GABS: Gambling Attitudes and Beliefs Scale
- GRCS: Gambling Related Cognitions Scale
- GEQ: Gambling Expectancy Questionnaire

GFI: Goodness of Fit Index

GMAB: Gambling Motives, Attitudes and Behaviour

GRDQ: Gambling Risk Decisions Questionnaire

GT: Grounded Theory

MM: Mental Models

MSA: Measure of Sampling Adequacy

PCA: Principal Components Analysis

PGSI: Problem Gambling Severity Index

RIA: Relative Importance Analysis

RMSEA: Root-Mean-Square Error of Approximation

SD: Standard Deviation

SOGS: South Oaks Gambling Screen

URL: Uniform Resource Locator

VGS: Victorian Gambling Screen

Certification by candidate

This thesis is submitted to the University of Sydney in fulfilment of the requirements for the Degree of Doctor of Clinical Psychology / Doctor of Philosophy. The work presented in this thesis is my own and to the best of my knowledge original, except where acknowledged in the text. The work contained in this thesis has not been submitted for a higher degree to any other university or institution. All of the material contained in this thesis was carried out during my PhD candidature at the University of Sydney under the supervision of Alex Blaszczyński and Paul Rhodes.

Michael Spurrier

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Abstract

Cognitive and biopsychological research has identified a significant relationship between perception, decision making and the negative consequences associated with sustained gambling. Drug and alcohol research suggests that how individuals navigate decisions involving motivating but risky activities involves several important, distinct but interrelated aspects of cognition. Nevertheless, risk perception and decision making has received little attention in the gambling literature. The aim of the current thesis therefore was to investigate risk perception in gambling, and to develop a model of gambling decision making mindful of risk perception concepts.

The project applied the Mental Models methodology – a common approach to evaluating decision making in hazardous scenarios. First, risks associated with a specified hazard are identified, along with factors controlling exposure to risk, then user concepts of risk are measured to identify gaps or errors in need of intervention.

The thesis included: a literature review, a qualitative study evaluating expert opinions regarding gambling risk decision making, a second qualitative study evaluating lay gambler mental models of risk, and a quantitative evaluation of risk perception and decision making concepts via a self-report questionnaire. Data from all phases of the project were used to develop an assessment tool and theoretical model of gambling risk decision making.

It was anticipated that understanding the processes by which risk perception predisposes an individual to maintain gambling despite adverse consequences would act as an invaluable guide for preventative educational campaigns, clinical treatment, and social policy interventions.

Study one involved systematic review of the literature on risk perception in gambling. The review aimed to identify evidence about perception of risk in gambling, and to examine the relationship between risk perceptions and behaviour. Sixteen studies met inclusion criteria, providing evidence that disordered gamblers hold both more optimistic overall perceptions of risk, and a mixture of more positive and more negative specific outcome expectations. Further, evidence suggested a range of contextual and individual differences influence the relationship between risk perception and decision-making, such as differences in insight, perception of the significance or impact of outcomes, and sensitivity to decision making cues.

Study two aimed to further explore the role played by risk perception and risk decision-making in gambling behaviour and Gambling Disorder. The study recruited eleven gambling expert clinicians and researchers, completing semi-structured interviews based in Mental Models and Grounded Theory methodologies. Expert interview data was used to construct a comprehensive expert mental model 'map' detailing risk-perception, and related factors contributing to harmful or safe gambling. Findings indicated experts considered idiosyncratic beliefs among disordered gamblers to result in: underestimation of risk and loss, insufficient prioritization of needs, and underutilization of risk management strategies. In addition, experts identified a number of factors that influenced the way that individuals used risk data, including: (1) reinforcement and learning experiences; (2) sensitivity to mental states and environmental triggers to gambling; (3) responses to perceived consequences leading to rationalization or biased interpretation of future events; (4) and socio-cultural and biological individual differences influencing instantiation of beliefs and cognitive processes affecting decision making.

Study three aimed to expand and test earlier findings among a lay gambler sample. Fifteen regular lay gamblers completed semi-structured interviews according to Mental Models and Grounded Theory methodologies. Gambler interview data was compared against the expert 'map' of risk-perception developed in study two, to identify comparative gaps or differences associated with harmful or safe gambling. Gambler accounts supported the presence of expert conceptual constructs, and to some degree the role of risk perception in vulnerability to harm and disordered gambling. Overall, disordered gambling appeared heavily influenced by relative underestimation of risk and overvaluation of gambling, based on explicit and implicit analysis, and deliberate, innate, contextual, and learned processing evaluations and biases.

Study four aimed to test gambling decision making, using data to develop a self-report questionnaire and model of gambling risk decision making. Data collection and analysis again followed the Mental Models methodology. Questionnaire items targeted important themes and concepts identified in the systematic literature review (study one) and qualitative interview studies (studies two and three). Validity evidence and other data gathered by questionnaires were used to develop a path model of gambling risk decision making. Results indicated gamblers' decision making was influenced by several important factors, with vulnerability to disordered gambling associated with: expectations and interpretations of outcomes and causality; greater sensitivity to contextual cues, processing biases, and urges; inaccurate self-monitoring; and inconsistency in decision making. Gambling decision making predicted a substantial proportion of negative behavioural outcomes, including unique variance and variance shared with gambling involvement. Decision making fully or partially mediated the influence of several well-established gambling risk factors.

Taken together, results of the four studies confirm the importance of relationships between decision making, behaviour, consequences, and disorder, with disorder largely predictable based on several core decision making factors, despite individual variation in clinical presentation.

CHAPTER 1: General introduction

Background

Gambling involves wagering something (usually money) on the outcome of an uncertain event determined by chance (Walker, 1998). By definition, gambling involves engagement with risk, with the potential for harmful outcomes, since wagers may potentially result in loss of stakes. Common commercially available forms of gambling in Australia have typically been designed so that individuals do not win over long term play, except in unusual circumstances (Walker, 1998). As a result, the majority of non-professional gamblers tend to experience net losses over the long term (Arnold, 1978; Stewart, 1989). Individuals therefore leave themselves vulnerable to financial and related harms if they repeatedly engage in gambling without due attention to sustainable investment, or accurate models of causality, probability, and expectancy. Research suggests that a range of individuals in the community are exposed to gambling related monetary loss and related problems (Productivity Commission, 2010). Further, a proportion develop a gambling disorder, characterized by persistent, recurrent maladaptive gambling choices resulting in losses, impairment, and distress (American Psychiatric Association, 2013). For this disordered subgroup of gamblers there appears to be a disconnection between positive expectations (e.g., Toneatto, Blitz-Miller, Calderwood, Dragonetti, & Tsasnos, 1997) and experience of negative outcomes (Productivity Commission, 2010). This disconnection implies risk perception and risky decision making are at the centre of gambling disorder. Despite the obvious significance of risk perception in this process, risk perception is an under-researched area in the gambling literature.

The main objectives of the research in this thesis were to investigate the nature of gambling risk perception, outline the role of risk perception in gambling, and propose a model of gambling that includes concepts of risk perception and risky decision making.

The thesis commences with a summary of existing literature addressing the nature of harmful and disordered gambling (chapter 1), decision making in gambling contributing to disordered gambling (chapter 2), and decision making in risky activities not related to gambling (chapter 3). The thesis then outlines research conducted to address gaps in literature via systematic review of the gambling risk perception literature (chapter 4), followed by three empirical chapters based on qualitative and quantitative methods investigating the role of risk perception in gambling risk decisions and behaviour concluding with a model of gambling decision making (chapter 5-7) and discussion of theoretical and clinical implications of the research findings (chapter 8).

The following sections address the nature and prevalence of potential harms associated with gambling, before examining diagnostic criteria for disordered gambling – concluding that gambling disorder is by definition a disorder of risky decision making, with implications for theoretical models.

Gambling related harm

Gambling is a popular recreational activity in Australia. However, not all gamblers gamble at a benign level. While, presence of environmental stressors and individual characteristics have been shown to increase harmful gambling (e.g., availability of gambling, alcohol dependence) (Hodgins, Schopflocher, Martin, el-Guebaly, Casey, Currie, Smith, &

Williams, 2012; Dussault, Brendgen, Vitaro, Wanner, & Tremblay, 2011), exposure to gambling and its excessive involvement has been shown to contribute to a number of significant psychological and life problems related to: finances, mental or physical wellbeing, relationships, employment, or legal status (Dickerson & O'Connor, 2006; Ministerial Council on Gambling, 2005; Johannson, Grant, Kim, Odlaug, & Gotestam, 2009).

Gambling engagement has been causally linked to a number of signifiers of problematic spending and financial difficulty, including: relative proportion of income spent on gambling (Grant, Kim, Odlaug, Buchanan, & Potenza, 2009), level of personal debt (Tang, Wu, & Tang, 2007), rates of bankruptcy (Breen & Zimmerman, 2002; Grant, Schreiber, Odlaug, & Kim, 2010), and relative property and investment losses (Grant, et al., 2009; Tang, et al., 2007).

Disordered gambling and gambling related problems has also been shown to contribute to problematic health outcomes, increasing strain on health care services (Gerstein, Murphy, Toce, Hoffmann, Palmer, Johnson, Larison, Chuchro, Bard, Engelman, Hill, Buie, Volberg, Harwood, Tucker, Christiansen, Cummings, & Sinclair, 1999). For example, difficulty managing gambling involvement and problems related to gambling contribute to increased risk of a range of physical and psychological health problems, including: stress (Myrseth, Litrère, Støylen, & Pallesen, 2009), depression (Dussault, et al., 2011; Delfabbro & LeCouteur, 2009), anxiety (Tang, et al., 2007, Bakken, Gotestam, Grawe, Wenzel, & Oren, 2009), drug and alcohol issues (Penfold, Hatcher, Sullivan, & Collins, 2006b), self-harm and suicidality (Penfold, et al., 2006a; Rodda & Cowie, 2005; Tang, et al., 2007).

Similarly, problem and disordered gambling is associated with a range of poor employment and legal outcomes with negative implications for well-being and functioning of

individuals, families, and the community. Disordered gamblers are more likely to take time off work (Delfabbro & LeCouteur, 2009), give up work to gamble (Delfabbro & LeCouteur, 2009), lose jobs due to gambling (Gerstein, et al., 1999), commit crimes to fund gambling (Potenza, et al., 2001; Grant, et al., 2009; Abbott, 2001), and commit crimes through their place of work (Delfabbro & LeCouteur, 2009).

Evidence suggests that gambling and related problems may negatively affect the relationships of problem and disordered gamblers, with flow on effects for family members, friends, and colleagues (Productivity Commission, 2010). Disordered gambling may affect relationships through imposition of debt, maladaptive coping styles, or deception (Howard, McMillen, Nower, Elze, Edmond, & Bricout, 2002). For example, relationship conflict and the secretiveness of disordered gamblers often mean that family finances are depleted before family members have an opportunity to intervene. Difficulties within the families of disordered gamblers have been indexed via various measures of interpersonal problems, such as higher rates of child and partner abuse (Afifi, Brownridge, MacMillan, & Sareen, 2010; Petry & Steinburg, 2005) and divorce (Dielman, 1979; Lorenz & Yaffee, 1986).

Prevalence of gambling problems and disordered gambling

Population surveys conducted since the 1990s show that approximately 65% to 80% of Australian adults gamble at least once a year (Delfabbro & King, 2012; Gainsbury, Russell, Hing, Wood, Lubman, Blaszczynski, 2013). A large number of recreational gamblers experience some kind of occasional gambling related problems, e.g., problems controlling self-imposed spending limits, losing track of time, or adverse health impacts (Ministerial Council on Gambling, 2005;

ACT Gambling and Racing Commission, 2012). The significance of gambling related problems rises with both frequency of gambling sessions and spending on gambling (Hodgins, et al., 2012). A significant minority of gamblers also meets criteria for diagnosis of gambling disorder (American Psychiatric Association, 2013).

Recent surveys of gambling in Australia (Gainsbury, et al., 2014; Productivity Commission, 2010) estimated that between 0.5 and 1.0 per cent of Australian adults suffer significant problems from their gambling. In addition, a further 1.4 to 3.7 per cent of adults experience moderate problems or are at risk of progressing to more severe problems or disordered gambling (Gainsbury, et al., 2014; Productivity Commission, 2010). Precise prevalence statistics for clinically significant gambling disorder are difficult to estimate due to lack of a clear 'gold standard' measurement. However, prevalence estimates derived from surveys undertaken at different times, and with different methodologies, measures and sample sizes show prevalence of disordered gambling between 0.4-1.8 per cent in Australia (ACT Gambling and Racing Commission, 2012; Ministerial Council on Gambling, 2005; Walker & Dickerson, 1996; Stucki & Rihs-Middel, 2007). When reduced to the approximately twelve per cent of people gambling regularly (once a week or more), and excluding forms of gambling generally shown to pose little risk of harm due to low typical financial investment (e.g., lotteries), problem and disordered gambling rates are much higher (around 8 per cent problem and disordered gamblers, or 22 per cent if moderate-risk gamblers are also included) (Productivity Commission, 2010). That is, gambling related problems and psychopathology is even more pronounced among those who gamble regularly.

Gambling in Australia therefore imparts significant costs and harms to a subset of individuals within the community that gamble at unsustainable levels, as well as to the community through costs imposed on family members and colleagues of problem gamblers, and costs to welfare and social support systems.

Diagnostic criteria for disordered gambling

Diagnosis of disordered gambling requires that individuals present with a cluster of “persistent and recurrent” symptoms usually including gambling related negative outcomes (American Psychiatric Association, 1994, 2013). The Diagnostic and Statistical Manual of Mental Disorders is the commonly used text in Australia for describing and classifying mental illness and disorder. Therefore, the latest iteration, the DSM 5 (American Psychiatric Association, 2013), is referred to within this thesis in defining clinically significant problem gambling (Productivity Commission, 2010).

The recent publication of the DSM 5 has resulted in several changes to clinically significant gambling diagnostic criteria, in response to research over the decades since release of the previous edition, DSM IV, including: label change from “pathological gambling” to the less pejorative “gambling disorder”, along with changes in diagnostic criteria and requirements, and categorization of the disorder (American Psychiatric Association, 1994, 2013). The term problem gambler is also used, but has broader application, covering those who meet criteria for disorder and those who experience harm. The DSM 5 requires that a cluster of four, or more, criteria be met that include description of gambling specific distress or impairment resulting

from: maladaptive decision making, poor behavioural control, and gambling related harms
(outlined in table 1 below) (American Psychiatric Association, 2013).

Table 1

Diagnostic criteria for DSM 5 Gambling Disorder 312.31 (F63.0), relating to gambling related harms, maladaptive decision making style, and maladaptive motivation

Aspect of decision making	Relevant diagnostic criteria	Examples of supporting evidence
Maladaptive decision making	Criteria 1: needs to gamble with increasing amounts of money in order to achieve the desired excitement	(Blaszczynski, Walker, Sharpe, & Nower, 2008)
	Criteria 5: often gambles when feeling distressed (e.g., helpless, guilty, anxious, depressed) <i>*Criteria 5 in DSM IV: gambles as a way of escaping from problems or of relieving a dysphoric mood (e.g., feelings of helplessness, guilt, anxiety, depression)</i>	(Farrelly, French, Ogeil, & Phillips, 2007; Thomas, Allen, Phillips, & Karantzas, 2011; Reid, Li, Lopez, Collard, Parhami, Karim, & Fong, 2011)
	Criteria 6: after losing money gambling, often returns another day to get even ("chasing" one's losses)	(Campbell-Meiklejohn, Woolrich, Passingham, & Rogers, 2008)
Motivation	Criteria 4: is often preoccupied with gambling (e.g., having persistent thoughts of reliving past gambling experiences, handicapping or planning the next venture, thinking of ways to get money with which to gamble)	(Hwang, Shin, Lim, Park, Shin, & Jang, 2006; Potenza, 2007; Tavares & Gentil, 2007)
	Criteria 3: has repeated unsuccessful efforts to cut down or stop gambling	(Hwang, et al.; Potenza, 2007; Tavares & Gentil, 2007)
Gambling related harms	Criteria 4: is often preoccupied with gambling (e.g., having persistent thoughts of reliving past gambling experiences, handicapping or planning the next venture, thinking of ways to get money with which to gamble)	(Potenza, 2007; Tavares & Gentil, 2007)
	Criteria 2: is restless or irritable when attempting to cut down or stop gambling	(Daughters, Lejuez, Strong, Brown, Breen, & Lesieur, 2005)
	Criteria 7: lies to conceal the extent of involvement with gambling	(Afifi, Brownridge, MacMillan, & Sareen, 2010; Productivity Commission, 2010; Dielman, 1979)
	<i>*Criteria 8 in DSM IV: has committed illegal acts such as forgery, fraud, theft, or embezzlement to finance gambling</i>	(Potenza, et al., 2001; Grant, et al., 2009; Abbott 2001; Delfabbro & LeCouteur, 2009)
	Criteria 8: has jeopardized or lost a significant relationship, job, or educational or career opportunity because of gambling	(Delfabbro & LeCouteur, 2009; Lorenz & Yaffee, 1986).
	Criteria 9: relies on others to provide money to relieve a desperate financial situations caused by gambling	(Chabra, 2009; Nariakira, 2008)

Table adapted from American Psychiatric Association (1994) and American Psychiatric Association (2013)

*DSM IV criterion 5 wording substantially changed, and criterion 8 removed as part of changes to diagnostic criteria in Gambling Disorder (American Psychiatric Association, 2013). The "illegal acts" criterion eliminated due to poor discrimination of clinically significant gambling problems (American Psychiatric Association, 2010).

A number of diagnostic criteria describe cognitive or behavioural features of maladaptive decision making, in that evidence suggests these decision making strategies lead to poor risk outcomes. Several studies indicate that play strategies that include chasing losses (criterion 6) (Campbell-Meiklejohn, et al., 2008), and increasing wager size (criterion 1) (Blaszczynski, et al., 2008) typically leads to poorer financial outcomes, and the compounding of gambling debts and related problems. Similarly, gambling during times of distress (criterion 5, reworded substantially in DSM 5) typically indicates use of gambling as an avoidant coping strategy, also shown to exacerbate gambling debts and distress (Farrelly, et al., 2007; Thomas, et al., 2011; Reid, et al., 2011).

Other diagnostic criteria describe behavioural indicators of impaired motivation including difficulty reducing gambling involvement (criterion 3) (Potenza, 2007; Tavares & Gentil, 2007), or controlling thoughts about gambling (criterion 4) (Hwang, et al., 2006; Potenza, 2007; Tavares & Gentil, 2007).

Finally, a number of criteria describe problematic or distressing outcomes resulting from previous or ongoing gambling. Gamblers may experience distress related to obsessional or uncontrollable thinking about gambling (criterion 4) (Potenza, 2007; Tavares & Gentil, 2007) that may manifest as restlessness or irritability during attempts to reduce problematic gambling (criterion 2) (Daughters, et al., 2005). Further, gambling may lead to acts that are distressing, or result in financial, interpersonal or other problems, such as increased deceptiveness (criterion 7) (Afifi, Brownridge, MacMillan, & Sareen, 2010; Productivity Commission, 2010; Dielman, 1979), indebtedness to others (criterion 9) (Chhabra, 2009; Nariakira, 2008), or law breaking (previously criterion 8 in DSM IV) (Potenza, et al., 2001; Grant, et al., 2009; Abbott 2001; Delfabbro & LeCouteur, 2009). Such behaviours may be associated with guilt, interpersonal

conflict, employment, legal or other problems, and lost opportunities (criterion 8) (Delfabbro & LeCouteur, 2009; Lorenz & Yaffee, 1986).

Therefore, gambling is an activity centrally focused on risk decisions and their outcomes. Disordered gambling is centrally defined by chronic maladaptive decision making, manifested as harmful navigation or enacting of risk decisions, along with the consequences of those decisions (American Psychiatric Association, 2013). Disordered gambling as presented in the DSM 5 may therefore be considered a disorder of risky decision making – occurring due to repeated, poorly considered and managed responses to perceived risks weighed against perceived benefits. In considering the central question of this thesis, the role of risk perception and in gambling decision making, the next phase of investigation focuses on what the contemporary gambling and related literatures tell us about why gamblers choose to endure engagement in uncontrolled, self-destructive behaviour, despite its negative consequences. The following chapters therefore focus on research illuminating decision making in gambling and gaps in this literature, followed by discussion of related areas of research within implications for valuable future gambling research.

CHAPTER 2: Risk perception and risky choice in the gambling literature

Gambling Disorder models

A range of theoretical paradigms or models have been applied in attempts to explain harmful gambling, including: psychodynamic (Rosenthal, 1987; Bergler, 1957), medical or biological-physiological (Blanco, et al., 2000), biological-psychological (Blaszczynski, Winter, & McConaghy, 1986), behavioural and learning-based (Anderson & Brown, 1984, Brown, 1987, McConaghy, 1980), cognitive or cognitive-behavioural (Sharpe & Tarrier, 1993), sociological (Ocean & Smith, 1993), personality (Zuckerman, 1999), addiction-based (Lesieur & Rosenthal 1991, Jacobs, 1986), and dual processing (Redish, Jensen, & Johnson, 2008). Other models and theories have attempted to integrate a combination of theoretical approaches (Sharpe, 2002; Blaszczynski & Nower, 2002; Redish, et al., 2008). Models explain disordered gambling behaviour and its consequences according to various environmental and individual variables, e.g., as expression of underlying pre-genital psychosexual neuroses (Rosenthal, 1987), or uncontrollable urges resulting from pathological neural change (Blume, 1987; West, 2005). Within well-supported contemporary theories and models, two dominant explanatory approaches are relevant to explanations specific to gambling decision making: (1) the biopsychological approach, and (2) the cognitive approach. The following sections describe each of these approaches, limitations of these approaches, and ways research may be integrated or expanded in order to more effectively model decision making.

Biopsychological models of gambling decision making

A number of researchers have applied biopsychological evidence in attempts to explain maladaptive gambling, arguing that gambling problems result from dysregulation of brain regions that play a role in decision making. Gambling disorder is manifest in maladaptive

regulation of gambling behaviour, displayed when gamblers do not or are not able to inhibit urges, shift to less destructive behaviours, or assess and respond accurately to feedback.

Deficits displayed behaviorally in gambling disorder have their basis in structural and functional brain abnormalities involved in decision making, identified through comparison between disordered gamblers and healthy controls. Evidence comes from a range of areas including research in: neuroimaging, neurophysiology, neuropsychology, neurochemistry, and genetics (Clark, 2010; Goudriaan, Oosterlaan, de Beurs, & Van den Brink, 2004).

Accordingly, review of available research posits that disordered gambling results from a number of processing biases leading to maladaptive approach-avoidance behaviour (Nussbaum, Honarmand, Govoni, Kalahani-Bargis, Bass, Ni, & LaForge, 2011), including for example: heightened sensitivity for reward (Blum, Braverman, Holder, Lubar, Monastra, Miller, Lubar, Chen, & Comings, 2000), abnormal arousal levels (Lowman, Hunt, Litten, & Drummond, 2000), and executive dysfunction during gambling (Goldstein & Volkow, 2002; Rogers & Robbins, 2001).

Neurobiological evidence suggests neurotransmitter regulation may be abnormal in the 'reward pathways' of disordered gamblers (Goldstein & Volkow, 2002). Mesolimbic abnormality for example has been shown in other addictive disorders to play a role in withdrawal and craving (Ebert, et al., 2002). Similarly in gambling disorder, evidence shows dysregulation of dopamine, an important neurotransmitter in the mesolimbic system (Blum, Braverman, Holder, Lubar, Monastra, Miller, Lubar, Chen, & Comings, 2000). Such dysregulation of reward processes may result in hypersensitivity to reward, loss, or both, providing disproportionate feedback likely to sustain engagement despite normatively harmful outcomes.

Dysregulation of limbic structures involved in arousal regulation has also been suggested as a possible source of dysfunctional gambling decision making. Abnormalities in mesolimbic brain structures may also contribute to abnormal arousal regulation observed in disordered gambling (Ibanez, Blanco, de Castro, Fernandez-Piqueras, & Saiz-Ruiz, 2003; Lowman, et al., 2000). Prolonged play may therefore result from insufficient arousal when losses are experienced, or chronically low arousal leading gamblers to 'thrill seek', leading to behavioural disinhibition.

Executive functioning impairment in gambling disorder has also been compared to deficits observed in substance dependency, providing an additional possible pathway for maladaptive decision making. Substance addiction research has identified abnormalities in prefrontal cortical regions, and subcortico-cortical networks projecting to the frontal cortex (Rogers & Robbins, 2001) - areas that play an important role in executive functioning (Goldstein & Volkow, 2002). Executive functions such as planning, inhibition and response modulation play important roles in planning, responding to feedback, and other aspects of decision making (Lyvers, 2000). It is therefore probable that behavioural similarities between gambling and substance disorders may stem from related neurophysiologically-based executive deficits contributing to maladaptive decision making in this group of disorders.

A number of other processes have also been hypothesized to contribute to maladaptive gambling decision making, such as dysregulation of dopamine, testosterone, and endogenous opioids resulting in dysfunctional regulation of reward seeking (Comings, 1998; Kreek, et al., 2005), and GABA dysfunction resulting in impaired inhibition of impulsive behaviour (Brebner, Childress, & Roberts, 2002). Nussbaum and colleagues (2011) have attempted to integrate

biopsychological findings, and reduce gambling decision making to dysregulation of approach-avoidance behaviours applying to the immediate rewards available in gambling.

While biopsychological evidence represents a significant and rapidly growing area of research, providing valuable insights into maladaptive decision making, several issues confound attempts to explain gambling decision making entirely in terms of biopsychological evidence (Nussbaum, et al., 2011). Accordingly, the following section evaluates criticisms applied to the biopsychological theoretical approach, proposing that an integrative approach is of value to incorporating findings across the multidisciplinary gambling literature.

Issues in developing a biopsychological model of decision making

An important criticism applied to biopsychological models of gambling decision making (e.g., Nussbaum, et al., 2011) relates to the level of functional reduction required for such models to be consistent (Moscrop, 2011). In reducing decision making to regulation of approach-avoidance behaviour, or some other functional equivalent, results in an explanatory gap regarding how individuals develop meanings and motivation specific to gambling - meanings that arguably cannot be entirely explained by purely bottom-up neural accounts of decision making. How, for example, can such models explain common low levels of gambling problems in individuals without significant brain dysregulation problems, or presence of substance disorder without gambling problems?

Perhaps unsurprisingly then we find that other theoretical paradigms have contributed to explanation of variance in gambling decision making, behaviour and harms, according to variables indirectly related, or entirely unrelated to neural functioning (e.g., changes in gambling social policy) (Moscrop, 2011; Sharpe, 2002). In fact, well-established risk factors for

gambling disorder come from a range of research paradigms, often with limited relevance to biopsychological functioning. For example, higher risk of disordered gambling is well established among people with particular static (age, gender, ethnicity) and dynamic demographic features (involvement in delinquency and illegal acts) (Hodgins, et al., 2012; Brunelle, Leclerc, Cousineau, Dufour, Gendron, & Martin, 2012), and comorbid or concurrent mental health symptoms (e.g., Obsessive Compulsive Disorder, anxiety, depression, bipolar disorder, alcohol and substance dependence or abuse) (Potenza, 2007; Van holst, Van Den Brink, Veltman, & Goudriaan 2010; Johannson, et al., 2009) that may influence emotion regulation, perception, and responses to feedback. Similarly, disordered gambling has well established associations with various environmental factors, including availability and exposure to gambling environments (Johannson, et al., 2009), and the features of preferred games (e.g., payout intervals, sensory characteristics, rates of play) (Gilovich, 1983; Hodgins, et al., 2012; Brunelle, et al., 2012).

Therefore, while a growing body of evidence supports the utility of brain research in theoretical explanations and interventions for disordered gambling, biopsychological evidence does not and cannot provide a complete, successful model of gambling decision making. That is, gambling disorder is not only a disorder of brain regulation, it is also brought about by the interaction between individuals and their environments, through exposure to culture and gambling experiences resulting in gambling-specific beliefs, meanings, and values. A further line of evidence supporting a multidisciplinary, integrative approach to gambling decision making is found in assertions that gambling disorder may originate from multiple underlying causes, at times inclusive of, but not necessarily limited to neurological dysfunction.

Subtyping as evidence of multiple pathways to gambling disorder

Evidence suggests that recreational and disordered gamblers are varied (Milosevic & Ledgerwood, 2010; Blaszczynski & Nower, 2002), and that specific individual, demographic, and environmental characteristics may leave particular individuals more or less vulnerable to harmful and disordered gambling decision making (Johansson, et al., 2009). Examples of risk factors include high impulsivity or antisocial personality traits (Brunelle, et al., 2012; Van holst, et al., 2010), strong erroneous beliefs (Van holst, et al., 2010; Hodgins, et al., 2012), or exposure to gambling environments (Johansson, et al., 2009). Considerable heterogeneity has nevertheless been identified in the clinical presentation of disordered gamblers (Milosevic & Ledgerwood, 2010). Blaszczynski and Nower (2002) suggested in their Pathways Model for example, that there are various different routes to disordered gambling. In a review of the subtyping literature Milosevic and colleagues (2010) found evidence supporting this assertion, noting that three relatively distinct subtypes consistently emerged from the data, differentiable based on motivation for gambling, and the personality, psychopathological and physiological presentations underpinning these motivations.

The first “emotionally vulnerable” subtype of disordered gamblers demonstrate high levels of anxiety, depression (or both), along with low impulsivity, sensation seeking (or both), with gambling commonly used to regulate dysphoric feelings (Ledgerwood & Petry, 2006; Turner, Jain, Spence, & Zangeneh, 2008). A second “antisocial impulsive” subtype consistently emerging in the literature, shows elevated antisocial traits, marked impulsivity, and the tendency to gamble in order to increase arousal or relieve boredom (Vachon & Bagby, 2009; Turner et al., 2008; Stewart, Zack, Collins, Klein, & Fragopoulos, 2008). Milosevic and Ledgerwood (2010) also posit a third subtype of “behaviourally conditioned” disordered

gambler, that does not show serious psychopathology or maladaptive personality traits, gambles due to social influence and erroneous expectations, and develops disordered gambling due to behavioural conditioning (Vachon & Bagby, 2009; Stewart, et al., 2008). Disordered gamblers are therefore somewhat heterogenous but may fall into particular subtypes according to personal attributes.

Clinical presentation of gamblers therefore demonstrates that certain individuals are more likely to develop gambling disorder, but not necessarily for the same reasons, nor consistently (LaPlante, Nelson, LaBrie, & Shaffer, 2008). That is, the diagnostic criteria refer to a disordered pattern of behaviour and consequences, but not necessarily a single, consistent subgroup in the population.

Evidence supporting subtyping is also found in biopsychological approach. A neuropsychological study by Grant and colleagues (2000), for example, found evidence that different subgroups of drug abusers presented different types of maladaptive decision making. Approximately one third of drug abusers demonstrated no systematic impairment in reasoning. Approximately 25 per cent, in contrast, made decisions consistent with patients with frontal lobe damage or executive functioning deficits, consistently choosing higher immediate rewards despite awareness that the strategy was unprofitable in the long term. The remaining 40 percent of participants appeared highly sensitive to potential reward, regardless of whether it was immediate or long term (Grant, Contoreggi, & London, 2000). That is, various types of neurophysiological dysfunction supported by biopsychological research (Goudriaan, et al., 2004) appear present to differing degrees across subgroups in the study. While research integrating biopsychological findings with other decision making models in gambling is scarce, these findings are consistent with evidence suggesting motivational subtypes and different

pathways to disordered gambling (Milosevic & Ledgerwood, 2010; Binde, 2009). That is, different types of brain dysregulation may contribute to different functional decision making problems responsible for disordered gambling. Also consistent with this are findings that suggest probable bidirectional causation in biopsychological dysfunction underpinning maladaptive gambling decision making. For example, neural abnormality and dysfunction has been shown to predispose individuals to gambling disorder (Sher & Trull, 1994) in addition to evidence that prolonged exposure to gambling reinforcement schedules may lead to harmful changes in brain functioning (Goudriaan, et al., 2004).

Critical problems for purely biopsychological explanations of maladaptive gambling decision making are that some individuals develop gambling disorder for reasons other than or in addition to neural dysregulation (Clark, 2010), while individuals with neural dysregulation may manifest non-gambling disorders, or no disorder at all (Goudriaan, Oosterlaan, de Beurs, & Van den Brink, 2004). It is putting the cart before the horse to propose a biopsychological solution without attending to the way we formulate description of the problem. That is, a description of the reason for a problem must incorporate the perspective consistent with the description of the problem, based in a coherent phenomenological approach (Searle, 1992). An eclectic, integrative approach to the modelling of gambling decision making centered around maladaptive decision making is a more practical approach to explaining disordered gambling, with biopsychosocial, cognitive, or other contributors reframed as idiosyncratically expressed risk factors for disorder.

Cognitive models of gambling decision making

Cognitive gambling theories argue that disordered gambling develops and is maintained by maladaptive decision making cognitions (e.g., Walker, 1992a). Specifically, erroneous beliefs and distorted interpretation lead to overly optimistic evaluations that maintain motivation to gamble, regardless of negative outcomes (Clark, 2010). Cognition is a significant research area in the gambling literature, and a dominant framework in clinical interventions for gambling disorder (Gooding & Tarrier, 2009; Ladouceur, Sylvain, Boutin, Lachance, Doucet, & Leblond, 2003). Some researchers have consequently proposed that exaggerated expectation of winning is the predominant factor underlying maladaptive gambling decision making and behaviour (Walker, 1992b; Ladouceur & Walker, 1996).

Cognitive studies indicate that ‘irrationality’ may be common in human decision making about gambling (Griffiths, 1995; Ladouceur, Gaboury, Dumont, & Rochette, 1988; Wagenaar, 1988; Walker, 1992a). For example, in so called ‘think aloud’ studies, in which gamblers verbalise their thoughts during real gambling sessions, over 70% of gamblers’ statements were found to be irrational (Griffiths, 1994; Coventry & Norman, 1998; Delfabbro & Winefield, 2000; Griffiths, 1994; Walker, 1992b), with gamblers frequently misinterpreting odds and demonstrating false attributions of cause and effect (Gaboury & Ladouceur, 1988). Research also indicates that regular or disordered gamblers are significantly more likely to make erroneous verbalisations while gambling, than irregular or recreational gamblers (Coulombe, Ladouceur, Desharnais, & Jobin, 1992; Griffiths, 1994; Coventry & Norman, 1998).

In addition, disordered gamblers hold particular exaggerated or mistaken perceptions and interpretative biases (Toneatto, Blitz-Miller, Calderwood, Dragonetti, & Tsanos, 1997; Johannson, et al., 2009). For example, disordered gamblers are more likely to overestimate skill

(Toneatto, et al., 1997; Fortune & Goodie 2011; Jacobsen, Knudsen, Krogh, Pallesen, & Molde, 2007; Myrseth et al. 2010), or the chance of positive outcomes (Delfabbro 2004; Walker, 1992b; Wohl 2008; Wood & Clapham, 2005; Joukhador, et al., 2004).

A number of theorists have attempted to describe patterns or categorize problematic cognitions, or systematize relationships between types of error or bias, in order to guide research that may further quantify differences between gambler subgroups (e.g., Toneatto, 1999; Redish, et al., 2008). Reviews of the cognitive literature (e.g., Crockford & el-Guebaly 1998; Goudriaan, et al., 2004; Raylu & Oei 2002), and models of gambling (e.g., Toneatto, 1999; Sharpe, 2002) typically discuss gambling cognitions according to beliefs, heuristics, biases, or some combination of fixed beliefs and dynamic cognitive processes. Taxonomies or models typically divide cognitions into categories and subcategories of bias or error – though there is no clear consensus among researchers as to how this may be systematically achieved, and consequently no commonly agreed upon model or taxonomy. Toneatto (1999) for example, attempted to differentiate erroneous beliefs (e.g., superstitions about luck), interpretative biases (e.g., the availability heuristic), and abnormal processes (e.g., memory biases), classifying frequently identified erroneous or distorted cognition types (e.g., ‘the illusion of control’, ‘the gamblers’ fallacy’) into these three types of domain. By contrast, Fortune and Goodie (2011) attempted to reclassify commonly described distortions and beliefs based on the heuristics (e.g., ‘representativeness’, ‘availability’) from which they apparently derive.

A broad range of cognitive or cognitive-behavioural interventions are aimed at ‘debiasing’ gamblers’ erroneous or distorted cognitions, correcting beliefs about odds, randomness, and control (e.g., Griffiths, 1995; Walker, 1992b). In fact, the majority of gambling treatment approaches fall broadly within cognitive or cognitive-behavioural frameworks

(Cowlshaw, et al., 2012; Thomas, et al., 2011; Gooding & Tarrrier, 2009), and review and meta-analysis of cognitive-behavioural interventions demonstrate significant, long term reduction of gambling, based on cognitive-behavioural therapeutic approaches (Gooding & Tarrrier, 2009). Some researchers argue that the effectiveness of cognitively-oriented treatment interventions is strong evidence of the practicality and legitimacy of cognitive gambling models, particularly in comparison to abstracted, expensive or invasive biopsychological methodologies (Clark, 2010).

Issues in developing a cognitive model of decision making

A range of approaches to investigating cognitive decision making have been applied in the gambling literature. Evidence falls predominantly across three broad methodological approaches: laboratory-based experiments investigating specific aspects of decision making, investigation of beliefs and reasoning in more 'naturalistic' settings such as via verbalisation, observation and interview techniques; and questionnaire studies that attempt to identify, quantify and describe relationships between cognitions involved in decision making (Moodie, 2007). These different approaches have particular strengths and weaknesses related to the validity and reliability of findings and have been critiqued accordingly, with particular implications for gambling decision making theories.

Poor ecological validity in laboratory-based research

A large body of research has attempted to systematically investigate reasoning processes within laboratory settings (e.g., Ladouceur & Sévigny, 2005). However, several authors argue that ecological conditions in many laboratory-based studies undermine the

validity of findings, and cast doubt on contributions to cognitive gambling models (Delfabbro, 2004). Walker (1992a, 1992b) for example, argued that significant effects, or lack thereof, may result from the artificiality of laboratory-based tasks, or non-representativeness of participant samples. Arousal for example, has been shown to play a significant role in selection and execution of gambling decisions (Baudinet & Blaszczynski, 2012), but is likely to be significantly reduced in laboratory tasks in which participants do not wager real money (e.g., Kassinove & Schare, 2001; Coventry & Norman, 1998; Dixon, Hayes, & Ebbs, 1998) or are not exposed to realistic game or environmental stimuli (e.g., Coventry & Norman 1998; Fisher & Griffiths, 1995).

A more significant issue in laboratory based studies relates to variation in how cognitions are applied during decision making. Delfabbro (2004) and Rachlin (1990) for example, point out that accounts of decision making relying on systematic subgroup differences between beliefs, heuristics or biases (e.g., Wagenaar, 1988) are hindered by evidence of the context-dependence of beliefs, heuristics and biases in decision making. The 'availability' heuristic for example suggests that what is most easily remembered by the gambler has the most powerful effect on probability judgments. Therefore, if a gambler were to apply a heuristic such as 'availability', it might be expected that gambling persistence would be associated with memory biased to wins over losses, or the exaggerated expectation of winning proportionate to past experience. However, at least one study has found results contradictory to such expectations, instead showing that persistent gamblers tended to remember losses better than wins (Gilovich, 1983). Similarly laboratory studies show that individuals typically avoid risk when choosing between single shot options with positive outcomes, but this pattern

is reversed when the same alternatives are presented multiple times (Keren & Wagenaar, 1987).

In fact, evidence indicates that a number of heuristics and biases commonly referred to in the gambling literature are not inevitable features of gambling decision making, but are highly sensitive to the context in which they are investigated, and only arise in specific circumstances (Delfabbro, 2004). Thompson, Armstrong and Thomas (1998) for example, found that the 'illusion of control' tended only to occur in situations when gamblers perceived association between actions and outcomes based upon 'contiguity' (i.e., temporal proximity) or 'contingency' (i.e., actions appeared to predict outcomes). In contrast, when these factors were absent or greater emphasis was given to the failure of strategies (e.g., through feedback), the illusion of control was rarely observed. Argument for the context dependence of the illusion of control is further strengthened by studies linking illusory control to individual difference variables such as gender (Delfabbro, 2000), locus of control (Hong & Chui, 1988), and control motivation (Burger, 1991), suggesting that individual differences may predispose particular individuals towards developing the bias (Delfabbro, 2004).

Similar issues relate to research investigating other beliefs, heuristics or biases argued to differentiate disordered gamblers. Delfabbro and Winefield (1999) for example, found little evidence to suggest electronic gaming machine gamblers adapted bet sizes in response to a series of losses or large wins, as would be expected according to the 'gamblers' fallacy' and 'availability' heuristic, respectively.

Evidence therefore suggests that gamblers' application of heuristics and biases may not be inevitable features of gambling decision making in gambling disorder. Instead, problematic decision making appears to depend heavily on contextual factors. A serious problem with

cognitive decision making theories that account for subgroup differences according to systematic differences in reasoning rules is that theories have failed to specify rules outlining when heuristics will be applied to a given situation (Waganaar 1988; Tversy & Kahnemann, 1973; Tversy, Kahnemann, & Slovic, 1982). Such theories are left with explanatory gaps disabling accurate prediction of gambling cognition and decision making in real world scenarios.

A number of heuristics studies indicate that several heuristics may be applied by gamblers to the same situation, and that different heuristics lead to varied or opposite behaviours (Rachlin, 1990; Wagenaar, 1988), as well as vice versa. That is, the same behaviour applied in different situations has been explained by researchers according to different heuristics and biases (Delfabbro & Winefield 1999; Delfabbro, 2004). Accordingly, theories of gambling disorder heavily reliant on laboratory study research (e.g., Toneatto, 1999; Wagenaar, 1988), fail to take into account decision making variation relevant in real world gambling scenarios (Mischel, 2004), and lack explanatory and predictive power important to development of an effective model that captures the context dependent application of decision making processes in gambling.

Naturalistic studies and normative decision making theories

A number of studies have attempted to conduct cognitive research mindful of the limitations on ecological validity of laboratory based research. For example, studies asked gamblers to verbalize decision making processes during real-world gambling sessions (Coulombe, Ladouceur, Desharnais, & Jobin, 1992; Griffiths, 1994; Coventry & Norman, 1998; Delfabbro & Winefield, 2000) or applied observational or open-ended interview techniques with gamblers in naturalistic settings (Toneatto, Blitz-Miller, Calderwood, Dragonetti, & Tsanos,

1997). Attempts to identify and describe gamblers' belief structures in real-world scenarios have met with a number of specific methodological and theoretical issues and criticisms. For example, naturalistic gambling studies frequently include non-representative samples that are likely to express views that do not generalise to the population, for example: treatment seeking disordered gamblers (Joukhador, MacCallum, & Blaszczynski, 2003), students (Walker, 1992b; Kweitel & Allen, 1998; Côté, Caron, Aubert, Desrochers, & Ladouceur, 2003), or low-frequency gamblers (Gaboury & Ladouceur, 1989; Benhsain, Taillefer, & Ladouceur, 2004; Ladouceur & Sévigny, 2005).

A more significant issue for naturalistic studies relates to the classification of data and comparison across groups (Moodie, 2007). Many naturalistic studies for example have attempted to quantify the 'irrationality' of gamblers, by comparing the quantity or quality of erroneous statements made by gamblers. Critics have suggested that studies often confuse the intensity of irrationality with number of statements or beliefs (Delfabbro, 2004). Given there are only a limited number of ways participants can express accurate or rational cognitions about chance and randomness, the more participants speak in these studies, the more irrational they are assessed to be – though critics argue this is not necessarily a reasonable conclusion (Dickerson & O'Connor 2006). Flippant verbalizations do not necessarily reflect cognitions held with conviction, and individual participants may respond differently to study demand characteristics in a manner that is not reflective of irrationality. For example, regular gamblers with greater experience of gambling are likely to develop and report a wider repertoire of beliefs and behaviours - these complex belief systems are not necessarily reflective of more irrational cognitions, though they are likely to be classified as such in 'think aloud' studies.

Further, normative views of cognition assumed by studies may make unreasonable assumptions about what constitutes an 'irrational' belief. For example, many studies have defined 'irrationality' according to variations between subjective and objective estimations of long term success (Walker, 1992a, 1992b). However, it may be inappropriate to assume that all gamblers are primarily focused on long term goals, or profit maximisation. Delfabbro and Winefield (1999) for example, argue that gamblers often hold specific, short-term goals, such as winning back losses from the previous day, gaining a win or game feature of a specific size or type, or gambling for as long as possible. Little consideration might therefore be given to how much money has been lost in previous sessions, or the likelihood of poor long term outcomes.

Alternatively, maladaptive decision making may stem not from error, but from selective, or inappropriate application of beliefs. For example, gamblers may justify continued gambling through cognitive mechanisms that suppress or deny gambling risks and harms as protection against shame, guilt or other distressing emotions (American Psychiatric Association, 2013). Cognitive models that assume a purely error based approach are therefore problematic, as maladaptive beliefs may stem more from selective misuse of information than from a lack of knowledge about gambling activities.

Research replicating 'think aloud' studies with more comprehensive methodologies have further undermined naturalistic research findings (e.g., Moodie, 2007; Coventry & Norman, 1998). Moodie (2007) for example applied a mixed qualitative-quantitative method, combining think aloud, questionnaire, interview studies, but failed to find significant differences between recreational and disordered gamblers in number of erroneous cognitions (e.g., Moodie, 2007; Coventry & Norman, 1998). Most statements made during gambling sessions were classifiable as descriptive, but not irrational. Further, when individuals were

given the opportunity to explain responses deemed inadequate (e.g., alluding to predictions or confirmation of predictions while thinking aloud), both recreational and disordered gamblers were able to adequately explain more than half of cases relating to supposedly irrational beliefs (Moodie, 2007).

Limitations of psychometric measurement

A more recent, alternative approach to laboratory-based and naturalistic research, involves investigating cognition involving quantitative, psychometric assessment, for example, through development and use of self-report questionnaires about decision making cognitions (e.g., Raylu & Oei, 2004; Wood & Clapham, 2005). Psychometric approaches enable flexible but targeted assessment of explicit beliefs, based in lay language that is potentially free from normative assumptions.

Again, however, criticisms apply to current psychometric assessment tools. Relatively few measures have been developed investigating the content of gambling cognition, and many of the existing measures remain relatively untested (e.g., the Gambling Related Cognitions Scale (GRCS; Raylu & Oei, 2004)). Further, evidence suggests that the majority of existing measures poorly discriminate gambling subgroups and cognitive constructs. Strong and colleagues (2004) for example, found only 15 of 35 items of the Gambling Attitudes and Beliefs Scale (GABS; Breen & Zuckerman, 1999) effectively discriminated students from clinical gamblers.

Critics have also questioned the utility of questionnaires that identify or reduce gambling cognition to only a small number of constructs - given that evidence suggests gamblers hold complex belief systems responsive to contextual cues and mental states (Delfabbro, 2004; Clark, 2010; Baudinet & Blaszczynski, 2012). For example, the Gamblers'

Beliefs Questionnaire (GBQ; Steenbergh, Meyers, May, & Whelan, 2002) and Drake Beliefs about Chance Inventory (DBC; Wood & Clapham, 2005) each load on only two factors – ‘Illusion of Control’ and ‘Luck/Perseverance’; and ‘Illusion of Control’ and ‘Superstition’, respectively. Psychometric tools therefore fail to meaningfully identify or assess many of the concepts expressed by gamblers that are likely to be important in decision making. Instead tools reduce cognitions to a limited number of domains, related to over-exaggeration of either control or probability.

A notable area of cognition absent from this area of research is risk perception and interpretation. A number of related disciplines suggest that risk perception plays an important role in decision making and behaviour (Ajzen, 2011; Albarracin, Johnson, Fishbein, & Muellerleile, 2001; Glanz, Rimer, & Viswanath, 2008; Siegrist, Keller, & Kiers, 2005; Morgan, Fischhoff, Bostrom, & Atman, 2002; Skog 2000). However, gambling theories to date have not considered gamblers’ explicit perceptions, beliefs or attitudes about potential negative outcomes, nor how this information is utilised within decision making systems to make reasoned choices or motivate behaviour. The existing cognitive research therefore appears to lack examination of the full range of beliefs considered by gamblers in making decisions, such as negative outcome expectancies, and how percepts relate to the motivation, interpretation and goals of individuals.

Conclusions

Cognitive and biopsychological approaches identify a number of important differences between recreational and disordered gamblers’ cognitive and neurophysiological functioning but lack clarification in a number of important areas based on methodological and theoretical

issues (outlined above). In contrast, a comprehensive gambling decision making model should be integrative, idiosyncratically and contextually sensitive, and avoidant of normative assumptions. An important next step in developing such a model therefore is to examine other theories of risky decision making that have more effectively addressed the gaps inherent in gambling research.

CHAPTER 3: Alternative theories of risky decision making

Decision making models

A range of theoretical approaches have addressed decision making in potentially hazardous scenarios, including: the Theories of Planned Behaviour and Reasoned Action (Ajzen 2011; Albarracin et al. 2001); the Health Belief Model (Glanz et al. 2008), the Psychometric Paradigm of Perceptions of Hazards (Siegrist et al. 2005), the Mental Models approach (Morgan et al. 2002); and Choice theory (Skog 2000). Consequently, risk perception, interpretative biases, and decision making involving potentially harmful scenarios has been addressed in many areas of research. Two areas in which risk perception has been investigated with particular relevance to harmful and disordered gambling, include (1) the mental models of risk literature, and (2) research addressing substance addiction.

Mental model and substance addiction research are significant to gambling because these areas examine concepts that have largely remained unexplored in the gambling literature, but have yielded valuable insights into methodological and theoretical approaches that may enable more effective modelling of risk decision making in gambling, while avoiding normative assumptions about rationality.

Mental models research outlines a specific theoretical and methodological approach to decision making in hazardous scenarios, identifying risks, factors controlling exposure to risk, and mapping user concepts of risk to identify gaps or errors in need of intervention (Morgan et al., 2002). Substance addiction research also includes concepts of risk perception, but goes further to consider the impact of conflicting motivation in risky choice, contextualizing risk perception within an integrative understanding inclusive of environmental, biological, or cognitive factors that may impact on decision making. The concepts outlined here appear to have received little attention in the gambling research literature. Hence, examination of mental

models and substance addiction research may provide insights valuable to future gambling research.

Mental models of risk perception

The mental models approach describes a methodology developed to examine the belief systems applied by individuals using known hazards, such as employees working with nuclear energy (Morgan et al., 2002). The mental models approach seeks to identify for a particular hazard both accurate and inaccurate beliefs that are held by a target population. Findings are used to develop risk communication material that will correct misunderstandings, thereby enabling more responsible, adaptive decision-making by individuals exposed to risk.

The mental models approach argues that the decisions people make when faced with a 'hazard' depend at least in part on the knowledge or beliefs they hold about it (Breakwell, 2007). For example, research suggests that individuals often develop schemas about identified hazards that may account for causal relationships (Breakwell, 2007) and that decision-making processes people apply in rapidly changing 'real world' scenarios depend more on pre-existing or learned beliefs and theories than on formal rational judgment procedures (Nisbett & Ross 1980; Breakwell, 2007; Cantor & Mischel, 1977). The term 'mental model' has been applied to the theoretical overarching knowledge schemas composed of these beliefs and theories (Breakwell, 2007).

Mental models may be made up of information that is propositional (e.g. gambling expenditure is harder to limit if alcohol is consumed), or holistic/schematic (e.g. knowing generally what happens in a gambling venue), and describes various aspects of a hazard (e.g., who or what is implicated in the hazard, how it can be controlled, or factors impairing control).

For mental models to enable effective or adaptive interaction within an individual's environment they need not be factually accurate, follow a standardized format, remain constant over the long-term, or be bound by the specifics of a hazard, instead remaining free to evolve in response to the particular needs of an individual or community to account for a hazard (Breakwell, 2007). Such a model avoids normative assumptions about rationality or the innate 'structure' of cognition or cognitive systems – instead enabling non-directive, dynamically responsive mapping of individuals own idiosyncratic beliefs (and relationships between beliefs) relevant to the specific hazard under investigation. This may include not just the biases that lead people to make particular decisions, but the actual information that is used by the individuals, and how that information is utilized in making decisions.

In response to mental models theory, Morgan and colleagues developed a methodological approach that has been applied to a large number of hazardous scenarios to identify and correct maladaptive components of mental models applied in risky decision making (Morgan et al., 2002). A number of studies have looked into mental models about risks, e.g.: radon gas or nuclear contamination (Bostrom, Fischhoff, & Morgan, 1992); effects of drugs (Jungermann, Schutz, & Thuring, 1988); physical processes (Gentner & Stevens, 1983); and energy conservation (Kempton, 1987).

This research has provided information about the tacit theories people develop to cope with uncertain environments. These theories identify potential negative outcomes of interacting with hazards, as well as causality within systems that manage or contribute to exposure to risk and harm. In addition research has demonstrated that if mental models contain 'critical bugs', individuals may draw incorrect conclusions and engage in maladaptive behaviours - even among otherwise well-informed people (Fischhoff, 1995; Galotti, 1989). For

example Bostrom and colleagues (1992) found that many people know radon is a colourless, odourless radioactive gas, but frequently incorrectly associate it with permanent contamination. In not realizing that radon has a short half-life, home owners tended not to bother to test homes for radon, believing that there is nothing they can do to correct for radon contamination (Bostrom et al., 1992). Consideration of potential negative outcomes and risk therefore impacts on the decisions and behaviour of people interacting with hazards, in this instance leading to ineffective use of resources. Further, in identifying misconceptions of harm and causality, research was able to predict behaviour and guide interventions that may correct inaccurate beliefs about interacting with this hazard.

Morgan and colleagues (2002) have contributed to the development of a well-defined means of evaluating the practical risks associated with hazards, and factors mediating exposure to risks, along with how people perceive and use risk data to make decisions. Interventions identify gaps between real and perceived risk, enabling targeted education to correct maladaptive beliefs in language comprehensible to the user. Targeted interventions have shown efficacy in addressing maladaptive decision making in various problem areas (Breakwell, 2007; Morgan, et al., 2002; Fischhoff, 1995).

Such analysis and intervention is particularly relevant to gambling risk because relatively clearly defined subgroups of gamblers experience problems due to gambling, and gambling decision making, and gamblers with more severe problems demonstrate a higher rate of cognitive errors and biases in general (e.g., overestimating the probability of winning and the capacity to control the outcome of games) (Raylu & Oei, 2002; Ferris & Wynne, 2001). A limitation of these studies is that they do not present a complete or cohesive model of the beliefs and theories that are held by gamblers about gambling. Evidence suggests that beliefs

play a significant role in the development and maintenance of disordered gambling at least for some gamblers (Johansson, et al., 2009). That is, disordered gamblers hold a number of erroneous, biased or incomplete beliefs about gambling that help to maintain gambling despite heavy or continuous losses. Hence, the context within which gambling-related judgments are made by gamblers remains largely unexplained. This is significant because the decisions that people make when faced with a 'hazard' depend at least in part on the knowledge they hold about it (Breakwell, 2007). Gamblers' 'negative' perceptions, such as beliefs about risk, harm, and risk causality, remain largely uninvestigated within gambling.

An issue within the mental models literature with possible implications to potential gambling research is that mental models research has not previously considered motivation, or risk scenarios in which agents may have conflicting goals, and therefore how this may influence decision making. It is assumed most users of hazards are primarily motivated to safely use a hazard. In contrast, the substance addiction literature considers potential conflict between positive and negative contingencies, suggesting this may be a relevant area for further discussion.

Drug and alcohol models of risky choice

Research into drug and alcohol use has also examined how individuals perceive positive and negative potential outcomes – going further than mental models research to consider how idiosyncratic differences in the importance of different contingencies may influence decision making. A large body of biological and psychological drug and alcohol research has investigated positive and negative outcome expectancy associated with preferences over long term use (e.g., Aarons, Brown, Stice, & Coe, 2001). Research suggests that users' expectations of

potential outcomes are important to the development, maintenance and moderation of risky behaviours such as alcohol and drug use (Smith, Goldman, Greenbaum, & Christiansen, 1995), and addiction (Aarons et al., 2001; Goldberg & Fischhoff, 2000). In addition, behaviour and experience have been shown to influence risk perception. For example, longitudinal alcohol research has demonstrated both the influence of outcome expectancy on drinking behaviour, and experience on outcome expectancy (Smith et al., 1995).

A number of studies have linked overestimation of positive outcomes to increased drug and alcohol use, and riskier behaviour. For example, heavy substance users overestimated positive outcomes, exaggerated emphasis or magnified low probability outcomes, and were more likely to consider vivid, immediate positive consequences in decision making (Leigh, 1999; Slovic, Fischhoff, & Lichtenstein, 1978). Similarly and independently, underestimation of risk is also associated with increased risk taking and substance dependence (Breakwell, 2007; Oei & Jardim 2007). For example, heavy substance users were more likely to underestimate the significance of harm, personal vulnerability, and the likelihood of harmful outcomes (Jones, Corbin, & Fromme, 2001; Leigh, 1999; Lipkus, Eissenberg, Schwartz-Bloom, Prokhorov, & Levy, 2011; Weinstein 1987).

Evidence also suggests that users may hold multiple positive and negative perceptions of substance use at the same time (Oei & Jardim 2007; Smith, et al., 1995; Lipkus, et al., 2011; Jones, et al., 2001), implying individuals may negotiate conflicting motivational goals when making decisions. For example, both higher expectation of pleasure, and lower expectation of addiction, significantly and independently contributed to increased experimentation and problems with drug use (Goldberg & Fischhoff, 2000; Jones, et al., 2001). Jones and colleagues (2001) also reported that priming positive expectancies increased alcohol consumption, while

priming negative expectancies decreased alcohol consumption. However, while increasing negative perceptions reduced alcohol use, reducing positive expectancy failed to significantly change behaviour.

Certain contextual and individual factors have also been shown to influence the decision making of substance users, along with between group differences. For example, current heavy users were more likely to underreport risk and experience of harm (Magura & Kang, 1996; James, Lonczak, & Moore, 1996), based on cognitive strategies that inhibit risk perception or reporting (e.g., externalizing blame, exaggerating personal control) (Howard, et al., 2002; Peretti-Watel, 2003; Rebelo 1999), and neuro-physiological changes associated with impaired insight about risk (Goldstein, Craig, Bechara, Garavan, Childress, & Paulus, 2009; Rinn, Desai, Rosenblatt, & Gastfriend, 2002).

Addressing the gap in the gambling literature

A number of similarities between substance use and gambling addiction highlight the relevance of substance theories to future gambling research (Holden, 2010; American Psychiatric Association, 2013). For example, both substance users and gamblers report varied and potentially competing motivations for use (Binde, 2009; Clarke, Tse, Abbott, Townsend, Kingi, & Manaia, 2007; Cotte, 1997), while the relevance of particular cognitions to decisions vary depending on contextual factors and individual differences (Delfabbro & Winefield, 1999) - such as increased suppression of negative perceptions with compounding experience of harm (Magura & Kang, 1996; James, et al., 1996). Biopsychological research has also identified similarities between gambling and substance-based decision making processes such as: the presence of cravings and highs, hereditary, comorbidity, and similarities in efficacious

treatment modalities (e.g., 12-step programs, cognitive behavioural therapy) (Kessler, Hwang, LaBrie, & Petukhova, 2008). Risk perception concepts explored in the substance addiction research are therefore likely to have relevance to gamblers' decision making processes, yet have garnered little attention to date in the gambling literature.

Several issues further limit gambling decision making models, including problematic normative assumptions, descriptive rather than predictive reduction of cognitive concepts, and failure to consider the role of distinct negative and positive contingencies. Gambling models have not to date considered gamblers' explicit perceptions, beliefs or attitudes about potential negative outcomes, or how risk perception is utilised in risky decision making. Further, an integrative gambling model is needed, that avoids normative concepts of rationality, and provides scope to capture individual or subgroup variations, the diversity, intensity and importance of concepts applied by gamblers during decision making, and the contextual dependence of decision making processes.

Theories of risky choice in hazard management and substance addiction therefore highlight several factors warranting further attention in gambling theories and research methodologies: gamblers' perceptions of harmful versus beneficial outcomes (Morgan, et al., 2002), the relative significance and influence of competing motivations (Ajzen, 2011), and consideration of how contextual factors such as 'denial' mechanisms may influence risk perception and decision making (Howard, et al., 2002; Peretti-Watel, 2003; Rebelo 1999).

A particular strength of outcome expectancy research in substance use relates to the predictive power of expectancy theories compared to the 'post-hoc'-descriptive categorical systems presented in the gambling literature (e.g., Toneatto, 1999; Fortune & Goodie, 2011). That is, exaggerated estimation of positive and negative outcomes, associated with disordered

use, are likely to be useful in predicting maladaptive decision making in a manner that inconsistent ‘heuristic-bias’ models are unable to predict consistently, particularly when the influence of contextual and individual difference factors such as ‘denial’ are taken into account.

The broad aim of this thesis, therefore, is to investigate risk perception in gambling, and to present a refined model of gambling decision making, inclusive of risk perception concepts. This thesis is presented as a thesis by publication (see table 2).

Table 2
List of publications and manuscripts prepared for publication presented within the thesis

	Manuscript
Chapter 4 (study 1)	Spurrier, M. & Blaszczynski, A. (2013). Risk Perception in Gambling: A Systematic Review. <i>Journal of Gambling Studies</i> , DOI 10.1007/s10899-013-9371-z
Chapter 5 (study 2)	Spurrier, M., Blaszczynski, A., & Rhodes, P. (2014a). An expert map of gambling risk perception. <i>Journal of Gambling Studies</i> , DOI: 10.1007/s10899-014-9486-x
Chapter 6 (study 3)	Spurrier, M., Blaszczynski, A., & Rhodes, P. (2014b). Gambler risk perception: A mental model and grounded theory analysis. <i>Journal of Gambling Studies</i> , DOI 10.1007/s10899-013-9439-9.
Chapter 7 (study 4)	Spurrier, M., Blaszczynski, A., & MacCann, C. (<i>To be submitted</i>) Development of the Gambling Risk Decisions Questionnaire and a Risk Decision Model of Gambling Disorder

Chapter four systematically reviews risk perception evidence in the gambling literature, highlighting important further areas of research. Chapters five and six examine the role of risk perception in gambling based on qualitative investigation guided by mental models and grounded theory methodologies (Morgan, et al., 2002). Chapter five investigates factors directly influencing perception of risk in gambling, while chapter six investigates factors influencing how risk perception data is used to make decisions. Chapter seven quantitatively

examines the contribution of direct and indirect risk perception factors on gambling decision making using a self-report questionnaire methodology. Chapter eight proposes a gambling risk decision model summarizing the role of risk perception in decision making, how gambling decision making operates, and in what circumstances individuals may become disordered gamblers. Chapter nine summarizes implications for gambling theory and intervention, future directions, and the limitations of the current studies.

CHAPTER 4: Risk Perception in Gambling: A Systematic Review

This chapter was accepted for publication in the *Journal of Gambling Studies*.

Reference:

Spurrier, M. & Blaszczynski, A. (2013). Risk Perception in Gambling: A Systematic Review.

Journal of Gambling Studies, DOI 10.1007/s10899-013-9371-z

Introduction

Gambling is a widely available, commonly accessed hazard, associated with significant social costs (Productivity Commission, 2010). Yet, only some individuals gamble long enough, or with large enough sums, that they experience significant harm (Walker, 2005). A large body of research argues that attitudes, perceptions and beliefs about risk play an important role in risky behaviour (Breakwell, 2007; Glanz, Rimer, & Viswanath, 2008; Binde, 2009). Understanding how gamblers perceive risk is likely to be important in understanding why specific subgroups of gamblers expose themselves to gambling-related harm (Johansson, Grant, Kim, Odlaug, & Gotestam, 2009).

Risk perception, decision-making and gambling behaviour

A key feature of gambling is that it involves risky choice, in that outcomes are typically both uncertain, and potentially harmful. Evidence from risk and health behaviour research suggests that when faced with risky choices, agents' perceptions of risk play a significant role in determining intention, and subsequent behaviour (Ajzen, 2011; Breakwell, 2007; Morgan, Fischhoff, Bostrom, & Atman, 2002; Oei & Jardim, 2007; Siegrist, Keller, & Kiers, 2005). Central to risky choice and behaviour is how agents perceive critical risk parameters: the range of potential outcomes; the meaning of potential outcomes; and factors that determine the likelihood of outcomes (e.g., the agents' cognition, and behavioural control, or game mechanics determining probability) (Ajzen, 2011; Weber, Blais, & Betz, 2002).

In uncertain systems, agents must estimate one or more of the parameters defining outcomes. By its nature, such estimation is open to error. Estimation may relate to parameters determining outcomes, e.g., the likelihood of one side of a die facing up instead of another.

However, estimation may also be involved in the interpretation of potential outcomes (Campbell, 2006). That is, individuals may accurately or inaccurately perceive the potential impact of particular outcomes, such as the harm caused by losing a wager, or series of wagers.

Risky choice may expose people to harm, via underestimation of risk related to how outcomes are determined, error in the meaning assigned to outcomes, or through conscious engagement with risk-bearing systems. However, while agents may knowingly make choices that carry risk of negative consequences, the accuracy of risk estimation in itself may have important consequences for behaviour related to hazards (Breakwell, 2007). Understanding how agents estimate risk parameters, and how estimations are used in decision-making and behaviour, is important in assisting people to safely negotiate hazards. An empirically-based understanding of gambling risk-perception would be useful for guiding treatment or developing preventative education for individuals who experience harm as a result of systematic errors in risk estimation. What then does the existing literature tell us about how individuals perceive gambling-related risk parameters, and the role of risk perception in choice and behaviour?

Risk and positive perception of gambling

Research suggests that users' expectations of potential outcomes are important to the maintenance or moderation of risky behaviours such as alcohol (Oei & Jardim, 2007; Smith, Goldman, Greenbaum, & Christiansen, 1995); and drug use (Aarons, Brown, Stice, & Coe, 2001; Julie Goldberg, & Fischhoff, 2000). Similarly, cognitive research in gambling has shown that gamblers' perceptions about risk play a significant role in gambling behaviour. Gamblers hold preferences (Lee, Chae, Lee, & Kim, 2007; Binde, 2009) and make predictions (Fortune & Goodie, 2011) about particular game outcomes.

Gamblers report different motivations for engaging in, or avoiding gambling (Clarke et al., 2007). Preferences for particular outcomes are reflected in idiosyncratic motivation for gambling. When gambling, individuals or subgroups appear to be differentially motivated by potential outcomes, such as: winning money (Rosecrance, 1985); the 'dream' of a substantial win (Cotte, 1997); intellectual challenge (Cotte, 1997; Lee, et al., 2007); emotion regulation (Shead, Callan, & Hodgins, 2008); avoiding loss (Hing & Breen, 2008); and social rewards (Cotte, 1997; Lee et al., 2007).

In addition, gamblers hold detailed representations of the causality within gambling systems. Causal representations of gambling operations have been examined in the literature in the form of explicit beliefs about: luck (Wohl, 2008; Wood & Clapham, 2005); determinism (Joukhador, Blaszczynski, & Maccallum, 2004); strategies for playing (Luengo et al., 2000); and the perceived impact that the gambler has on game-play and outcomes (Jacobsen, Knudsen, Krogh, Pallesen, & Molde, 2007; Myrseth, Brunborg, & Eidem, 2010).

Evidence suggests that there is considerable individual variation in perceptions of gambling-related preference (Clarke et al., 2007; Shead et al., 2008) and causality (Delfabbro, 2004). Further, some types of perceptions about gambling have been explicitly linked to disordered gambling (Toneatto, 1999). For example, more preoccupied, disordered gamblers were both: more likely to perceive gambling as a means of escape from stress or problems (Clarke, et al., 2007) or augmentation of positive mood states (Shead, et al., 2008); and, more likely to overestimate skill (Fortune & Goodie, 2011), and the chance of positive outcomes (Delfabbro, 2004). Such research provides evidence of a relationship between risk perception, motivation, and gambling although it does not provide sufficient data for a comprehensive model of how individuals think and behave in relation to perceived gambling risk.

Highly-cited reviews (e.g., Crockford & el-Guebaly, 1998; Goudriaan, Oosterlaan, de Beurs, & Van den Brink, 2004; Raylu & Oei, 2002; Toneatto, Blitz-Miller, Calderwood, Dragonetti, & Tsanos, 1997), and models (e.g., Blaszczynski & Nower, 2002; Sharpe, 2002) of gambling typically discuss gambling cognitions in relation to: beliefs or heuristics related to overestimation of either the likelihood of positive outcomes; the gamblers' capacity to favourably control outcomes; or both. However, gambling models have not to date included consideration of gamblers' explicit perceptions, beliefs or attitudes about potential negative outcomes. Representing risk perception in this way fails to include important components of perception and choice, according to many, well-supported models of risky choice across other disciplines, e.g., the Theories of Planned Behaviour and Reasoned Action (Ajzen, 2011; Albarracin, Johnson, Fishbein, & Muellerleile, 2001); the Health Belief Model (Glanz et al., 2008), The Psychometric Paradigm of Perceptions of Hazards (Siegrist et al., 2005), the Mental Models approach (Morgan et al., 2002); and Choice theory (Skog, 2000).

Theories of risky choice highlight several factors warranting further attention in gambling theories such as gamblers' perceptions of beneficial versus harmful outcomes (Morgan et al., 2002), the risk of harmful outcomes (Glanz et al., 2008), and the meaning of outcomes (Ajzen, 2011); and influence between risk perception, motivation and behaviour. The aim of this systematic review was to evaluate existing evidence related to: gamblers' perceptions of gambling risks and harms; and the relationship between risk perception and behaviour. Specifically, we attempted to determine what research tells us about: (1) the harmful outcomes gamblers expect from gambling; (2) the role of gambling outcome expectations in decision-making and behaviour; and (3) cognitive factors that moderate relationships between outcome perception and choice behaviour.

Method

A literature search was conducted using the electronic databases MEDLINE, PsycINFO, Web of Science, and Google Scholar were searched using keywords: 'risk*', 'harm*', and 'outcome*', combined with 'gambling'. There were no limits placed on the years for searched articles. All subject headings were auto-exploded to broaden the search for relevant studies. Article reference lists were reviewed to identify research not captured in the initial screening process.

Studies were included if they made reference to: perception of negative or harmful consequences of gambling; perception of risk or likelihood of potentially harmful consequences of gambling; appraisal or comparison of different gambling outcomes.

Studies were excluded if they: did not include human participants; were not published in English; were not available as full-text (e.g., published conference abstracts with no associated article); or were not published in a refereed format (excluding government reports). Studies were not included if they were limited to discussion of only: risks or harms to society or non-gamblers (e.g., family members of gamblers); perceptions of purely beneficial consequences of gambling; general attitudes about gambling; non-gamblers' perceptions of risks or harms (e.g., expert opinion, general public sample); examination of past, but not current or future-oriented gambling consequences.

In all, 2,814 articles were identified through the search strategy. Titles and abstract were reviewed to determine the relevance of studies to the inclusion and exclusion criteria. Eighty-four articles were retained and read in full. Of these articles, four were excluded Articles meeting inclusion criteria (as described above) were retained and reviewed in detail.

Results

Of the 2,814 articles identified, 2743 articles did not examine perceptions of gambling risk or consequence, 36 were replicated titles, 7 were not peer-reviewed, and 12 addressed perceptions of gambling by non-gamblers. 16 studies met criteria for inclusion, and their characteristics are summarized in Table 3.

Year of publication ranged from 2003 to 2012. Of the 16 articles reviewed, three were carried out in Australia, four in Canada, three in China, one in Switzerland, one in the UK, and four in the USA. Eleven studies included some measure of gambling behaviour (e.g., self-report of gambling activity or spending), psychopathology (e.g., psychometric measures such as the SOGS (Lesieur & Blume, 1987) and DSM-IV-MR-J (Fisher, 2000), or both behaviour and psychopathology. It is noted that Gillespie et al., (2007a, 2007b) published two papers using the same sample of participants, but reporting different comparative breakdown of data. Articles were analysed according to how they addressed the three aims of the review.

Table 3
Summary of articles reviewed

Author	Sample and study design	Measures #	Gambling risk perception and behavioural variables	Key findings about risk perception in gambling
(Wong & Tsang, 2012)	<p><i>Study 1:</i> N=14 (28.6% female) (M_{age}=16.5yrs, SD=0.8, Range=13-18). Purposive sampling from three public children and youth services in Hong Kong. Focus group interviews.</p> <p><i>Study 2:</i> N=258 (25.2% female) (M_{age}=16.1yrs, SD=2.0). See <i>Study 1</i>. Self-report survey.</p> <p><i>Study 3:</i> N = 1218 (43.8% female) (M_{age}=14.8yrs, SD=1.3, Range=12-18). Hong Kong public school students. Self-report survey.</p>	<p><i>Study 1:</i> Focus group interviews</p> <p><i>Study 2:</i> CAGES (38 items)</p> <p><i>Study 3:</i> CAGES (18 items) SOGS-RA</p>	<p><i>Study 1:</i> qualitative focus group interviews: expectations from gambling, including benefits and risks. Participant gambling behaviour classified based on self-report.</p> <p><i>Study 2:</i> 38-item (9 factors), forced-choice Chinese Adolescent Gambling Expectancy Scale (CAGES) measured gambling expectations.</p> <p><i>Study 3:</i> 18-item (5 factors) version of the CAGES.</p>	<p><i>Study 1:</i> two main themes emerged: positive (material gain, social benefit, enjoyment/arousal, self-enhancement, tension/boredom reduction) and negative gambling consequences (relational cost, out of control, money loss, behavioural problems).</p> <p><i>Study 2:</i> Principal Components Analysis reduced CAGES to 18 items loading on five factors (relational, social benefit, material gain, out of control, money loss).</p> <p><i>Study 3:</i> Chinese adolescents held well-formed gambling expectations. Individuals with greater gambling involvement reported higher expectations of positive outcomes (social benefit and material gain) and some negative outcomes (being out of control); reported weaker expectations of other types of negative outcomes (relational costs, money loss).</p>
(Tao, Wu, Cheung, & Tong, 2011)	<p>N=791 (42.2% female) (Age\geq18 yrs). Chinese-speaking Macau residents; gambled in the last 12 months. Telephone numbers randomly selected from Residential Telephone Directory. Standardized telephone self-report survey.</p>	<p>GMAB*</p>	<p>110-item, forced-choice Gambling Motives, Attitudes and Behaviour (GMAB) scale for Chinese gamblers measured: superstitious beliefs; techniques for winning; behavioural control; arousal; involvement; DSM-IV PG symptoms; motivations to gamble. GMAB includes 10 items about perceived negative consequences of gambling; summed as single factor denoting perceived unfavourability of gambling.</p>	<p>Perception that gambling has negative consequences significantly negatively correlated with: self-worth, sensation-seeking, superstitious beliefs and behavior; gambling involvement; positively correlated with: female gender, increased age, beliefs that gambling outcomes are determined by luck, chance or fate. No significant relationship between PG and perception of negative gambling consequences.</p>

(Inglin & Gmel, 2011)	N=2500 (51.2% female) ($M_{age}=43$ yrs, Range=15-74). Random-quota sampling and interviewing using computer-assisted telephone interviewing; Switzerland.	*Attitudes scale Self-reported gambling activity and spending	Attitudes scale evaluated various attitudes to gambling: gambling policy, purpose of gambling, typical gamblers' personality. Scale includes: 1 item assessing perceived addictiveness of gambling, 7 items assessing perceived dangerousness of various games.	Gamblers compared to non-gamblers rated some games (poker, video lottery, scratch cards, lottery, sport toto) significantly less dangerous. No significant differences in perception of table games and slot machines. Gamblers compared to non-gamblers perceived gambling and tobacco as less addictive.
(Dean, 2011)	N=103 (53.4% female) ($M_{age}=21.6$ yrs, $SD=1.3$). Convenience sample of undergraduate business students; ≤ 24 yrs; some experience of blackjack; Albuquerque, USA. Self-report survey.	Socio-demographic characteristics Self-reported risk and skill related to playing blackjack	Questionnaire evaluated perceived: financial risk for an average player; personal financial risk; enjoyment of playing; personal experience; skill at playing.	Authors reported that perceived financial risk to self was both significantly correlated and significantly different to perceived risk to an average other player. Self-reported level of experience significantly associated with skill, but not risk to self. Higher perceived vulnerability to loss associated with perception of lower skill and fun.
(Wickwire, Whelan, & Meyers, 2010)	<i>Study 1:</i> N=35 (58.8% female) ($M_{age}=16.9$ yrs, $SD=0.8$, Range=16-19). High school students; Memphis, USA. 33 participants self-identified as African-American. Self-report survey. <i>Study 2:</i> N=1076 (55.9% female) ($M_{age}=16.2$ yrs, $SD=1.1$, Range=13-19). Urban, public high school students; Memphis, USA. Self-report survey.	<i>Study 1:</i> Open-ended expectancy questionnaire Fixed-list questionnaire Draft expectancy items Gambling Activity <i>Study 2:</i> Gambling Expectancies SOGS-RA	<i>Study 1:</i> Participants listed all potential outcomes of gambling; rated expectancy of outcomes identified in literature review. <i>Study 2:</i> Participants rated expectancy of 50 specific gambling outcomes (20 items from Study 1, 30 items from literature review).	Adolescents hold well-formed expectations of gambling. All five expectancy domains accounted for significant variance in gambling problems and frequency, and together accounted for a majority of variance in gambling frequency, and approximately half of variance in gambling problems. More frequent gamblers and Problem Gamblers had higher expectation of material gain, negative emotions, self-enhancement; and lower expectations of negative social consequences, parental disapproval.
(Nower & Blaszczynski, 2010)	N=1601 (49.8% female) (Range=21-79 yrs). Problem gamblers voluntarily self-excluding; Missouri casinos from 2001-2003.	Application for self-exclusion	Application for exclusion from casinos included information about: gambling involvement and behaviour (including PG status); reasons for self-exclusion (i.e., perceived negative consequences of continued gambling).	Participants across all age groups endorsed hitting rock bottom, needing help, and gaining control as three primary reasons for self-exclusion. Older adults were less likely to self-exclude because they hit rock bottom, recognized they needed help, or wanted to save their marriage or job; and more likely to self-exclude because they wanted to prevent suicide.

(Mishra, Lalumiere, & Williams, 2010)	N=240 (50% female) (<i>M</i> _{age} =20.3yrs, <i>SD</i> =1.9, Range=18-25). Canadian undergraduate psychology students. Self-report survey.	SSS-V EIS RBS Choice Task VPT BART DOSPERT PGSI Self-reported gambling activity	50 item Domain Specific Risk Taking Scale (DOSPERT; Weber, Blais, & Betz, 2002) measured risk attitudes across five domains: financial, health/safety, recreational, ethical, social. Participants rated perceived: riskiness; benefit; likelihood of engaging in activity. 'Financial' subscale included four gambling items.	PG and gambling involvement associated with greater gambling risk-acceptance, and overall risk-acceptance. Gambling risk acceptance significantly associated with risk acceptance in most other domains.
(Li et al., 2010)	N=373 (58.7% female) (Range=18-55 yrs). Macau University of Science and Technology students. Self-report survey.	Perceived risk of gambling, anticipated regret, and intention to gamble	Questions measured: perceived risk of losing, anticipated regret attached to gambling loss, intention to gamble (across 13 game types). N.B. No explicit measures of gambling behaviour or psychopathology included.	Anticipated regret, risk perception, and type of gambling significantly predicted intention to gamble in 12 out of 13 game types. Anticipated regret was more predictive of gambling intentions than gambling type, or risk perception. Higher risk perception associated with greater regret anticipation.
(Derevensky, Sklar, Gupta, & Messerlian, 2010)	N=1147 (49.9% female) (Range=12-19yrs). Secondary school students; middle-class regions of Quebec and Ontario, Canada. Self-report survey.	EGAQ* GAQ DSM-IV-MR-J	Effects of Gambling Advertising Questionnaire (EGAQ) evaluated: exposure, recall, and attitudes related to gambling and gambling advertising (including five positive attitudes, one general negative attitude)	PG compared to non-gamblers and social gamblers held more positive attitudes about gambling, and perceived gambling as less harmful. Males and older students held more positive attitudes to gambling, , and perceived gambling as less harmful.
(Orford, Griffiths, Wardle, Sproston, & Erens, 2009)	N=8880, (Range= \geq 16 yrs). Addresses randomly selected by postcode across UK regions. Standardized telephone self-report survey.	ATGS* Socio-demographic, health and lifestyle characteristics Family gambling behaviour Self-reported gambling activity PGSI DSM-IV	14-item Attitude Towards Gambling Scale (ATGS) measured: attitudes about gambling; perception of harms and benefits. Items summed as single factor denoting general favourability towards gambling.	Overall attitude towards gambling correlated with: socio-demographic status variables, gambling behaviour, health-related behaviour, gambling psychopathology. PG, 'At Risk' gamblers, and more frequent gamblers tended to hold more favourable general attitude to gambling.

(Delfabbro, Lambos, King, & Puglies, 2009)	N=2669 (49.2% female) (<i>M_{age}</i> =14.6yrs, <i>SD</i> =1.4, Range=12-17). South Australian high-school students. Self-report survey.	Perceptions of skill Understanding of objective odds Misperceptions of randomness Attitudes towards gambling Gambling habits DSM-IV-J	9-item attitudes towards gambling subscale adapted from Delfabbro & Thrupp (2003) (<i>see below</i>), summed as single factor denoting perceived unprofitability of gambling.	Adolescents had generally poor knowledge of gambling odds, chance and randomness. Adolescent PG reported significantly less 'risk aversion' than 'At Risk' gamblers, who in turn were less risk averse than non-problem gamblers. Adolescent PG compared to non-PG: were significantly less accurate in estimation of skill in chance tasks, coin sequences, EGM outcomes; more accurate about roulette odds; not significantly different in estimating odds of lottery, coin tosses, die tosses.
(Wickwire et al., 2007)	N=302 (60.6% female) (<i>M_{age}</i> =20.5yrs, <i>SD</i> =1.5, Range=18-25). Adult psychology undergraduates. Self-report survey.	Perceived availability of gambling products and services Perceived likelihood of engaging in gambling Perceived benefits of gambling Socio-demographic characteristics SOGS	Perceived harmfulness of gambling scale measured perception of general harmfulness of gambling.	No significant relationship between perception of harm and PG status; perception of availability and PG status. PGs held greater expectation of benefit from gambling.
(Gillespie, Derevensky, & Gupta, 2007a)	N=1013 (57.4% female) (<i>M_{age}</i> =14.8yrs, <i>SD</i> =1.5, Range=11-18). High school students; Montreal and Ottawa, Canada. Self-report survey.	GEQ trial items	48-item Gambling Expectancy Questionnaire (GEQ) assessed expectations of various, specific gambling consequences.	Principal Components Analysis suggested retention of 23 items: three 'positive' factors (enjoyment/arousal, self-enhancement, money); two 'negative' factors (over-involvement, emotional impact)

(Gillespie, Derevensky, & Gupta, 2007b)	Same sample as Gillespie, et al., (2007a) (<i>see above</i>). Self-report survey.	GAQ DSM-IV-MR-J GEQ	23 item GEQ, developed by Gillespie, et al., (2007a) (<i>see above</i>).	Gamblers versus non-gamblers reported different expectations about all five types of outcome. Probable Pathological Gamblers (PPGs) and at-risk gamblers more strongly anticipated positive outcomes (winning, enjoyment, self-enhancement) than social gamblers, who in turn anticipated positive outcomes more than non-gamblers. Non-gamblers expected negative emotional outcomes more than gamblers. Both PPGs and non-gamblers anticipated losing control significantly more than social, or at risk gamblers. Older adolescents more strongly endorsed the positive expectancy scale (enjoyment/arousal), and more weakly endorsed negative expectancy scale (emotional impact). Overall, males compared to females more strongly endorsed two positive expectancy scales (enjoyment/arousal and money); and more weakly endorsed one negative expectancy scale (emotional impact). For males, positive (enjoyment/arousal, self-enhancement, money) and negative (over-involvement) expectancy scales all significantly predicted gambling severity; with enjoyment/arousal the strongest predictor. For females, positive expectancies (enjoyment/arousal and money) significantly predicted gambling severity.
(Delfabbro, Lahn, & Grabosky, 2006)	N=926 (48.4% female) (<i>Age</i> =14.5yrs, <i>SD</i> =1.6, <i>Range</i> =11-19). South Australian high-school students. Self-report survey.	Gambling habits DSM-IV-J VGS Attitudes towards gambling Perceptions of skill Understanding of odds and probabilistic concepts	9-item attitudes towards gambling subscale adapted from Delfabbro & Thrupp (2003) (<i>see below</i>), summed as single factor denoting perceived unprofitability of gambling.	Adolescents had poor general knowledge of gambling odds, chance and randomness. Adolescent PGs were more optimistic about gambling than non-problem gamblers. Adolescent PG compared to non-PG: had similar overall mathematical knowledge; were significantly less accurate in understanding the randomness of a die toss; were more accurate at calculating binary odds.

(Delfabbro & Thrupp, 2003)	N=505 (53.5% female) ($M_{age}=16.5yrs, SD=0.8,$ Range=14-17). South Australian high-school students. Self-report survey.	Gambling habits Future gambling intentions Peer and family approval of gambling Attitudes towards gambling DSM-IV-J Money management and economic socialization Initial gambling experiences	12-item Attitudes towards gambling subscale assessed attitudes towards gambling. Nine items retained following Principal Components Analysis loaded on two factors: perceived unprofitability; perceived profitability.	PG and 'At Risk' gamblers compared to other adolescents perceived gambling as more profitable, and less likely to involve 'throwing money away'. Low future intention to gamble was associated with perception of gambling as: risky, not profitable, a waste of money, likely to lead to loss. Experience of early wins, higher frequency of gambling, and future intention to gamble was associated with perception of gambling as profitable.
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All studies recorded some socio-demographic data on participants (e.g., gender, age, income). Standardized questionnaire names abbreviated. Measures without acronyms represent non-standardized question batteries developed through the study. Measures of gambling pathology, behaviour and involvement highlighted in bold.

*Measure validated in summarised study. References were provided when study validating stated questionnaire has been included in this review.

PG denotes Pathological or Problem Gambler status. All articles reported findings from cross-sectional, empirical studies.

General Limitations of the gambling risk perception literature

Based on the literature review, very few studies evaluated or made reference to risk perception, in contrast to the wealth of literature addressing other forms of addiction (Ajzen, 2011; Breakwell, 2007; Glanz et al., 2008), and cognitive distortions contributing to overestimation of winning (Delfabbro, 2004; Fortune & Goodie, 2011; Jacobsen et al., 2007; Raylu & Oei, 2002). Most studies reviewed made only tangential reference to risk perception, and were limited by several common methodological issues.

First, all reviewed articles reported findings from cross-sectional empirical studies, meaning that inference could not be made about the causal influence between perception, intention and behaviour (Baron & Kenny, 1986; Weinstein, 2007). Several of the studies included indirect or no measurement of gambling psychopathology (Dean, 2011; Gillespie, Derevensky, & Gupta, 2007a; Inglin & Gmel, 2011; Li et al., 2010) or gambling behaviour (Dean, 2011; Gillespie et al., 2007a; Li et al., 2010), therefore relationships between risk perception and behaviour could not be evaluated in many of the studies reviewed.

Second, assessment of risk perception in all of the studies relied exclusively on subjective, self-report data. Gambling research has demonstrated that gamblers often deliberately misrepresent (Kuentzel, Henderson, & Melville, 2008; Rosenthal, 1986) or have poor insight into (Kuentzel et al., 2008; Yi & Kanetkar, 2010) cognitions and behaviour related to gambling. Further, many of the studies assessed risk perception constructs poorly via single (Derevensky, Sklar, Gupta, & Messerlian, 2010; Inglin & Gmel, 2011), or small numbers of specifically targeted questionnaire items (Dean, 2011; Li et al., 2010; Wickwire et al., 2007) not checked for reliability and validity via theoretically-supported statistical methods (Floyd &

Widaman, 1995). Various risk perception constructs were therefore poorly identified among many of the studies.

Finally, most studies included specific, non-representative samples due either to recruitment procedures or research goals, e.g., university students (Li et al., 2010; Mishra, Lalumiere, & Williams, 2010; Wickwire et al., 2007), adolescents (Dean, 2011; Delfabbro, Lahn, & Grabosky, 2006; Delfabbro, Lambos, King, & Pugliese, 2009; Delfabbro & Thrupp, 2003; Gillespie et al., 2007a; Gillespie, Derevensky, & Gupta, 2007b; Wickwire, Whelan, & Meyers, 2010; Wong & Tsang, 2012), self-excluding problem gamblers (Nower & Blaszczynski, 2010), and blackjack players (Dean, 2011). Many of the restrictions placed on samples (e.g., age, history and experience of gambling problems) relate to well-established risk factors associated with biased cognition or excessive gambling behaviour (Johansson et al., 2009; Raylu & Oei, 2002), limiting the relevance of research findings to specific subpopulations in many cases.

(1.) Gamblers' expectations about harmful outcomes

Expectations about harmful gambling consequences have typically been dichotomized into: (1) perceptions about relative, overall consequences (e.g., Orford, Griffiths, Wardle, Sproston, & Erens, 2009); and (2) expectations about specific types of outcome (e.g., Gillespie et al., 2007a).

Gamblers' relative expectations of harm versus benefit

Five studies have assessed the relationship between overall negative, or negative-versus-positive expectations, and gambling behaviour (Derevensky et al., 2010; Inglin & Gmel,

2011; Orford et al., 2009; Tao, Wu, Cheung, & Tong, 2011; Wickwire et al., 2007). Each study gathered relative attitudinal ratings of risks and benefits of gambling (e.g., participant agreement that 'gambling can become a problem' Derevensky et al., (2010)), compiling group mean scores that represented perception of the general harmfulness of gambling. Overall, studies provided evidence that heavier and more disordered gamblers hold more positive relative expectations of gambling. Orford et al., (2009) found that more favourable attitudes towards gambling were associated with greater time and money spent gambling, as well as problem and 'at risk' gambling status. Similarly, Derevensky et al., (2010) and Wickwire et al., (2007) reported that pathological gamblers were more likely to perceive gambling as beneficial, than non-gamblers, or social gamblers. Partial support was provided by Tao et al., (2011), who found that a perception that gambling carried negative consequences was associated with less gambling involvement, but not with pathological gambling status.

Inglin and Gmel (2011) included a single question investigating gamblers' perceptions that gambling may be addictive. In line with other 'relative attitude' studies, results suggested that gamblers compared to non-gamblers expected gambling to be less addictive, though expectations did not vary based on proportion of income spent on gambling.

Gamblers' expectations about specific types of outcomes

Four recent studies investigated gambling outcome expectancy with greater specificity than 'relative attitude' research (Gillespie et al., 2007a, 2007b; Wickwire et al., 2010; Wong & Tsang, 2012). Each study attempted to comprehensively investigate the full range of specific outcomes gamblers expect of gambling. Those who gambled excessively whether responsibly or

not at all perceived gambling expectancy differently. Overall, studies found: heavier and more disordered gamblers expected greater benefits from gambling; disordered gamblers and non-gamblers expected some harmful outcomes to a greater degree than less experienced gamblers. All four studies were limited to exclusively adolescent populations, and followed a similar methodology (related to Gillespie et al. (2007a)). Each study compiled a questionnaire assessing the most commonly expected types of outcome (based on literature review, qualitative investigation, and factor analysis); then used their questionnaire to assess outcome expectancy among groups of gamblers and non-gamblers.

Gillespie et al., (2007a) classified the most commonly expected gambling outcomes according to three positive categories (enjoyment or arousal; positive feelings of self-enhancement; financial gain) and two negative categories (over-involvement or preoccupation; negative feelings of shame, guilt, and loss of control). Gamblers versus non-gamblers reported different expectations of all five types of outcome. Probable Pathological Gamblers (PPGs) and at-risk gamblers more strongly anticipated positive outcomes (winning, enjoyment, self-enhancement) than social gamblers, who in turn anticipated positive outcomes more than non-gamblers. Non-gamblers expected negative emotional outcomes more than gamblers. However, both PPGs and non-gamblers anticipated losing control significantly more than social, or at risk gamblers. All five expectancy scales accounted for significant variance in gambling involvement, although patterns differed between males and females. For males, both positive (enjoyment/arousal, self-enhancement, money) and negative (over-involvement) expectancies significantly contributed to prediction of gambling severity; with enjoyment/arousal being the strongest predictor of gambling behaviour. For females, the predictive value of outcome

expectancies was weaker. However, positive expectancies (enjoyment/arousal and money) were significant predictors of gambling severity.

A similar, mixed pattern of expectations was found by Wong and Tsang, (2012), and Wickwire et al., (2010). Chinese Adolescents with greater gambling involvement reported higher expectations of positive outcomes (social benefit and material gain) and some negative outcomes (being out of control); but reported weaker expectations of other types of negative outcomes (relational costs, money loss) (Wong & Tsang, 2012). Wickwire et al., (2010) reported that more frequent and more problematic gambling related to more positive and negative expectations, including: greater expectancies of material gain, negative emotions, and self-enhancement; and lower expectations of negative social consequences, and parental disapproval. Wickwire et al., (2010) found that all five expectancy domains accounted for significant variance in gambling problems and frequency, and together accounted for a majority of variance in gambling frequency, and approximately half of variance in gambling problems.

Taken together, these studies suggest a complex pattern of mixed expectations, or ambivalence, among higher frequency and more disordered gamblers, with stronger expectations of positive outcomes (e.g., excitement, financial reward) and some negative outcomes (e.g., loss of control), at least among adolescents. Both positive and negative expectancies were important predictors of gambling behaviour and problems (Gillespie et al., 2007b; Wickwire et al., 2010). However, positive expectancies (particularly emotional arousal) were more influential in decision making than perception of negative outcomes (Gillespie et al., 2007b), in line with 'general attitude' research showing disordered gamblers to be more optimistic overall about their expectations of gambling.

(2.)The role of outcome expectancy in decision making and behaviour

Disordered gamblers hold more optimistic overall expectations

Despite few studies and poor identification of risk perception in some cases, 'relative attitude' research provided evidence that gamblers' expectations relate to behaviour. Specifically, that a more optimistic outlook on gambling is associated with heavier and more disordered gambling. Several possible explanations are possible for the relationship between risk perceptions and gambling. Lower relative risk estimation or awareness may expose individuals to harm, e.g., because attitudes result in poor management and overinvestment of resources (time, money). Alternatively, high investment or disordered cognition may cause gamblers to under-report or lack insight about risk, based for example, on a wish to justify behaviour, or because of the greater salience of desired outcomes. Overall, cross-sectional 'relative-attitude' research alone allows little more than speculation about cognitive processes underlying beliefs, or about causal influence between cognition and behaviour (Weinstein, 2007).

Evidence from a range of sources supports the assumption that attitudes influence behaviour, and vice versa. Research has shown that poor risk estimation increased risk-taking behaviour, resulting in increased risk of harm (Breakwell, 2007). Individuals have demonstrated several types of estimation errors that result in riskier behaviour and higher rates of harm, e.g., inaccurate calculation of personal vulnerability or likelihood of harmful outcomes (Jones, Corbin, & Fromme, 2001; Leigh, 1999; Lipkus, Eissenberg, Schwartz-Bloom, Prokhorov, & Levy,

2011; Weinstein, 1987), or exaggerated emphasis on low probability outcomes, or vivid, immediate consequences (Leigh, 1999; Slovic, Fischhoff, & Lichtenstein, 1978).

Evidence from drug, alcohol, and offending research also supports the alternative, i.e., that riskier behaviour is associated with deception (Hall & Poirier, 2001; Magura & Kang, 1996); and leads to denial of harm (Auslander, 1999; James, Lonczak, & Moore, 1996) via cognitive strategies that inhibit risk perception (Howard et al., 2002; Peretti-Watel, 2003; Rebelo, 1999), and neuro-physiological changes associated with impaired insight and awareness of risk (Goldstein et al., 2009; Rinn, Desai, Rosenblatt, & Gastfriend, 2002). Although, further research is needed to clearly elucidate the influence between gambling-risk cognition and behaviour, more specific outcome expectancy research had provided preliminary evidence that expectations of gamblers may help to explain gambling behaviour.

Disordered gamblers expect a range of negative and positive outcomes

Outcome expectancy research suggests that not only do disordered gamblers hold more optimistic expectations overall, they expect a range of both positive and negative specific outcomes with differing influence on gambling behaviour.

Little research has investigated how disordered gamblers may maintain greater optimism and continued motivation to gamble, despite ambivalent expectations. Risk and addiction research suggests that individuals may continue to engage in risky behaviour due to the greater weighting of positive-over-negative outcome expectancies based on the greater personal significance or salience of positive outcomes (Goldberg & Fischhoff, 2000; Leigh, 1999; Redish, Jensen, & Johnson, 2008; Slovic et al., 1978). At least one study provided evidence that

gamblers may perceive positive expectancies to be more important than negative (Gillespie et al., 2007b).

Alternatively, automatic 'urges' to gamble may overwhelm attempts to critically evaluate the potential consequences (Grant, Brewer, & Potenza, 2006; Potenza et al., 2003). How individuals respond to mental states and environmental cues may therefore influence salience, and subsequent framing, of positive versus negative expectancies (Goldstein et al., 2009; Stanovich & West, 2008; Toplak, Liu, Macpherson, Toneatto, & Stanovich, 2007).

It is therefore possible that disordered gamblers, exposed to negative gambling experiences, learn to expect more negative outcomes than other gamblers (e.g., preoccupation), but continue to gamble due to dominant positive expectancies, automatic urges, or some combination of these factors (Baudinet & Blaszczynski, 2012). Similarly, negative expectancies among low or non-gamblers may protect individuals from gambling problems, by inhibiting motivation to engage in gambling, and thereby limited exposure to loss, problems, and conditioning processes (Blaszczynski & Nower, 2002; Jessor, 1998).

The meaning of outcomes is idiosyncratic and important to decision making

Outcome expectancy research also revealed important idiosyncratic variation in risk perception that may influence decision-making. Despite similarities in sample and methodology, outcomes identified among specific outcome studies varied considerably, and differences between samples appeared to reflect cultural differences related to sample demographics. For example, Chinese adolescents (Wong & Tsang, 2012), unlike their Canadian (Gillespie et al., 2007a) and African-American counterparts (Wickwire et al., 2010), did not identify affective and

self-referent expectancies as discrete gambling expectancies, but perceived gambling as an activity through which they may impress peers or gain approval. Such a difference in emphasis follows well-established 'value' differences between Asian and North American populations (Markus & Kitayama, 1991; Morris & Peng, 1994).

Demographic profiles of gambler risk perception further support the relevance of personal experience and individual difference in development of risk perception. Certain static demographic variables (i.e., younger age, male gender) correlated consistently with more optimistic risk perception (Derevensky et al., 2010; Gillespie et al., 2007b; Inglin & Gmel, 2011; Orford et al., 2009; Tao et al., 2011), in line with established patterns among disordered gambling (Johansson et al., 2009; Raylu & Oei, 2002). Gillespie et al., (2007b) in particular identified that, while male adolescents exhibit higher rates of disordered gambling than females, there were significant gender differences in expectations above and beyond those associated with gambling severity. For example, males more strongly expected some positive outcomes (enjoyment/arousal, money), while females were more perceptive of some harms (emotional impact).

Perception of lower risk was also associated in at least one study with other static and dynamic factors: lower education and occupational status; better general health; higher levels of drinking and smoking; lower family history of gambling problems; higher sensation seeking and self-worth; stronger belief in superstition and luck; superstitious behaviour (Derevensky et al., 2010; Orford et al., 2009; Tao et al., 2011). Overall, these findings suggest that risk perception among gamblers is not homogenous in the general population, and that particular

demographic factors (and possibly socio-cultural and cognitive-behavioural factors) predispose gamblers to develop particular beliefs associated with greater exposure to risk and harm.

No research to date has directly assessed the value individuals place on gambling outcomes. Nevertheless, evidence from four other studies further support the assertion that individual differences and context predispose gamblers to frame outcomes in particular ways, and that the meaning of outcomes play a role in expectation, motivation and risk-taking. In a study of self-excluding problem gamblers, participants reported a number of reasons for self-exclusion from casinos related to perception of the harmful consequences of gambling (e.g., 'hitting rock bottom', loss of control) along with anticipation and desire to avoid future harm (e.g., wanting to prevent suicide) (Nower & Blaszczynski, 2010). Gamblers' personal experience therefore informed their anticipation of future emotional or cognitive states, and thereby acted as a deterrent to future gambling. Similarly, Li et al., (2010) found that intention to gamble in a lay sample was predicted by both the level of regret anticipated in relation to losing a day's wages, and perception that a game was risky; with regret anticipation more predictive than risk perception of gambling intentions overall. Likewise, blackjack players found games less fun if they perceived themselves to be personally vulnerable to financial harm (Dean, 2011), while frequent and disordered gamblers were found to be more tolerant of risk than others, both overall and in relation to gambling (Mishra et al., 2010). This evidence is consistent with drug and alcohol research indicating that the meaning of outcomes to individuals is important in the way that expectations influence motivation and risk-taking. For example, 'positive' expectancies are better predictors of alcohol consumption than 'negative' expectancies. (Goldberg, Halpern-Felsher, & Millstein, 2002; Stacy, Widaman, & Marlatt, 1990).

Taken together the research discussed here suggests that gamblers may frame consequences, overall attitudes, and decisions based on what they find important or salient, in itself influenced by cultural experience (Dhillon, Horch, & Hodgins, 2011; Kim, 2012), mental state (Raylu & Oei, 2002), environmental context (Baudinet & Blaszczynski, 2012), or other individual differences.

Given the heterogeneity of outcome meaning across subgroups, the importance of meaning in motivation and behaviour, and exclusive use of lay adolescent samples; it is doubtful that measures developed in outcome expectancy studies comprehensively identify outcomes meaningful to the decision making of important gambler subgroups (e.g., disordered gamblers versus long-term, responsible non-problem gamblers). For example 'parental disapproval' (Wickwire et al., 2010) is unlikely to be one of the five most easily identifiable, important or salient outcomes for a 50 year old with a 30 year history of gambling, and comorbid mood disorder or antisocial personality traits (Milosevic & Ledgerwood, 2010).

Further, the 'value' of outcomes identified in expectancy studies may not necessarily adhere to simple 'positive-negative' polarizations, or other categorizations imposed through factor analytic modelling, and instead may vary dependent on context or individual preferences. For example, 'escape' or tension reduction is a well-established effect or goal in gambling (Rockloff & Dyer, 2006) with both positive and negative potential effects for mood and behaviour (Wood & Griffiths, 2007). Yet, during development of the Gambling Expectancy Questionnaire, Gillespie and colleagues (2007a) removed six escape/tension reduction items from their scale, due to loadings on both positive and negative emotional scales. Such an omission follows well-established statistical guidelines (Floyd & Widaman, 1995), but may have

nevertheless pre-emptively removed important information that may predict decision-making and behaviour among disordered gamblers (Lee et al., 2007).

Idiosyncratic variation in risk perception should be taken into account in cognitive-behavioural and demographic formulations of disordered gambling (Milosevic & Ledgerwood, 2010; Sharpe, 2008). Further, it is important to consider what research suggests are factors that may moderate or influence the role of risk perception in decision making and behaviour, including factors that influence the meaning of outcomes, as well as how gamblers resolve conflicting motivations and expectations.

(3.) Factors that influence the role of risk perception in decision making and behaviour

The perceived qualities of gambling outcomes

Gambling risk perception research has tended to apply positive-negative labels to anticipated outcomes on the basis of assumptions about normative belief (e.g., Gillespie et al., 2007a; Wong & Tsang, 2012). However, research suggests that a number of outcome qualities may influence what outcomes mean to individuals, such as: the impact of consequences; the likelihood of outcomes occurring; and the presence or absence of particular environmental cues and mental states.

i) The perceived impact of consequences

A number of researchers have argued that positive outcomes of addictive (Goldberg et al., 2002) or impulsive behaviours (Ainslie, 1975) are often more immediate and direct, and as a

result more powerful reinforcers and predictors of behaviour (Stacy et al., 1990). The immediacy and directness of consequences is highly relevant in gambling, where consequences vary, in terms of when and how directly outcomes affect individuals (Hing, Breen, & Gordon, 2012; Nussbaum et al., 2011; Wardle, Griffiths, Orford, Moody, & Volberg, 2012), and how different aspects of the gambling experience (e.g., sensory stimuli) reinforce cognition and behaviour (Rockloff, Signal, & Dyer, 2007). Nevertheless, no studies to date have looked directly at how gamblers' perceptions of risk are influenced by the immediacy or personal relevance of consequences.

ii) The perceived likelihood of outcomes

The importance of particular consequences may also be affected by the perceived likelihood of an event occurring. Several studies have measured the relationship between perceived risk and gambling activity. All but one of these studies (Wickwire et al., 2007), provided evidence that lower estimation of likelihood of harm was associated with higher gambling involvement (Inglin & Gmel, 2011) or psychopathology (Delfabbro et al., 2006; Delfabbro et al., 2009; Delfabbro & Thrupp, 2003; Derevensky et al., 2010), despite comparable risk estimation skills (Delfabbro et al., 2006; Delfabbro et al., 2009).

All six studies considered 'likelihood' in a general sense, referring to perception of the overall likelihood of negative outcomes, similar to 'general attitude' research. Therefore, 'overall likelihood' studies may in fact be measuring the same conceptual domain as 'general attitude' studies. Differentiating 'likelihood' from 'attitude' constructs is a difficult task. Few gambling studies have measured more than one risk perception construct among a single

experiment enabling comparison of conceptual constructs; those studies that did (Derevensky et al., 2010; E. Wickwire et al., 2007) present mixed results. Derevensky et al., (2010) for example, included questions that addressed perceived benefits, risk of long-term problems, and likelihood of beneficial outcomes, and found problem gamblers to be more optimistic across all factors. Wickwire et al., (2007) measured perceived riskiness distinct from the perceived benefit of gambling, and found problem/pathological gamblers to expect greater benefit from gambling with no differences from other groups in perceived riskiness. Therefore, one study showed perceived of the likelihood of harm to be distinct and subordinate to expectations of benefit in predicting problem behaviour (Wickwire et al., 2007), but this distinction was not necessarily consistent (Derevensky et al., 2010).

Therefore, evidence suggests that lower estimation of risk is associated with greater gambling involvement and psychopathology, but to date estimation of likelihood has not been clearly differentiated from other attitudes or beliefs about harm.

iii) The presence of perceptual cues and mental states

Investigators have also suggested that the salience and meaning of particular expectations may be influenced by subjective experience, and the presence of particular environmental cues or mental states. Gambling research highlights the importance of subjective arousal to development of disordered gambling (Baudinet & Blaszczynski, 2012). Gambling triggers states of arousal (e.g., through intermittent rewards, and sensory cues (Rockloff et al., 2007)), and individuals learn to associate arousal with environmental stimuli via classical and operant conditioning processes (Blaszczynski & Nower, 2002). Exposure to environmental

stimuli, particularly when individuals are in vulnerable mood states, may therefore come to trigger particular expectations, as well as precipitating emotional responses associated with the urge to gamble (Sharpe, 2002; Wood & Griffiths, 2007). Hence individual experiences of gambling, in conjunction with the presence or absence of particular environmental cues or vulnerable mental states is likely to impact on the salience and motivational power of particular gambling outcomes (Freidenberg, Blanchard, Wulfert, & Malta, 2002). Nevertheless research is yet to investigate the influence of psychological states or environment on gambling risk perception.

Therefore, while there is reason to believe that a number of factors may affect the perceived meaning of gambling consequences, there is limited research about how these affect gambling risk perception.

Lack of insight and resolution of conflicting expectations

Although risk assessment may be influenced by various qualities of outcomes, risk perception is also affected by individuals' knowledge or information processing in relation to gambling. Evidence suggests that particular individuals are prone to processing gambling wins and losses differently (Gilovich, 1983; Toneatto et al., 1997), and in doing so unrealistically enhancing expectations of positive outcomes (Joukhador et al., 2004). Regardless of individual differences in cognitive biases, all gamblers appear to hold poor understandings of the mechanics determining outcomes (Delfabbro, 2004; Delfabbro et al., 2009; Lambos & Delfabbro, 2007). It is likely that processing biases that inhibit awareness of harmful outcomes, along with poor insight about risk, may result in some gamblers underestimating risk and

exposing themselves to risk and harm. However, while research has explored the range of processing biases and erroneous beliefs of gamblers, no studies to date have explicitly tested the accuracy of expectations about gambling harm, beyond tests of mathematical ability.

In addition, it is likely that gamblers further expose themselves to risk through attempts to justify desire to gamble in the context of distressing expectations or conflicting cognitions. Addiction research suggests that some anticipated outcomes in risky scenarios are motivating enough that individuals become dependent on substances or activities (Freidenberg et al., 2002; Gawin, 1991; Grant et al., 2006; Toplak et al., 2007). Individuals nevertheless report regret or distress in response to perceived dependence, as well as other consequences of risky behaviours (Anderson, Sisask, & Varnik, 2011; Li et al., 2010; Yi & Kanetkar, 2011). It is likely that individuals are therefore motivated to both: continue gambling due to expected positive outcomes, and reduce negative emotions such as regret and cognitive dissonance.

Research suggests that individuals may appease conflicting motivations through behavioural change (e.g., by discontinuing gambling (Slutske, 2010; Sobell et al., 2001)) or on a cognitive level (e.g., by altering existing beliefs, adding new beliefs, or reducing the importance of a cognitive element (Cooper, 2012; Jarcho, Berkman, & Lieberman, 2011)). This process of minimising negative expectations, or bolstering positive expectations, may mean that gamblers do not take adequate steps to avoid risk. In line with these expectations, disordered gamblers have been shown to hold a mix of negative and positive unconscious expectations, but explicitly report only positive expectations (Yi & Kanetkar, 2010), implying that disordered gamblers are unconsciously denying negative outcomes, or deceptively reporting expectations.

Conclusions

Despite an extensive focus in the literature on cognitive biases and errors associated with disordered gambling, there has been a paucity of research addressing gamblers' perceptions of potential harms and risk related to gambling. The extant research provides evidence that disordered gamblers hold both: more optimistic overall perceptions of risk, and a mix of more positive and more negative specific expectations about outcomes. Despite holding more negative expectations, disordered gamblers maintain motivation to gamble, and hence we may assume that this group is discounting risks in some way, such as by attributing preferential importance to positive outcomes.

Research suggests that risk perception varies based on contextual factors or individual differences, such as gamblers' cultural experiences and exposure to gaming. A range of factors may moderate the role of risk perception in decision-making and behaviour such as the perceived qualities of anticipated outcomes, awareness of consequences, and responses to conflicting cognitions. Given potential differences in the perception of risk between various categories of gamblers, clinicians should take into account how gamblers in treatment view gambling as a risky behaviour. Improving the accuracy of such perceptions may reduce the propensity for risk-taking behaviours.

Further research is needed to identify the range of outcomes expected by important subgroups of gamblers, how gamblers interpret and use information about risk perception, and the influence of individual differences and context on gambling risk perception and behaviour.

The current literature is limited in a number of ways, related to sample specificity, cross-sectional study design, and methodological approach to the identification of risk

perception parameters. Future research should work to address these issues in study design and implementation.

CHAPTER 5: An expert map of gambling risk perception

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Introduction

Gambling is a risky behaviour associated with harmful consequences for a proportion of participants (Productivity Commission, 2010). Although evidence from studies on offending, and drug and alcohol use indicates that risk perception plays an important role in risk taking behaviors (Glanz, Rimer, & Viswanath, 2008), few studies have investigated the role played by an individual's perceptions of risk and harm in gambling (Spurrier & Blaszczynski, 2013).

Data derived from risk perception studies suggests that gamblers' perceptions of negative consequences play an important role in decision-making, behaviour, and disordered gambling aetiology (Spurrier & Blaszczynski 2013). Studies have reported the presence of a functional relationship between disordered gambling and a mix of positive ('material gain', 'social benefits') and negative expectations ('loss of control') (Gillespie, Derevensky, & Gupta, 2007; Wickwire, Whelan, & Meyers, 2010), and lower overall risk expectancies (Derevensky, Sklar, Gupta, & Messerlian, 2010; Inglin & Gmel, 2011).

Findings that gamblers maintain greater optimism about gambling, despite the experience and expectation of negative consequences (Wickwire, Whelan, West, Meyers, McCausland, & Luellen, 2007; Wong & Tsang, 2012; Yi & Kanetkar, 2010), suggest that disordered gambling cannot be fully explained by gamblers overestimating positive outcomes or personal control (Fortune & Goodie, 2011; Toneatto, 1999). Instead, both positive and negative perceptions play independent but interrelated roles in motivation and risky decision making (Wickwire, et al., 2007; Yi & Kanetkar, 2010). Disordered gamblers appear to maintain maladaptive optimism through, either, dominance in magnitude, salience, or significance of positive over negative perception, or implicit or explicit manipulation of perceptual data

(Gillespie et al., 2007; Wickwire et al., 2010). Yi and Kanetkar (2010) for example, showed disordered gamblers hold more positive and negative implicit expectations, but explicitly acknowledge only positive expectations, suggesting the implicit or explicit resolution of tension between conflicting perceptions, through implicit suppression or amplification of risk perceptions, deceptive reporting, or both.

Related drug, alcohol and offending research also suggest that stronger positive and weaker negative perceptions relate to riskier behaviour, also at times a consequence of users' manipulation of risk data. Problematic users and offenders exaggerate emphasis on low probability outcomes and vivid, immediate consequences (Leigh, 1999; Slovic, Fischhoff, & Lichtenstein, 1978), and underestimate personal vulnerability, and likelihood of harmful outcomes (Jones, Corbin, & Fromme, 2001; Lipkus, Eissenberg, Schwartz-Bloom, Prokhorov, & Levy, 2011; Weinstein, 1987). In addition, harmful users exhibit greater deception of self and others (Hall & Poirier, 2001; Magura & Kang, 1996) and denial of harm (Auslander, 1999; James, Lonczak, & Moore, 1996), employ cognitive strategies that inhibit risk perception (Howard, McMillen, Nower, Elze, Edmond, & Bricout, 2002; Peretti-Watel, 2003; Rebelo, 1999) and experience neurophysiological change associated with impaired risk awareness (Goldstein et al., 2009; Rinn, Desai, Rosenblatt, & Gastfriend, 2002).

Findings in the gambling literature are compatible with drug, alcohol and offending research. However, comparable conclusions about gambling risk perception are limited by a paucity of relevant research, and design issues potentially biasing or restricting results (cross-sectional and self-report designs, limited risk perception construct measurement, non-representative sampling) (Baron & Kenny, 1986; Spurrier & Blaszczynski, 2013; Weinstein,

2007). Therefore, despite a clear relationship between risk perception and gambling, the available research allows only limited inference about cognitive, behavioural, social, biological or environmental processes underlying risk perception and risky decision making in gambling (Spurrier & Blaszczynski, 2013; Weinstein, 2007).

The aim of this study was to investigate the perspectives of expert gambling clinicians and researchers about how disordered versus recreational gamblers perceive, interpret and use risk information in gambling decision making and behaviour.

Method

Participants

A convenience sample of eleven experts were invited to participate. Selection criteria included local and international experts identified by the second author, with gambling-specific research or clinical experience greater than four years, and specific expertise in gambler perceptions, beliefs, or appraisals. Eight participants were located in Australia, two in Canada, and one in the USA.

Three experts accepted an email invitation to participate in the first round of interviews. Six experts were subsequently recruited after preliminary data analysis was completed in order to clarify and extend emergent themes until theoretical saturation was achieved (Strauss & Corbin, 1994). Two additional interviewees were recruited post-saturation, to check if any new themes or concepts emerged (Strauss & Corbin, 1994).

Table 4 lists expert participants' descriptive information. Pseudonyms were used for all participants to protect anonymity.

Table 4
Experts' professional experience

Name	Gambling-specific & years of experience
Expert 1	Counsellor, trainer/educator, policy development >30years
Expert 2	Clinical psychologist, researcher (cognition) 7years
Expert 3	Counsellor >10years
Expert 4	Researcher (sociological factors, technology/EGMs) >10years
Expert 5	Researcher (reinforcement/behaviour, technology/EGMs) >10years
Expert 6	Clinical psychologist, researcher (cognition) >4years
Expert 7	Trainer/educator, policy development >10years
Expert 8	Clinical psychologist, trainer/educator, researcher (individual differences, sociological factors) 20years
Expert 9	Researcher (cognition, reinforcement/behaviour, risk decision-making, technology/EGMs), policy development >10years
Expert 10	Researcher (behaviour, individual differences, technology/EGMs, cognition) >10years
Expert 11	Clinical psychologist, policy development, researcher (individual differences, risk decision-making) >10years

Measures

A semi-structured interview based on a combination of Grounded Theory and Mental Models methodologies (Morgan, Fischhoff, Bostrom, & Atman, 2002; Strauss & Corbin, 1994, 1998) was used to elicit expert perspectives. Initial interview questions were open-ended and attempted to explore participants' beliefs about the content and influence of gambler risk perception cognition (see Appendix A for sample questions) (Strauss & Corbin, 1998). Coding overlapped with interviews such that as analysis developed interview content and participant selection was modified to affirm, modify, add, elaborate, clarify, and find exceptions in emerging themes (Strauss & Corbin, 1994). Interviews lasted 40-90 minutes. Six interviews were

conducted in person, four via Skype, and one by telephone. With the permission of the participants, all interviews were digitally audio-recorded and transcribed. The University of Sydney Human Research Ethics Committee approved the conduct of the study.

Procedure

The study combined the Mental Models (MM) approach to risk perception evaluation (Morgan et al., 2002), with data collection and interpretation based in Grounded Theory (GT) (Strauss & Corbin, 1994, 1998).

The MM approach aims to identify incomplete or inaccurate content in lay mental models associated with the use of specified hazards; where this content is assumed to be responsible for potentially harmful outcomes among users (Fischhoff, 1995). GT analysis enables development of a substantive theories to describe content and process in perception, decision making, or behaviour. Both the MM and GT approaches have demonstrated efficacy in the development of effective, evidence-based risk communication interventions (Jungermann, Schutz, & Thuring, 1988), and psycho-social theory (Strauss & Corbin, 1994, 1998), and were therefore deemed appropriate for investigating gambling risk perception, since gambling is a hazardous activity.

The study followed the step-by-step MM procedure outlined by Morgan et al. (2002). First, semi-structured interviews were conducted with gambling experts. Second, interview data was compiled into a comprehensive mental model 'map' that detailed vulnerability and protection factors contributing respectively to harmful or safe gambling. Within each phase, systematic overlapping processes of data gathering and analysis were used to iteratively

extend, saturate, test for exception and verify the content of mental model maps (Strauss & Corbin, 1994, 1998; Hayes, 1997).

Data analysis

NVivo qualitative data analysis software was used to apply open, axial and selective coding analyses (QSR International, Version 9; Richards, 2005; Strauss & Corbin, 1994, 1998). Coded concepts were arranged chronologically to enable processes to emerge, after which data was subject to open coding. As the interviews progressed, recurrent themes were explored in subsequent interviews to enable theoretical sampling. Conceptual relationships were assembled through a process of axial coding whereby initial categories were linked to subcategories along the lines of their properties and dimensions. Finally, selective coding integrated and refined final categories, in order to provide a detailed, complete explanation of situated gambling risk perception. Two additional participants confirmed that theoretical saturation was achieved. A comprehensive expert influence map emerged from the coding process (see Figure 1).

Controlling for bias

Several strategies were employed to reduce potential researcher bias based on Chiovitti and Piran's (2003) recommendations. Interview paradigms were initially based on open questions. The author kept notes during interview, transcription, and analysis, to detail emergent concepts and identify potential personal bias. At the same time, participants' own language was used where possible to label and describe concepts. Following initial coding, two

randomly selected interviews were blind-coded by a co-author, and used to refine coding and theory development. Finally, within-interview member checking tested interviewer interpretation of participant data. Participant statements were selected and included below to represent either typical, exemplar, or contrasting viewpoints on a particular topic.

Results

Experts' model of risk perception

Responses were consistent with the hypothesis that gambler perceptions of risk and value have adaptive or maladaptive influence on decision-making and behaviour (Spurrier & Blaszczynski, 2013). Coding of interviews with experts revealed eight major themes (represented in Figure 1 below). Three of these themes related to the core functional components of gambler risk perception content and processes:

- (1) Estimation and expectancy: beliefs or estimations about how gambling systems operate and generate outcomes combine with perception of the benefit versus cost of expected or possible event outcomes.
- (2) Meaning and motivation: perception of the meaning or value of gambling and its consequences combine with individuals' wants, motivation drives and goal seeking.
- (3) Strategic planning: understanding of how operating rules and strategies are prioritised and integrated according to internal goals.

Five additional themes described environmental and individual factors mediating or moderating relationships between risk perception, decision making and behaviour:

- (4) Reinforcement, learning and experience: exposure to gambling reinforcement schedules, and resultant cognitive changes.
- (5) Decisional context and available choice: availability, salience and sensitivity to internal and external cues.
- (6) Implicit versus explicit cognition: the comparative application and control of implicit versus explicit cognitive processes.
- (7) Ambivalence and manipulation of risk data: perception and implicit or explicit suppression or amplification of positive and negative perceptions.
- (8) Innate and developmental individual differences: experiential or dispositional differences between individuals.

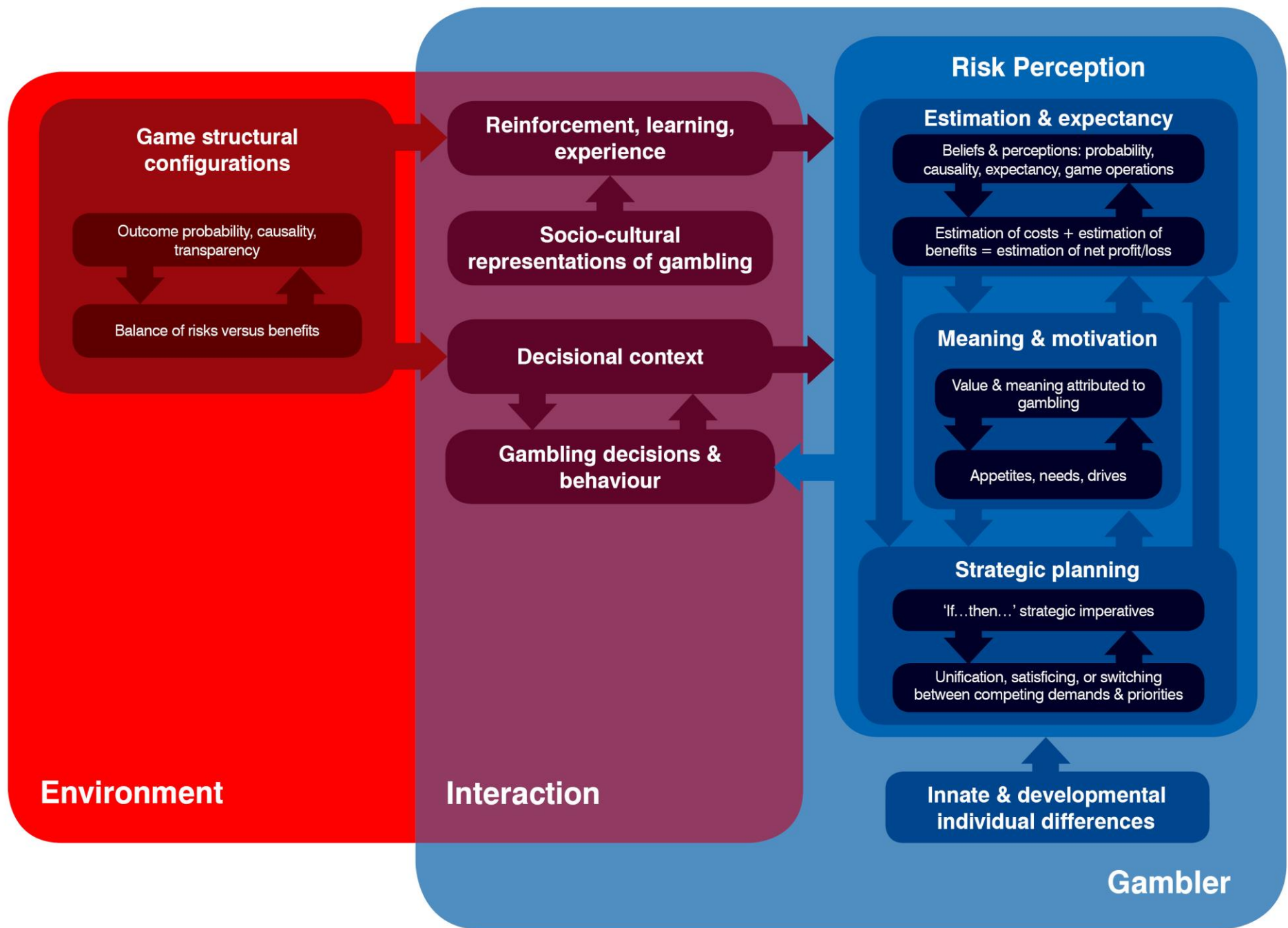


Figure 1. Expert map of gambling risk perception, decision making, and behavioural operations. Perception and decision making processes involve both implicit and explicit cognition, and may be subject to deliberate or automatic distortion or manipulation. Risky operations within the gambler's cognition or interaction with the environment may result in disordered gambling.

Themes are presented here as modular schema to enable meaningful discussion of decision-making processes. However, it is important to bear in mind that individual risk perceptions had referential overlap, that is, perceptions related concurrently to multiple themes, with aspects of risk perception potentially occurring simultaneously, sequentially, and/or with reciprocal influence during sessions of play.

Certain types of risk perception content relating to key themes were found to either increase or decrease risk of harm (summarized respectively as 'vulnerability' and 'protection factors' in Table 5 below). In the following sections, expert accounts of each of the key themes were summarized and contrasted.

Table 5

Vulnerability and protection factors associated with specific individual and environmental domains related to gambling risk perception

Domain	Vulnerability Factor	Protection Factor
Estimation & expectancy	Inaccurate risk estimation (low erudition, expectation, emphasis on negative outcomes; high erudition, expectation, emphasis on positive outcomes; inconsistent estimation; inaccurate causal understandings; overall underestimation of negative outcomes and long term loss)	Accurate or cautious risk estimation (detailed, consistent, heightened negative expectations; consistent low erudition, expectation, emphasis on positive outcomes; overestimation or accurate expectations of outcomes and long term loss)
Meaning & motivation	Low emphasis or value attributed to risk management High value attributed to risky gambling goals (e.g., winning, emotion regulation, other non-monetary goals) Difficulty resisting impulse to gamble Presence of intense urges to gamble Increasing will to manipulate risk perception (exposure to problems and consequent need for emotion regulation, avoidant coping, rationalization of gambling behaviour and its consequences)	High value attributed to risk management Low emphasis or negative attributions towards gambling Competing gambling-inconsistent goals Increasing will to decrease gambling with exposure to negative outcomes
Strategic planning	Insufficient risk management emphasis (low or inconsistent prioritization of risk management goals; failure or inconsistency setting or following sustainable limits; high prioritization of conflicting, risky goals, e.g., winning money, emotion regulation)	Consistent, high risk management emphasis (prioritization of risk management goals; consistent, cohesive, precise limit setting)
Reinforcement, learning, experience	Exposure to high value representations of gambling Significant exposure to reinforcement schedules (intermittent wins; money-independent rewarding outcomes; game configurations and events distorting perception of causality, softening punishment, or amplifying intensity or rate of rewards)	Exposure to meaningful negative consequences
Decisional context & available choice	Availability of internal or external triggers Presence of risky mental states or significant stressors (e.g., low mood)	
Implicit versus explicit cognition	Implicit reasoning problems (overuse of implicit reasoning; lack of error correction; dominance of implicit over explicit reasoning) Hypersensitivity to gambling cues (presence of risky mental states, sensitivity to internal or external triggers, presence of intense urges) Increasing automaticity of gambling with experience	
Ambivalence and manipulation of risk data	Perceptual or attentional distortion (implicit or explicit suppression of negative outcome expectancy or value, implicit or explicit amplification of positive outcome expectancy or value; deception)	Increasing awareness of probability of negative outcomes with exposure to negative outcomes
Innate & developmental individual differences	Individual differences amplifying vulnerability factors (Overvaluation and hypersensitivity to gambling rewards; hyposensitivity to punishment; vulnerability to erroneous associations; vulnerability to processing biases; poor gratification delay skills; need for emotion regulation, escape, hope, money)	Individual differences amplifying protection factors (Low valuation and sensitivity towards gambling rewards; hypersensitivity to punishment)

Functional components of gambler risk perception

Estimation and expectancy

Two experts (*Experts 9 and 10*) argued that common, contemporary models (e.g., Fortune & Goodie, 2011; Toneatto, 1999) of disordered gambling cognition lack concepts of risk perception, and only a handful of studies explicitly address outcome expectancy (see Spurrier & Blaszczynski, 2013). As a result, attempts to predict outcomes are based on only a partial picture of disordered gamblers' excessive optimism about specific aspects of gambling, such as luck, or the controllability of outcomes, without due attention to independent positively versus negatively motivating content, or contextual factors influencing decisions. Current models therefore remain "controversial", because commonly discussed gambling cognitions (e.g., the gamblers' fallacy, the availability heuristic) remain "circular" (*Expert 9*) or descriptive rather than predictive, because they lack clear guidelines for when gamblers apply particular principles.

Several experts cited evidence that gamblers hold highly idiosyncratic mental models of causality, outcome, and game structural configurations, used to estimate outcomes and make decisions (Moodie, 2007). A majority of experts cited either clinical experience or research showing the influence of both positive and negative perceptions on decision-making (e.g., Aarons, Brown, Stice, & Coe, 2001).

High attention or importance, along with accurate or overestimated estimation of risks was interpreted to lead to protective gambling choices and behaviours:

"People who are not convinced of winning, of course approach gambling, as: "I'm going to lose this, so can I afford it, and what will happen if I do?" Assessment of risk is more practiced, likely to be more accurate, and certainly more realistic in its conclusion that "I am likely to lose and therefore am I OK with losing it?"" Expert 2

In contrast, experts reported problem and disordered gamblers place low emphasis on risk evaluation, underestimate likelihood or magnitude of negative outcomes, or both:

"Problem gamblers do not put a great deal of well-considered effort into risk management." Expert 1

"There's a naive view out there that the rules of probability don't actually operate the way mathematicians think they do." Expert 4

Experts also reported that low prioritisation of risk or underestimation of risk, may be, but is not always due to over-prioritisation, or over-estimation of positive outcomes. That is, any or all of these four factors may independently contribute to increased vulnerability to harmful gambling. However, how these factors combine as overall optimism or pessimism about gambling is critically important to predicting gamblers' vulnerability to harm - this importantly relates to the meaning or value gamblers attribute to cognitions, goal-prioritisation and planning.

Meaning and motivation

The majority of expert perspectives described overvaluation of gambling and gambling outcomes as intrinsically risky, and a core, or the core feature of gambling disorder:

“Not many things are true for every single person who gambles, but I think one is they overvalue gambling as an activity. I think every single person who has a gambling problem has their perception of themselves in the world somehow out of line with reality, like their value as people... I think part of what that thinking - that cognitive distortion is - about their own values, is they over-attribute how much better they will feel about themselves if they were good at this gambling thing. I think that’s true for everybody.”

Expert 8

Over-valuation of gambling was referenced by a majority of experts who discussed two aspects of gamblers’ cognition: (1) evaluation or interpretation of gambling information, including the value and importance attributed to perceived benefits and costs (discussed above), and (2) motivation, or the goals and needs of individuals, and how this motivation related to the value attributed to anticipated outcomes. That is, how gambling outcomes are perceived to help or hinder individuals from attaining goals, and how needs or goals are prioritised by individuals ultimately determines how much motivation individuals have to gamble. Hence, evaluation and motivation were represented by experts as highly influential aspects of risk perception.

Participants argued that evaluation and motivation may influence risk perception, and hence decision making, in several harmful or protective ways. For example, evaluation of outcomes and intrinsic motivational drives lead gamblers to attend to, or value particular outcomes as important or insignificant, and based on this, prioritise particular goals in strategic planning within gambling systems - increasing vulnerability or protection from risk, depending on the type of goals prioritised.

Experts cited a number of specific examples, increasing or decreasing vulnerability to problematic or disordered gambling. Overall, high value or importance attributed to risk-management, and non-gambling life goals are likely to protect individuals from harm by leading gamblers to limit time and money expenditure. Alternatively, high value attributed to goals that failed to prioritise risk management (e.g., winning money), particularly if goals were achieved through gambling but were independent of monetary outcomes (e.g., emotion regulation), are likely to increase vulnerability to harm and disordered gambling, since these goals respectively lead gamblers to perceive expenditure on gambling as an important priority, increase sensitivity to risky cues, or gamble with low attention or importance attributed to spending.

Strategic planning

Experts cited evidence that gamblers make gambling decisions according to personal compilations of cognitive-behavioural 'if...then...' imperatives - labelled "stratagems" by one expert (*Expert 2*). Stratagem imperatives are derived from causal understanding, estimation, meaning, and motivation. Stratagems aim to achieve goals, according to gamblers'

understanding of outcome determination. Reciprocally, strategic planning may influence attention and importance attributed to risk data.

Experts typically described stratagems as dynamic and flexible, since gamblers must often unify, satisfice (attempt to meet a threshold of acceptability rather than find an optimal solution), or switch between competing or contradictory motivations, beliefs, and contextual demands. Like other aspects of risk perception, the salience and composition of stratagem content may change over the short- or long-term, according to how experiential and contextual input affects perception, motivation, and available choice.

A majority of experts made reference to at least three significant themes when discussing stratagem goals that differentiated recreational from disordered gamblers: (1) risk management, (2) winning, and (3) emotional or self-regulation.

Experts argued that preferential, consistent emphasis on risk exposure management is associated with protection from harm and disordered gambling. Gamblers may achieve this through specific strategies such as setting firm, realistic, consistent, and sustainable spending limits:

“Most people enjoy playing the pokies, but don't appear to be experiencing harm, or experience it only sporadically. They manage their risk by managing their exposure to that risk, they almost religiously refuse to get any money out, and when that's gone they go and have a drink and go home, or whatever.” Expert 4

In contrast, experts stated that gamblers leave themselves vulnerable to harm and disordered gambling if: stratagems contain erroneous, inconsistent or contradictory content; are easily influenced by contextual demands or mental states; or prefer strategic goals other than risk management - particularly 'winning' or short term monetary goals, or emotional or self-regulation. Prioritisation of non-risk-management strategies, even if only for short periods, leaves gamblers vulnerable to harm, since goal-directed behaviour becomes detached from monetary outcomes associated with gambling problems. Further, decisions may be reinforced by outcomes despite losses. For example, gamblers are likely to experience intermittent wins and motivating emotional outcomes regardless of overall loss, sustaining motivation to gamble. Emotional and self-regulation goals in particular are likely to contribute to downward spiralling into disordered gambling, since exposure to loss and problems are likely to trigger individuals to gamble to manage distress.

Factors mediating or moderating risk perception

Reinforcement, learning and experience

A majority of experts reported that various well-documented learning processes, involving exposure to sociocultural representations of gambling, and game reinforcement schedules contingent on game structural configurations (Brevers, et al., 2011), have significant, often unhelpful influence on gambler risk perception:

“We know that [games] are designed to engage people and to keep people playing with the intermittent reinforcement that is always present with gambling, and I think people's expectations become very distorted.” Expert 1

“I think the single biggest factor seems to be exposure.” Expert 4

Experts noted evidence of maladaptive distortion of risk perception processes with exposure to reinforcement, observed in neurophysiological (Brevers et al., 2011), cognitive (Toplak, Liu, MacPherson, Toneatto, & Stanovich, 2007), and behavioural change (Griffiths, 1995), results in decreased volitional control (Toplak et al., 2007), attentional biases for positive and negative outcomes (Stanovich & West, 2008), and hypersensitivity to mental states and environmental triggers associated with gambling (Baudinet & Blaszczynski, 2012). In turn, the increasing automaticity of play decreases the mindfulness with which gamblers make choices, and leads to myopic life focus and approach to problem solving (Stanovich & West, 2008; Toplak et al., 2007).

Participants argued that long term, repeated exposure to gambling is likely to lead to net loss based on structural configurations of commercially available games (Walker, 1998), and therefore also experience and awareness of negative game contingencies. Such experience was expected to be protective if it results in decreased motivation to gamble, or an increased risk management focus. However, gamblers may increase vulnerability to harm by avoiding responsibility for losses, suppressing negative perceptions, or focusing on non-monetary, ‘emotional’ reasons for gambling.

Decisional context and available choice

A majority of experts made reference to evidence, that: (1) individuals' sensitivity to contextual cues, along with the (2) contextual cues available to individuals, each influence risk perception in significant, often harmful ways (Baudinet & Blaszczynski, 2012). First, dispositional or learned sensitivities to internal and external contextual cues may trigger fluctuations in perceptions that increase vulnerability to harm. That is, gamblers exposed and sensitive to vulnerable emotional states, or other internal or environmental cues, are likely to make greater use of incidental information in decision-making, or give in to fantasies or urges to gamble, resulting in riskier choices:

"Hope can initiate a session. I mean if things are looking dire for somebody financially, if their depression is related to a financial situation, then initiating a session based on the hope of winning can occur, and then certainly within session there would still be that factor of the hope of winning." Expert 10

Second, the availability of gaming services and other environmental triggers, along with in-game structural configurations, influence the salience and motivational valence of risk perceptions that promote gambling. With exposure this may reinforce risk perceptions promoting continued gambling (Productivity Commission, 2010). Decisional context was therefore represented as potentially important to shaping and motivating increased or

continued gambling involvement, not only through the availability of behavioural options and triggers, but also by increasing individuals' preoccupation and sensitivity to environmental cues and mental states with exposure.

Implicit versus explicit cognition

Several experts cited the importance of implicit risk perception within gambling reasoning and decision-making. Gamblers may leave themselves vulnerable to harm not only via explicit reasoning errors (e.g., underestimating risk), but also by misapplying 'automatic' reasoning (e.g., applying 'pattern recognition' heuristics to random events), or ineffectively managing implicit processes with explicit reasoning (e.g., failing to inhibit implicit motivation or failing to correct implicit reasoning errors) (Coventry & Norman, 1998).

For example, common reasoning processes such as pattern recognition enable adaptive, quick judgment, but apply automatic reasoning prone to error dependent on correction by higher analyses. Gamblers that fail to apply, or:

"...suppress the natural checking and controls, or oversight, imposed by high level cognitive, cortical processes are more susceptible just to that basic instinctual low level processing, which tends to be associated with forming false associations. You know, taking unrepresentative information as being more important than it really is and those sorts of things." Expert 9

How gamblers apply and resolve conflict between implicit and explicit risk perception has important implications for accurate risk estimation, and therefore for the riskiness of decisions and behaviour.

Ambivalence and manipulation of risk data

A majority of experts outlined ways that repeated, long term gambling provides a mix of positive and negative contingencies, particularly a tendency towards overall loss interrupted intermittently by wins. Long-term gamblers responses to ambivalent or dissonant experiences and perceptions of gambling were believed to have significant implications for risky decision-making. Dominant negative perceptions motivate change or decreased gambling, likely to protect against harm. However, dominant positive perception, or difficulty accepting negative experiences, may trigger implicit or explicit strategies that amplify positive perceptions, reduce negative perceptions, or both. Gamblers may engage in mental rehearsal or fantasy around experience, blame others, or satisfice short-term goals (getting a bonus feature tonight) over long term goals (paying the rent tomorrow), or may adjust and increase the complexity of strategies rather than challenge faith in winning. Several experts noted that positive manipulation of risk perceptions may be highly motivating for gamblers with negative experiences, as a means of “neutralising their anxiety about their losses through the hope that they're going to win it back” (*Expert 6*). Alternatively:

“There’s a psychological protection that happens for people, that props up the belief that the win is going to happen for them. I think once you take it away it’s really, really scary psychological material.” Expert 8

Positive manipulation strategies however, tend to further compound problems, distress, and dependence on gambling, by underestimating risk, increasing expenditure and motivation to gamble, and de-prioritising risk management strategies, particularly if gambling is an important emotion regulation or coping mechanism for individuals.

Innate and developmental individual differences

All experts discussed evidence that individual differences predispose gamblers to: (1) develop risk beliefs, and (2) process data, in ways that are more or less protective. The important role of individual differences in shaping risk perception, means that gambler presentations are highly idiosyncratic:

“The problem I think generally that I’ve discovered with problem gamblers is that whatever theory you develop the next two or three clients will always disprove it, so I think it’s very hard to nail it down to any particular population or to any particular variable that just happens. I think it’s more a combination of variables, features that will push them in that direction.” Expert 1

Experts argued that evidence suggests “how someone gets culturally indoctrinated into a particular stream of gambling” is critical in the development of risk beliefs, and the consequent choices that gamblers make (Raylu & Oei, 2004) (*Expert 8*). Sociocultural representations of gambling contain various embedded values and causal explanations that shape decision making, by exposing individuals to particular associations with meaning. Socio-demographic background (e.g., gender, ethnicity, experience of peer and familial interaction, mental illness, or socioeconomic hardship) is therefore important in the development of implicit and explicit beliefs about gambling causality, meaning, value, and strategic choice (e.g., concepts of luck, will, or fate) (Johansson et al., 2009).

Similarly, a number of experiential and dispositional individual differences may unhelpfully influence risk perception and vulnerability to harm, according to processing differences that shape the salience and meaning of risk data. Experts cited a number of attributes that increase risky decision making, supported in the literature, such as: relative sensitivity to short-term rewards and punishment, processing biases, ability to delay gratification, emotion regulation needs, and vulnerable mental states. Such attributes are likely to influence other mediating or moderating risk perception factors, such as: individuals’ responsiveness to internal or external contextual cues, the likelihood of giving in to urges, fantasy, or deception, changeability of mental states, and the relative influences of implicit and explicit volitional control.

Discussion

The current study has several important implications for theory and treatment of gambling disorder. Expert participants cited clinical experience and research showing the importance of lack of consideration for risk to disordered gambling. Gambling theories, however, commonly reduce harmful processes to exaggerated biases or errors, exaggerating overall positive expectations (Fortune & Goodie, 2011), or single dimensions (e.g., approach/avoidance) (Nussbaum, Honarmand, Govoni, Kalahani-Bargis, Bass, Ni, & LaForge, 2011), without due attention to: important risk perception factors, e.g. attention to harmful contingencies (Gillespie et al., 2007), variation in decision making across contexts and individuals (Moodie, 2007), or interplay between perception, value attribution and other processes (Delfabbro, 2004; Delfabbro & Winefield 1999). Despite a clear role in literature addressing other risky behaviours (Goldberg & Fischhoff, 2000; Smith, Goldman, Greenbaum, & Christiansen, 1995), risk perception is referenced in only a handful of gambling studies (Wong & Tsang, 2012). It is likely therefore that more thorough investigation and integration into gambling models will improve prediction within disordered gambling models (Delfabbro & Winefield 1999).

The present study also suggests that even the more detailed picture of risk perception represented in recent 'outcome expectancy' studies (Wickwire, Whelan, & Meyers, 2010), may unhelpfully reduce cognitions to 'positive/negative' valence, or categorical 'types' (e.g., social benefit), and thereby fail to completely capture the variable role expectations play in decision making. Results suggest that gamblers attribute more personally varied meaning and value to risk perceptions, based on complex personal dispositional and experiential factors (e.g., family history), and that these varied meanings shape how risk data is used to satisfice complex,

multifaceted goals. Therefore, there is clear need for future research to investigate how risk perception and meanings vary among individuals and cultural groups.

In addition, historically, cognitive models of gambling have struggled to reliably and validly outline how observed perceptions relate to, or predict decisions. Cognitive gambling research, limited by the poor ecological validity of laboratory experiments (Rachlin, 1990; Wagenaar, 1988), controversial normative assumptions of naturalistic studies (Delfabbro, 2004), and limited utility of extant psychometric measurement (Strong, Breen, & Lejuez, 2004), nevertheless acknowledges variation in decision making across contexts (Delfabbro & Winefield, 1999) and over the short and long term (LaPlante, Nelson, LaBrie, & Shaffer, 2008). Future research is needed to explore and model how gamblers satisfy multiple, individually varied strategic goals, in the context of complex motivational, environmental, and cognitive demands (e.g., decisional context, game structural configurations, personality, implicit and explicit processing).

The findings of this study also have important implications for psycho-educative and other interventions for gambling disorder. Gambling assessment and treatment would benefit from: expanding treatment models to include multifactorial risk perception concepts; identifying and targeting personally-relevant risk belief, motivation, and strategy 'vulnerability' factors, along with relevant moderating and mediating factors; identifying and amplifying individuals' 'protection' factors; and potentially to identify holistic patterns among vulnerability and protection factors, such that, critical vulnerability factors are addressed, and protective factors are strategically employed to override vulnerability factors.

Future directions, limitations

Mental models theory outlines valuable, future steps for developing a comprehensive model of gambling risk perception and decision making, following on from the findings of this study. Specifically, expert risk concepts should be tested among lay gamblers using qualitative and quantitative methods, and this data should be used to develop tailored intervention (Morgan et al., 2002).

The themes presented in the current study focused primarily on risk perception and decision making affecting gambling behaviour, due in part to selection processes for participants and research questions. Further research regarding risky gambling decision making may also benefit from investigation of how types of factors affecting gambling behaviour that were not considered in the current study interact with risk perception and cognition to generate harm (e.g., psychobiological, sociological, or actuarial vulnerability factors for gambling disorder) (Andrews, Bonta, & Wormith, 2006).

Conclusions

Findings suggest that perception, evaluation, and utilisation of risk information may play an important role in the development of disordered gambling, powerfully mediated or moderated by individuals' location within a dispositional, socio-cultural context. The current study is the first to discuss the role of value and meaning in gambling risk perception.

CHAPTER 6: Gambler risk perception: A mental model and grounded theory analysis

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Introduction

Despite the paucity of studies and methodological limitations associated with cross-sectional and self-report data (Baron & Kenny, 1986; Weinstein, 2007), risk perception research suggests that gamblers' perceptions of negative consequences play an important role in decision-making, behaviour, and disordered gambling aetiology (Spurrier & Blaszczynski, 2013). Several studies have demonstrated a functional relationship between disordered gambling and a mix of positive ('material gain', 'social benefits') and negative expectations ('loss of control') (Gillespie, Derevensky, & Gupta, 2007; Wickwire, Whelan, & Meyers, 2010), along with lower overall risk expectancies (Derevensky, Sklar, Gupta, & Messerlian, 2010; Inglin & Gmel, 2011).

It appears disordered gamblers maintain greater optimism about gambling, despite greater experience and expectation of at least some negative consequences (Wong & Tsang, 2012; Wickwire, Whelan, West, Meyers, McCausland, & Luellen, 2007; Yi & Kanetkar, 2010), implying disordered gambling cannot simply be explained by gamblers overestimating positive outcomes, or personal control (Fortune & Goodie, 2011; Toneatto, 1999). Instead, both positive and negative perceptions independently influence perception of risk (Wickwire, Whelan, West, Meyers, McCausland, & Luellen, 2007; Yi & Kanetkar, 2010), and disordered gamblers preference or amplify positive representations of gambling, discount negative perceptions, or both, to hold more optimistic overall viewpoints consistent with motivation to gamble (Gillespie et al., 2007; Wickwire et al., 2010), presenting a picture of gambling risk perception compatible with findings in related drug, alcohol, and offending research (Goldstein, Craig, Bechara, Garavan, Childress, & Paulus, 2009; Jones, Corbin, & Fromme, 2001; Leigh, 1999; Rinn, Desai, Rosenblatt, & Gastfriend, 2002).

Study two (chapter five) applied a mental models and grounded theory methodology to develop a 'map', outlining the role of risk perception on gambling decision making and behaviour, based on experts' evaluation of relevant research and clinical experience (Morgan et al., 2002; Strauss & Corbin, 1994, 1998). The expert 'map' identified a number of factors influencing risky decision-making, relating to risk perception and how context influenced use of risk data.

The current study aimed to test this expert 'map', via interviews with regular gamblers that: detail lay risk perception concepts, compares lay concepts against expert map content, and identifies benign and maladaptive systematic gaps or errors in lay mental models of gambling held by recreational versus disordered gamblers.

Method

Participants

Fifteen regular gamblers participated in a second phase of data collection (5 females, $M_f=22.40$ years, $SD_f=3.58$ years; 10 males, $M_m=29.80$ years, $SD_m=16.53$ years, $t(13)=-.972$, $p=.349$). Participants were only included if they: spoke fluent English; were over 18 years of age; gambled at least once a week for the past two months or for any period greater than five years. Participants were invited to participate via face-to-face contact or third party referral. Three participants were recruited through gambling treatment clinics, eleven through the University of Sydney undergraduate psychology student research participation program, and one was referred by a previous participant.

Three gamblers accepted initial invitations and completed the first round of interviews. Following preliminary interview analysis, ten of thirteen further volunteers were accepted as participants based on provided demographics information, with the goal of maximally diversifying perspectives within the data. Again, two additional interviews were finally recruited at saturation, to check that no new themes or concepts emerged (Strauss & Corbin, 1998).

Table 6 lists participants' descriptive information. Pseudonyms were used for all participants to protect anonymity.

Table 6

Lay gambler descriptive and demographic information

Pseudonym	Age	Sex	Identified Ethnicity	Relationship status	Gambling experience	Gambling treatment	Recruitment	PGSI	Gambling Status
Tim	54	M	Anglo-Australian	Single	horse racing, EGMs, keno; (>5 years)	Hypnotherapy, cognitive therapy, counselling	Clinic	20	Problem
Marcel	19	M	Anglo-Australian	Never Married	EGMs		Student	3	Moderate
Simon	19	M	Lebanese-Australian	Never Married	EGMs		Student	2	Low risk
Colin	19	M	Italian-Australian	Never Married	EGMs		Student	3	Moderate
Lewis	23	M	Anglo-Australian	Living with Partner	EGMs		Student	12	Problem
Roger	20	M	Ukrainian-Australian	Never Married	EGMs, lottery		Student	2	Low risk
Gene	59	M	Anglo-Australian	Never Married	EGMs, keno; (>5 years)	Cognitive therapy	Clinic	24	Problem
Martin	19	M	Anglo-Australian	Never Married	Blackjack, EGMs		Student	13	Problem
Joslyn	19	F	Anglo-Australian	Never Married	EGMs		Student	0	Low risk
Steven	47	M	Anglo-Australian	Divorced	EGMs, horse-racing; (>5 years)	Cognitive behavioural therapy	Clinic	14	Problem
Sarah	25	F	Lebanese-Australian	Engaged	EGMs, poker; (>5 years)		Snowball	1	Low risk
Wendy	19	F	Chinese	Never Married	EGMs, pachinko, mahjong (>5 years)		Student	4	Moderate
Claude	19	M	Anglo-Australian	Never Married	Poker, EGMs		Student	6	Moderate
Susan	27	F	Korean	Never Married	EGMs		Student	2	Low risk
Victoria	22	F	European-Australian	Never Married	EGMs		Student	6	Moderate

Measures

Fourteen semi-structured interviews were conducted in person and one by telephone (Morgan, Fischhoff, Bostrom, & Atman, 2002; Strauss & Corbin, 1994, 1998). Initial interview questions were open-ended and explored participants' beliefs about the content and influence of risk perception cognition (Strauss & Corbin, 1998). Coding overlapped with interviews such that as analysis developed interview content and participant selection was modified to affirm, modify, add, elaborate, clarify, and find exceptions in emerging themes (Strauss & Corbin, 1994). Interviews lasted 30-90 minutes. With the permission of the participants, all interviews were digitally audio-recorded and transcribed.

Participants also completed a demographics questionnaire and the Problem Gambling Severity Index (PGSI; Ferris & Wynne, 2001). The demographics questionnaire gathered details about: age, gender, ethnicity, and relationship status, gambling and gambling treatment experience. The PGSI is a nine-item self-report subscale of the Canadian Problem Gambling Index (CPGI; Ferris & Wynne, 2001) measuring severity of problem gambling (low risk, moderate risk, or problem gambling). The CPGI has been found to be reliable (Cronbach's alpha = .84, test-retest reliability = .78) (Ferris & Wynne, 2001).

Following conventions, lay gambler participants were classified into gambling subtypes according to their PGSI scores (0-2 = non-problem/low risk gambler; 3-7 = moderate risk gambler; ≥ 8 = problem gambler), with five participants meeting criteria for each subtype (Ferris & Wynne, 2001).

Procedure

The study combined the Mental Models (MM) approach to risk perception evaluation (Morgan et al., 2002), with data collection and interpretation based in Grounded Theory (GT) (Strauss & Corbin, 1994, 1998).

Traditionally, the MM methodology has been applied to hazard evaluation on the assumption that: users are entirely motivated by safety; users hold similar mental models evaluating risk; and that risk factors follow predictable, consistent physical laws (Morgan et al., 2002). Gambling differs from hazards typically evaluated using the MM approach (e.g., radon gas, nuclear contamination, physical illness) in several important ways (Bostrom, Fischhoff, & Morgan, 1992; Maharik & Fischhoff, 1993). Gamblers may hold additional variable motivations to notions of safety, for example, winning money (Binde, 2009; Lee, Chae, Lee, & Kim, 2007). Gamblers fall into clearly identifiable subgroups of recreational and disordered users, with systematic differences in cognitive functioning, and consequently, mental models (Raylu & Oei, 2002). Similarly, evidence suggests that gambler cognition varies systematically according to: preferred game type (Blaszczynski & Nower, 2002); experience (Hodgins, 2001); and other individual differences (Johansson, Grant, Kim, Odlaug, & Gotestam, 2009; Raylu & Oei, 2002).

Strategies were employed to control for the above factors. Participants were selectively recruited to reflect a broad range of backgrounds (e.g., gender, age, socio-economic status, length of gambling career) and exposure to problems with gambling (i.e., low risk, moderate risk, or problem gambling).

The study followed the step-by-step MM procedure outlined by Morgan et al. (2002), following on from study two (chapter five). Lay gamblers completed interviews and

questionnaires to: (1) identify the content of lay risk perception, (2) compare lay concepts against an expert map (outlined in chapter five), and (3) identify systematic gaps or errors in lay mental models of gambling held by recreational versus disordered gamblers, compared to the comprehensive expert map. The University of Sydney Human Research Ethics Committee approved the conduct of the study.

Data analysis

NVivo qualitative data analysis software was used to apply open, axial and selective coding analyses (QSR International, Version 9; Richards, 2005; Strauss & Corbin, 1994, 1998). Coded concepts were arranged chronologically to enable processes to emerge, after which data was subject to open coding. As the interviews progressed, recurrent themes were explored in subsequent interviews to enable theoretical sampling. Conceptual relationships were assembled through a process of axial coding whereby initial categories were linked to subcategories along the lines of their properties and dimensions. Finally, selective coding integrated and refined final categories, in order to provide a detailed, complete explanation of situated gambling risk perception. Two additional participants confirmed that theoretical saturation was achieved.

Controlling for bias

Several strategies were employed to reduce potential researcher bias based on Chiovitti and Piran's (2003) recommendations. Interview paradigms were initially based on open questions. The author kept notes during interview, transcription, and analysis, to detail

emergent concepts and identify potential personal bias. At the same time, participants' own language was used where possible to label and describe concepts. Following initial coding, two randomly selected interviews were blind-coded by a co-author, and used to refine coding and theory development. Finally, within-interview member checking tested interviewer interpretation of participant data.

Results

Overview of lay gambler perspectives on risk perception

Gamblers' accounts of risk perception, decision-making and behaviour generally supported 'vulnerability' and 'protection' factors identified as relevant within the expert map outlined in chapter five. Table 7 outlines each participant's vulnerability and protection factors based on interview data.

Table 7
Participant vulnerability and protection factors

Pseudonym	Estimation & expectancy	Meaning & motivation	Strategic planning	Reinforcement, learning & exposure	Decisional context & available choice	Implicit vs. explicit cognition	Ambivalence & manipulation of risk data	Innate & developmental individual differences
Non-problem & low risk gamblers								
Roger	Accurate or cautious risk estimation	High value attributed to risk management Low emphasis or negative attributions towards gambling	Consistent, high risk management emphasis		Availability of internal or external triggers			
Joslyn	Accurate or cautious risk estimation	Low emphasis or negative attributions towards gambling	Consistent, high risk management emphasis		Availability of internal or external triggers			
Simon	Accurate or cautious risk estimation	High value attributed to risk management Low emphasis or negative attributions towards gambling	Consistent, high risk management emphasis					
Susan	Accurate or cautious risk estimation	High value attributed to risk management Low emphasis or negative attributions towards gambling	Consistent, high risk management emphasis					
Sarah	Inaccurate risk estimation	High value attributed to risk management Competing gambling-inconsistent goals High value attributed to risky gambling goals	Consistent, high risk management emphasis	Significant exposure to reinforcement schedules		Implicit reasoning problems		

Moderate risk gamblers

Marcel	Inaccurate risk estimation	High value attributed to risky gambling goals Presence of intense urges to gamble	Insufficient risk management emphasis		Availability of internal or external triggers	Hypersensitivity to gambling cues	
Colin	Accurate or cautious risk estimation	High value attributed to risky gambling goals Difficulty resisting impulse to gamble	Consistent, high risk management emphasis	Exposure to high value representations of gambling	Availability of internal or external triggers		Individual differences amplifying vulnerability factors
Victoria	Inaccurate risk estimation	High value attributed to risky gambling goals Difficulty resisting impulse to gamble	Consistent, high risk management emphasis		Availability of internal or external triggers		
Wendy	Inaccurate risk estimation	High value attributed to risky gambling goals	Insufficient risk management emphasis	Significant exposure to reinforcement schedules Exposure to high value representations of gambling	Availability of internal or external triggers	Hypersensitivity to gambling cues	Individual differences amplifying vulnerability factors
Claude	Inaccurate risk estimation	High value attributed to risky gambling goals	Insufficient risk management emphasis	Exposure to high value representations of gambling	Availability of internal or external triggers	Hypersensitivity to gambling cues	Individual differences amplifying vulnerability factors

Problem gamblers

Tim	*Accurate or cautious risk estimation	*High value attributed to risky gambling goals Presence of intense urges to gamble	*Consistent, high risk management emphasis	Exposure to meaningful negative consequences Significant exposure to reinforcement schedules	Availability of internal or external triggers Presence of risky mental states or significant stressors	Implicit reasoning problems Increasing automaticity of gambling with experience	*Perceptual or attentional distortion	Individual differences amplifying vulnerability factors
Steven	*Accurate or cautious risk estimation	*High value attributed to risk management Presence of intense urges to gamble	*Consistent, high risk management emphasis	Exposure to meaningful negative consequences Significant exposure to reinforcement schedules	Availability of internal or external triggers Presence of risky mental states or significant stressors	Increasing automaticity of gambling with experience	*Perceptual or attentional distortion	Individual differences amplifying vulnerability factors
Gene	*Accurate or cautious risk estimation	*High value attributed to risk management High value attributed to risky gambling goals Presence of intense urges to gamble	*Consistent, high risk management emphasis	Exposure to meaningful negative consequences Significant exposure to reinforcement schedules	Availability of internal or external triggers Presence of risky mental states or significant stressors	Increasing automaticity of gambling with experience		Individual differences amplifying vulnerability factors
Martin	Inaccurate risk estimation	Low emphasis or value attributed to risk management High value attributed to risky gambling goals Difficulty resisting impulse to gamble Presence of intense urges to gamble	Insufficient risk management emphasis	Exposure to high value representations of gambling	Availability of internal or external triggers			Individual differences amplifying vulnerability factors
Lewis	Accurate or cautious risk estimation	High value attributed to risky gambling goals Difficulty resisting impulse to gamble Presence of intense urges to gamble Increasing will to manipulate risk perception	Insufficient risk management emphasis	Exposure to high value representations of gambling	Availability of internal or external triggers Presence of risky mental states or significant stressors	Increasing automaticity of gambling with experience	Perceptual or attentional distortion	Individual differences amplifying vulnerability factors

*All three treatment experienced gamblers noted a significant shift in risk beliefs and distortions over the course of treatment from initially highly inaccurate risk perception.

The majority of non-problem/low risk gamblers consistently indicated either absence of vulnerability factors, or presence of protection factors, along with few mediating/moderating factors. Reciprocally, the majority of problem gamblers described vulnerability factors relevant all risk perception and many mediating/moderating factors. Moderate risk gambler presentations were more varied than non-problem/low risk or problem gamblers, presenting with a mix of vulnerability and protection factors relevant to both risk perception and mediating/moderating factors.

In approximately nine of fifteen cases, vulnerability or protection risk perception factors consistently correlated with each other, and matched predicted subgroup membership. That is, protective risk beliefs, evaluation, strategic planning and non-problem/low risk gambling correlated with each other; with equivalent correlations between risk perception vulnerability, and moderate/problem gambler status. In all cases, at least one vulnerability or protection factor related to expected group membership. That is, moderate risk and problem gamblers held at least one identifiable vulnerability factor, while non-problem/low risk gamblers held at least one protection factor. In describing narratives about gambling, all gamblers were able to reflect on the causal influences between risk perceptions, the role of risk perceptions in decisions, the significance of mediating/moderating factors to risk perception, and the manner in which contradictory vulnerability and protection factors overrode each other.

Gamblers varied considerably both in idiosyncratic descriptions of expert concepts, and the vulnerability and protection factors described, even among members of the same clinical subgroup. Instead, gamblers across subgroups described one or more, but never all, possible vulnerability or protection factors. A personalised 'profile' approach, incorporating a limited

number of personally relevant factors is therefore likely to be more appropriate than a general model, with vulnerability and protection factors applicable to all gamblers, or particular subgroups, contrary to common models in the literature.

Non-problem/Low Problem gamblers

Risk perception

Four of five non-problem/low risk gamblers described risk perception factors with consistent, protective or benign influence on decision making: high expectations of negative or low expectations of positive outcomes compared to other gambler groups. However, a majority of individuals did not present detailed views about possible outcomes, instead conflating expectations into a generally pessimistic attitude towards likely outcomes that reciprocally influenced meanings, evaluations and strategic planning. For example:

"I didn't really think that much about it. I just, I'm not a big fan of gambling... In the long-term, if you look at all the money you put in, you probably wouldn't have won it back... It's just a chance thing. That's why I think I don't put a lot of money on it, because there is no kind of logical way you could win". Joslyn (19, F)

"The very reason I don't play them very much is because I don't think you can really win on them." Simon, (19, M)

In the majority of cases, gamblers causal beliefs, though benign or even protective, were inaccurate or vague. For example, Roger (20, M) described vague, erroneous beliefs about gaming machine return-to-player percentage underlying pessimistic expectations and low expenditure (Harrigan, Dixon, MacLaren, Collins, & Fugelsang, 2011):

“The percentage back is really small. It's, like, under thirty percent or something, around thirty percent... It's ridiculous - twenty percent over a period...” Roger (20, M)

Nevertheless, compared to other gamblers, non-problem/low risk gamblers more frequently acknowledged subjectivity or fallibility of personal knowledge, and more clearly differentiated hopes as something distinct from expectations. For example:

“I don't believe in luck. It's more like hope because it doesn't seem to have a pattern.”
Susan (27, F)

Four of five non-problem/low risk gamblers stated that, as a consequence of expectations, motivation behind decision making emphasised risk management (e.g., limiting losses) over other non-monetary but positive motives (e.g., fun and socialising), based on consistent, pre-planned strategies that limit expenditure:

“When I'm walking into the pokies room, I just tell myself, like, ‘this is the limit’.
Whatever it is, I say, ‘twenty bucks is the max you're going to put in’. Obviously I'm

thinking about getting more beers for later. I don't think about, I know a lot of other gamblers do, I don't really think about gambling to win. I just think about, 'alright, we're just having some fun on the pokies', I'm not thinking about trying to, uh, obviously you'd like to win, but it's just for a bit of fun - something to do when you're in the pub. I've probably gone over a little bit, but it would probably only be like five or ten bucks. That'd be quite rare as well." Roger (20, M)

Overall, non-problem/low risk gamblers presented more similarly to each other than did members of other subgroups. Only one individual, Sarah (25, F), described risk perceptions that were functionally different to those so far described. Unlike other non-problem/low risk gamblers, Sarah (25, F) described an optimistic overall view of gambling, high expectation of personal control, skill, and winning, low expectation of negative consequences, with high personal importance and arousal attached to winning money and emotional outcomes, and strong emphasis on strategies aimed at winning. However, Sarah (25, F) also described strict, sustainable spending limits that overrode all other play strategies when limits were reached.

Mediating and moderating factors

A majority of non-problem/low risk gamblers were relatively less affected than other gamblers by mediating factors (that changed the influence of risk perception on decision making), or moderating factors (that partitioned risk perception variables according to their influence on decision making) (Baron & Kenny, 1986). Non-problem/low risk gamblers took greater personal responsibility for losses, with only two of five non-problem/low risk gamblers

stating that occasional rule breaking resulted in larger than planned losses, due to alcohol consumption, boredom, peer influence or other factors. Again Sarah (25, F), unlike other non-problem/low risk gamblers, described greater influence on risk perception and decision making by mediating/moderating factors, including: evidence of greater exposure to reinforcement, memory biased for positive outcomes, and mood states that triggered initiation of gambling.

Moderate risk gamblers

Risk perception

Moderate compared to non-problem/low risk gamblers described risk perceptions implying greater vulnerability to harm, though vulnerability factors appeared less consistently correlated than among problem gamblers. Four of five moderate risk gamblers admitted to similar assessments of the likelihood of negative outcomes (e.g., losing money), but also that they rarely reflected on this information when making decisions. Overall, moderate risk gamblers described more optimistic expectations, along with causal beliefs justifying riskier win-directed gambling - used in part to justify lack of reflection on negative contingencies.

Moderate and non-problem/low risk gamblers attributed similar positive qualities and goals when justifying motivation to gamble. However, moderate risk gamblers described experiences with greater emotional intensity, referring frequently for example, to the “thrill of winning” and the excitement, concentration and focus they felt while gambling (*Colin, 19, M*). Similarly, descriptions of mental rehearsal, fantasy or hope were more positive and emotional in tone, demonstrating less reflection on the mechanics determining likely outcomes:

"I think the risk of it is fun as well. It's not just about making money. It's about surprise, that element of surprise, or that element of 'it's a possibility'." Victoria (22, F)

Moderate risk gamblers also reported prioritising play strategies associated with different motivational goals than non-problem/low risk gamblers, often emphasising shorter term, specific, more immediate emotional or monetary goals over long term risk management. Like non-problem/low risk gamblers, a majority of moderate risk gamblers used behavioural rules to limit spending (e.g., playing only when in the company of peers), though often setting higher monetary limits (absolute, and as proportion of income), based on more complex, less consistent rules. For example, initially Wendy (19, F) described her strategy to limit spending as:

"Tonight I only want to spend \$200, and not spend more. You never take a card with you. Otherwise you're going to lose more." Wendy (19, F)

Although, later in her interview, she reflected on a more complex method for reaching a higher limit, based on her potential pattern of loss:

"The first time I would always take out small amounts of money, like fifties, but after that up to two hundred. If I still lose I will take the money up to five hundred. If I still lose, but not all of the five hundred, maybe four hundred, I will stop for the night. I will think 'tonight is no good'. Nobody wins all their money back all the time, so if you win once at

one place, you try a second place to see if you have good luck, but if not, then I change to another machine.” Wendy (19, F)

Mediating and moderating factors

Overall, moderate risk gamblers described less consistent, riskier decision making, both in risk perception or interpretation, and in the satisficing of goals or strategies. All moderate risk gamblers reported that decision-making may fluctuate with exposure to mental cues (alcohol intoxication, feelings of loneliness, confidence and boredom), and external cues (proximity to venues or peers, reaching preset spending limits, particular in-game events). Three of five moderate risk gamblers reported difficulty resisting the urge to gamble, even when mindful of likely negative outcomes. Common cues (alcohol, boredom, reaching spending limits) and implicit urges were reported to linger longer and be more influential on the decision making among moderate compared to non-problem/low risk gamblers, leading to spontaneous, often overwhelming urges to gamble, and prioritisation of riskier strategies (e.g., increasing bet sizes, ignoring preset spending limits, borrowing money):

“Alcohol would be my main influence, big time, especially when you're out and you're spending money. You're thinking, ‘well, this is a good idea’, at the time, ‘I might be able to make some money’. You also don't really have a bigger picture of how much you're actually losing, because you're under the influence of alcohol, and you're also enjoying yourself and having fun at the same time.” Victoria (22, F)

Three of five moderate risk gamblers described historical factors associated with increased risk of vulnerability to either harmful risk perceptions, or inconsistent decision making, such as: an early history of gambling, substantial early career wins, and normalization or high valuation of gambling by close family members (Johansson, Grant, Kim, Odlaug, & Gotestam, 2009; Raylu & Oei, 2002). Although, only one gambler reported gambling for an extended or prolonged period - in this case, more than two years.

Problem gamblers

Risk perception

All individuals meeting criteria for problem gambling described risk perception and mediating/moderating vulnerability factors. Three of five individuals (*Tim, 54, M; Gene, 59, M; Steven, 47, M*) had engaged in cognitive behavioural therapy for gambling, leading to recovery from symptoms. Treatment experienced individuals demonstrated similarities distinguishing them from other problem gamblers: personally significant problems leading to treatment seeking (e.g., suicidality, self-harm, relationship breakdown, large financial debts); beliefs, prior to treatment, that were vague or erroneous, supporting overestimation of positive outcomes, underestimation of negative outcomes, and overall excessive optimism; and, with treatment, significantly reduced positive, and increased negative expectations, decreased explicit valuation of gambling, and increased volitional control despite residual urges:

“Until [my therapist] explained it all, it was because everybody else was making a noise. It was the expectation of winning, thinking, ‘oh well, everything’s going off’, not knowing how they’re programmed, and how they work, and randomness, and probability. So it’s strange, I could walk into a pub, or a club, or sit at a poker machine by myself and just play away merrily.” Tim (54, M)

Treatment inexperienced problem gamblers (*Martin, 19, M; Lewis, 23, M*) were comparatively younger, and less experienced than other group members. Similar to treated gamblers, James described erroneous concepts of causality (overestimation of positive, underestimation of negative outcomes) related to consequent high value attributed to gambling, and risky strategising. However, Daniel, unlike other problem, and many moderate gamblers, endorsed low expectation of winning or positive outcomes, and high expectation of losing or negative outcomes.

Regardless of background and beliefs, all problem gambling group members reported gambling to regulate emotions (stimulation, excitement, boredom relief) and to win money, describing more intense motivation to play than other participants. Consequently, all problem gamblers described using strategies aimed primarily at emotion regulation and winning. Although, treatment experienced gamblers noted that they currently prioritised risk management strategies developed during treatment. Only one recovered problem gambler (*Gene, 59, M*) described attempting to use spending limits to reduce risk prior to treatment. All treated gamblers were currently abstinent or gambling at a low level, sustainable at their current income:

“The attraction's still there. It's something that I've had there for a long time in my life. I don't take drugs or anything like that. I do smoke cigarettes. I don't find myself wanting to go and get that extra fifty and go back so much, if you understand what I mean. The old [Gene] used to think of ways of going and getting some more money and returning straight away. I tend to go with what I've got and leave it at that.” Gene (59, M)

Mediating and moderating factors

Compared to low and moderate risk gamblers, problem gambling group members described greater intensity, number and influence of vulnerability factors associated with risk perception mediation/moderation. However, the relevance of particular factors varied considerably among individuals. Overall, problem gamblers described similar types of contextual influences as moderate risk gamblers (e.g., boredom, loneliness, alcohol, low mood, game events, proximity of venues and peers) though with a greater likelihood and intensity of arousing urges to gamble, and therefore with more powerful influence over gambling decisions:

“I do a lot of designated driving for my mates. If I'm there as well I might put on \$10, \$20, just because I'm not drinking so I can afford it. I don't sort of think in my head, 'I don't need to put it in, I can just save it', I say, 'I've got the money on me I may as well spend it'. It sort of lures you in a little bit. It's the way, this is the way I always thought of it, because I always think of this when I'm at home when I'm bored. Like, the way the

machines are set up to look like they're features, like a fun gaming opportunity. It's very sneaky." Martin (19, M)

"When you drink it's the worst. Alcohol just destroys your mind, you just, like, you lose all your inhibitions. You're like, 'oh, what's another \$20?'" Martin (19, M)

All group members noted changes in gambling cognition and behaviour over time, including: increasing exposure to reinforcement and negative consequences, more powerful urges to play often competing with conscious motivation, and greater mood, appraisal, and volitional fluctuation in response to contextual cues (e.g., intense feelings of regret, shame, or suicidality after losing money). Group members described higher rates of background risk factors (Johansson et al., 2009), often representative of more significant life problems predisposing individuals to vulnerable risk perceptions (e.g., substantial mental illness or trauma). Three of five group members also acknowledged that deception or denial of problems had had a significant influence over risk perceptions (e.g., amplifying positive, minimizing negative expectations), and decision-making:

"I liked the encouraging aspect of the 'random' part. I'm not a great fan of the 'probability' part. So, I'll sit there and accept the fact that I randomly I can walk into a machine, put a dollar in, and just hit one go for one credit, and the big jackpot would come up. The probability of it, being so remote, doesn't occur to me, because I see the randomness of it, so as far as you're concerned, I can accidentally trip over and just press

a button that's got two coins on it. So, I try to associate, or dis-associate I suppose, the probability from the randomness.” Tim (54, M)

Problem gambler Daniel presented a coherent, detailed narrative outlining his risk perceptions and their relationship with problematic gambling, in a similar way to many of the treated gamblers. Daniel reported that he had mostly negative memories and expectations of gambling. However, if enough time passed since his last gambling session, regret and other attributions about losses would dissipate, leaving him vulnerable to particular mental (boredom, being alone, perception of the close proximity of venues) and environmental cues (seeing gambling images), triggering positive perceptions and fantasies, increasing motivation to gamble. Daniel noted that he would then attempt to rationalise gambling, minimising negative, and amplifying positive expectations, thereby further increasing his motivation, reducing volitional control, often leading to harmful gambling sessions:

“That idea of, “maybe you could win” comes back in. And the negative feeling, maybe I push it down subconsciously, deliberately. I'm not sure. But those negative feelings sort of dissipate... I usually try and rationalise, ‘it would be good to win this money to do this’. I think I use that, more as an excuse too. But I think deep down, it's the idea of winning really big that's exciting - getting the actual jackpot or whatever... The temptation to keep playing and hopefully win just sort of wins in the end.” Lewis (23, M)

Discussion

Positive versus negative risk perceptions

Perception of 'positive' and 'negative' consequences conveyed distinct influence on decision making and behaviour. Detailed, consistent, heightened expectation of negative outcomes (e.g., losing money), and consistent, low erudition, expectation, and emphasis on positive outcomes (e.g., excitement, peer interaction), contributed independently to fewer gambling problems, while reciprocal, equivalent expectations contributed to problematic gambling. Strength of convictions was associated with level of problems, or lack thereof. A majority of gamblers outlined coherent narratives outlining content and reciprocal causal influence between gambling risk perceptions, mediating/moderating factors, decision-making, behaviour, and consequences.

Mental models and grounded theory analysis identified important between individual, and between group differences. Equivalent with the findings of this study, a number of drug and alcohol studies support the independent influence of positive and negative outcome expectancies and preferences in riskier behaviour and substance dependence, and in the reciprocal influence of substance use experience on risk perception (Aarons, Brown, Stice, & Coe, 2001; Leigh, 1999; Smith, Goldman, Greenbaum, & Christiansen, 1995). Gambling risk perception research has been limited to date, though is also broadly consistent with the current findings, and findings in related disciplines (Derevensky, et al., 2010; Inglin & Gmel, 2011; Gillespie, et al. 2007).

However, the current findings also suggest gamblers attribute meaning to risk perception in individually and contextually varied ways, incompatible with normative views of rationality (Delfabbro, 2004; Delfabbro & Winefield, 1999). Gamblers across groups described varied interpretations of behaviours, events, outcomes, causation, thought processes and content - relating interpretations to context-dependent, personally meaningful, short or long term goals. For example, Victoria (22, F, moderate risk gambler) described risk under uncertainty as exciting and positively motivating, while another gambler, Tim (54, M, problem gambler), ashamed of earlier life events, described gambling losses and problems as a means of deserved, self-inflicted punishment. Nevertheless, many gamblers noted risk and loss as important disincentives justifying careful spending limits (e.g., Joslyn, 19, F, low risk gambler). Therefore, even 'risk' itself, or loss of money, was not seen universally as an inherently 'negative' outcome. However, in the few gambling studies investigating outcome expectancy (Wong & Tsang, 2012), outcomes were typically pre-categorised, according to normative assumptions about motivational value, rather than reflecting idiosyncratic interpretation (Mischel, 2004; Moodie, 2007). Here, findings suggest that difficulties in predicting real world gambling behaviour according to current gambling decision making theories (Fortune & Goodie, 2011) may be due to unrealistic reduction, or generalisation, or that it is incorrect to assume all disordered gamblers adhere to a common set of irrational, biased or erroneous risk cognitions (Delfabbro, 2004; Rachlin, 1990).

Gamblers in the current study reported multiple, inconsistent perceptions and goals - considered simultaneously - satisficing perceived negatives (e.g., loss, financial difficulties, interpersonal conflict, guilt and shame) and perceived positives (e.g., excitement, hope,

stimulation, peer approval), to navigate multifaceted, subjective goals and scenarios. However, while research agrees gamblers may have multiple motivations for gambling (Binde, 2009), the processes by which gamblers satisfy or negotiate multiple perceptions has been largely neglected in the mental models and gambling literature (Breakwell, 2007). In contrast, here, gamblers presented coherent narratives to explain gambling behaviour under competing constraints and conditions, or else provided data that compiled into plausible formulations, even in the case of harmful or inconsistent choices, or decision making confounded by perceptual suppression or bias. For, example, non-problem/low risk gamblers tended to explain limited gambling according to conscious prioritisation of risk management over entertainment, social, winning or other goals, with the equivalent reverse situation true for more disordered gamblers.

Idiosyncratic gambler profiling

Participants' risk perception/decision making profiles were complex and idiosyncratic, with differences, even within groups, in: risk beliefs, meanings and strategizing; predisposing, experiential, or contextual factors influencing the use of risk data; and patterns of dominance among risk perception and mediating/moderating factors. Many moderate risk, and some non-problem/low risk gamblers described milder problems, and less severe vulnerabilities, while more problematic gamblers described more harmful patterns of decision making according to a broader range of more powerfully influential vulnerability factors.

Individuals' motivations and behaviours also varied across contexts, and over the course of gambling careers. For example, gamblers explained decision making variation based on

boredom, hope, guilt, uncontrollable urges, or alcohol consumption (e.g., *Lewis, 23, M, problem gambler; Tim, 54, M, problem gambler*), while treatment experienced gamblers reported shifts in estimation and consequent motivation, with downward spiral into problem gambling, and with recovery.

Findings suggest different predisposing and experiential factors lead individuals to make different decisions in different contexts - over time, or if gambling problems become more severe, problematic decision making processes may multiply and merge, compounding difficulties and making it difficult to tease apart cognitive processes responsible for problematic gambling. Current findings are consistent with research showing substantial exposure to reinforcement or problems and harmful decision making processes may interact, exacerbating and compounding problematic decision making over time, in turn leading to more comprehensive, intense problematic cognitions (Holtgraves, 2009). Meanwhile, less severe gambling problems result from fewer, less intense, more diverse risk perception vulnerabilities.

Individually varied and context dependent decision making observed here supports research highlighting, both, multiple pathways in and out of problem gambling (LaPlante, Nelson, LaBrie, & Shaffer, 2008; Milosevic & Ledgerwood, 2010), as well as probable decision making differences among disordered gamblers (Grant, Schreiber, Odlaug, & Kim, 2010; Holtgraves, 2009). The current findings suggest that these two research areas may potentially be usefully linked in an integrative understanding of gambling disorder: adding valuable decision making explanation to subtyping models (Blaszczynski & Nower, 2002), and helping to overcome the theoretical limitations of biopsychological theories of gambling (e.g., low level

gambling problems without neurophysiological biases, or lack of gambling problems with biases) (Moscrop, 2011).

Limitations and future directions

Despite following evidence-based methodological principles (Chiovitti & Piran, 2003; Morgan et al., 2002; Strauss & Corbin, 1998), it is difficult to generalise conclusions from this study, due to inevitable bias in participant and researcher viewpoints. Sampling, for example, was likely biased towards younger, university-educated, recreational gamblers, and more gambling experienced, treatment experienced, older, male problem gamblers. Analyses may also potentially over-explain uncertainty in the data (Burgess, Rhodes, & Wilson, 2013), despite analysis following an evidence based theory of gambling risk perception (outlined in detail in the previous study) (Morgan, et al., 2002). Gambler explanations throughout the study related to decision-making relationships, without control for combinatory effects among all relevant variables. Without psychometrically validated, quantitative measurement, it is difficult to reasonably infer which variables influence each another, or decisions, particularly when variables reportedly played different roles for different gamblers. Future research is therefore clearly needed to validate factors outlined here. Specifically, larger samples and mixed qualitative-quantitative data collection methods should be employed to further expand and test the findings of this study.

Conclusion

This project represents early, exploratory research, limited by the available qualitative methodology. The current study suggests development of disordered gambling may be heavily influenced by relative underestimation of risk and overvaluation of gambling, based on explicit and implicit analysis, and deliberate, innate, contextual, and learned processing evaluations and biases. Theoretical models or corrective interventions addressing estimation, expectation and evaluation of gambling may be beneficial, though researchers should be mindful of factors impinging on gamblers' capacities to accurately process risk, and explicitly control behaviour.

CHAPTER 7: Development of the Gambling Risk Decisions Questionnaire and a Risk Decision Model of Gambling Disorder

The following chapter is a reproduction of an article prepared for publication as an empirical article by Michael Spurrier, Alex Blaszczynski, and Carolyn MacCann. It has been formatted in accordance with American Psychological Association guidelines and includes some additional linking sentences and tables in order to aid comprehension in relation to other chapters of this thesis, as well as to comprehensively report findings.

Introduction

By definition, gambling involves engagement with risk, with the potential for harmful outcomes, since wagers may potentially result in loss of stakes (Walker, 1998). Common commercially available forms of gambling are typically designed so individuals do not win over long term play except in unusual circumstances (Walker, 1998) resulting in net long term losses for the majority of non-professional gamblers (Arnold, 1978; Stewart, 1989). For a subgroup of gamblers there appears to be a recurrent, persistent disconnect between positive expectations (Toneatto, Blitz-Miller, Calderwood, Dragonetti, & Tsasnos, 1997) and experience of negative outcomes (Australian Government Productivity Commission, 2010). The implication of this phenomenon is that risk perception and risky decision making is of central importance to development of a gambling disorder. Yet, despite this apparent link, understanding of the relationship between risky decision making and gambling disorder is limited by both scarcity of specifically relevant research (Spurrier & Blaszczynski, 2013) and significant methodological issues (Delfabbro, 2004; Rachlin, 1990).

Controlled laboratory experiments (Floyd, Whelan, & Meyers, 2006; Ladouceur & Sévigny, 2005) and psychometric self-report studies (Wood & Clapham, 2005; Raylu & Oei, 2004) for example, show a clear link between vulnerability to harm and cognitive errors or biases overestimating wins (Delfabbro 2004, Fortune & Goodie 2011). However, these studies typically reduce decision making to an unrealistically limited range of variables (Steenbergh, Meyers, May, & Whelan, 2002; Wood & Clapham, 2005). Except in a handful of instances (Wong & Tsang 2012; Gillespie, Derevensky, & Gupta, 2007b), studies ignore risk perception or

ecological influence on decision making (e.g., the impact of arousal differences between laboratory and real world wagering) (Walker, 1998).

Alternatively, naturalistic studies (Moodie, 2007; Coventry & Norman, 1998) demonstrate that gamblers utilise a diverse range of beliefs, interpretations, rationalizations, and strategies, depending heavily on mental states, game cues and other contextual data. However, typically these studies impose unreasonable normative demands on rationality (Stanovich, 1999), such as assuming homogeneity among the goals and convictions of participants (Delfabbro & Winefield, 1999).

Further, while a number of theoretical paradigms and models have addressed gambling disorder, clinically relevant risk decision concepts are typically either missing (Blanco, Ibanez, Saiz Ruiz, & Nunes, 2000; Bergler, 1957), incompletely considered (Toneatto et al., 1997), or presented in a manner inconsistent with functional clinical application (Goudriaan, Oosterlaan, de Beurs, & Van den Brink, 2004).

A large body of drug and alcohol research shows evaluation of harm versus benefit is critical to development and maintenance of risky behaviours (Breakwell, 2007; Oei & Jardim, 2007; Aarons, Brown, Stice, & Coe, 2001). Individuals negotiate multiple, varied, complex and conflicting goals and perceptions when making decisions about potential risks (Oei & Jardim 2007; Lipkus, Eissenberg, Schwartz-Bloom, Prokhorov, & Levy, 2011). Similarities between substance and gambling dependence in particular (e.g., cravings, highs, heredity, comorbidity, treatment) highlight the relevance of substance risk concepts to improving understanding and treatment of gambling disorder (Kessler, Hwang, LaBrie, & Petukhova, 2008; Holden, 2010; APA, 2013).

The current study therefore aimed to comprehensively test and extend previous research about risk decision making in gambling disorder (Spurrier, et al. 2013; Spurrier, et al., 2014a). Specifically, data collected in this study was used for dual purposes:

- (i) Refinement of a Gambling Risk Decisions Questionnaire assessing gambling risk decision domains and important related concepts (part 1), and
- (ii) Development of a Gambling Risk Decision Model, integrating factors associated with disordered gambling, centered on concepts of risky decision making (part 2).

Method

Participants

An invitation to participate, the questionnaire protocol, and information about the study were placed online (LimeSurvey, Version 1.91+) at a publically accessible URL address. The URL for the study was disseminated via: media release, Facebook page, posts on online gambling forums, and email invitations to universities and gambling treatment clinics in the USA, Australia, UK and Canada. First year psychology students at the University of Sydney were invited to take part in the study as part of coursework research participation requirements. A passive snowball method of recruitment was also employed. A paper version of the protocol was produced and disseminated through local gambling clinics, and made available upon request.

650 English-speaking individuals ($M_{age}=23.5$, $SD_{age}=9.3$, $Range_{age}=17-66$; $n_{male}=234$ [36.0%], $n_{female}=416$ [64%]) completed the Problem Gambling Severity Index (PGSI) and 181-item Gambling Risk Decisions Questionnaire. Seven of the participants recruited via gambling clinics completed the paper version of the questionnaires, and 487 students, and 156 other participants completed the protocol online.

Questionnaires were completed anonymously. Participants were offered the opportunity to receive an AUD\$50 grocery voucher, allocated randomly to individuals who provided contact details. Participants were allocated to one of five groups based on PGSI scores, and whether or not they gambled. Table 1 lists participants' descriptive data.

Table 8

Participant demographic data by group

	Non-gamblers	Gamblers				All gamblers
		No problems	Low risk	Hazardous	Problem	
N	248	243	114	12	33	402
Age						
<i>M</i>	19.5	26.8	22.8	28.8	29.8	25.9
<i>SD</i>	4.8	11.1	7.1	13.6	12.6	10.5
<i>Range</i>	17-58	17-66	17-52	17-55	17-60	17-66
	%	%	%	%	%	%
Gender						
<i>Male</i>	26.2	35.0	46.5	66.7	69.7	42.0
<i>Female</i>	73.8	65.0	53.5	33.3	30.3	58.0
Ethnicity / country of origin						
Australia, Pacific	33.9	62.6	50.9	66.7	57.6	59.0
Other Asia	37.9	16.9	25.4	33.3	12.1	19.4
Americas	2.0	1.6	1.8	0.0	3.0	1.7
Europe, Mid-east, other	26.2	19.0	21.9	0.0	27.3	19.8
Education						
High School	38.3	23.9	30.7	41.7	21.2	27.1
Technical college	1.2	5.3	36.8	8.3	21.2	7.0
University	60.4	77.7	22.5	50.0	57.6	66.9
Employment						
Unemployed	48.0	22.2	26.3	41.7	30.3	24.6
Casual, part-time	48.8	56.0	54.4	16.7	39.4	53.0
Full-time	3.2	21.8	19.3	41.7	30.3	22.4
Diagnosis mental health	20.6	29.2	26.3	8.3	57.6	30.1
Alcohol (standard drinks/wk)						
0	59.6	24.5	19.6	45.5	32.1	24.3
1-5	31.0	43.2	50.5	27.3	28.6	43.7
6+	9.4	56.8	29.9	27.3	39.3	56.3
Gambling pattern						
No gambling	100.0	-	-	-	-	-
Limited to a few events	-	62.5	48.3	0.0	9.1	51.6
Decreased	-	18.5	14.9	33.3	12.1	17.6
Remained constant	-	14.4	15.8	16.7	6.1	14.4
Increased	-	1.6	4.4	25.0	33.3	5.8
Clusters, binges, fluctuated	-	2.9	16.7	16.7	39.5	10.6
Ever tried to stop gambling	-	12.0	13.0	33.3	51.5	16.6

Measures

The Problem Gambling Severity Index (PGSI; Ferris & Wynne, 2001)

The PGSI nine-item self-report subscale of the Canadian Problem Gambling Index (CPGI; Ferris & Wynne, 2001) was used to assess the severity of problems associated with gambling. The CPGI has been found to be reliable (Cronbach's alpha = .84, test-retest reliability = .78) (Ferris & Wynne, 2001). Participants were classified into gambling subtypes according to their PGSI scores (0 = non-problem gambler; 1-4 = low risk gambler; 5-7 = hazardous gambler; ≥ 8 = problem gambler) based on conventions set out by Currie, Casey & Hodgins (2010).

Currie and colleagues (2010) demonstrated this scoring procedure improved clinical discrimination compared to previous PGSI scoring rules outlined by Ferris and Wynne (2001), better capturing the gradient of problem gambling severity ranging from non-problem to problem (Holtgraves, 2009).

The Gambling Risk Decision Questionnaire (GRDQ)

To assess gambling risk decision making, a self-report instrument was developed by the researchers. The GRDQ aimed to extensively identify, test and confirm concepts identified as important by the authors through prior research addressing gambling risk perception and decision making (Spurrier & Blaszczynski, 2013; Spurrier, et al., 2014a, 2014b).

The GRDQ was constructed in the following manner. An initial pool of 211 draft items were compiled targeting concepts identified through systematic review of the gambling literature (Spurrier & Blaszczynski, 2013), and two qualitative studies by the authors (Spurrier,

et al., 2014a, 2014b). Draft items were submitted to 14 content reviewers to examine face and content validity, completion time, clarity, comprehensibility, logical flow, appropriateness, and utility (Spurrier & Blaszczynski, 2013; Spurrier, et al., 2014a, 2014b). Reviewers included a convenience sample of lay gamblers and non-gamblers, and professional researchers with expertise in research methods, assessment tool design, and statistical modelling. Reviewer feedback suggested 58 items were ineffectively worded, and 54 items were redundant. Consequently, 44 items were dropped, 68 items modified, 14 items added, and question order rearranged, reducing the questionnaire to 181 items. Five key areas were evaluated by the questionnaire (described below).

Gambling behaviour (frequency or intensity)

Initial screening indicated that two items assessing behaviour, current gambling frequency and length of sessions, had moderate to strong relationships with PGSI score ($r=.547$, $p<.001$ and $r=.493$, $p<.001$, respectively), and with each other ($r=.604$, $p<.001$). Individual question scores were therefore combined as a mean score indicating current gambling involvement ($\alpha=.75$).

Background individual differences

Twenty forced-choice items assessed the presence or absence of several well-established dynamic or static risk factors for gambling disorder, including both demographic risk factors (age, gender, ethnicity, level of education, job status, income, mental health diagnostic and treatment history, alcohol and drug use, offending history), and exposure and type of

gambling experiences (length gambling career, early wins or losses, preferences for types of wagering, sources of gambling beliefs).

Stability of decision making across time and context

Thirteen questionnaire items assessed participants' anticipated responses to common gambling situations, events, and mental states (Baudinet & Blaszczynski, 2012). Responses were used to calculate how much individuals' decision making changed based on contextual information (Toplak, et al., 2007).

Insight and self-monitoring

Individuals' self-monitoring accuracy was estimated in the study by four items comparing individuals' reported gambling-related problems and spending, with individuals' perceptions of how their problems and spending related to the problems and spending of other gamblers (Toplak, et al., 2007; Productivity Commission, 2010).

Decision making content and processes

One hundred and thirty one items examined seven conceptually distinct aspects of the overt content of decisions, and the way that information is processed by individuals when making decisions, including:

- (1) estimation of outcome likelihood,
- (2) perception of the temporal impact of outcomes,
- (3) the perceived influence of outcomes on decision making,

- (4) personal and game causal attributions and rationalizations,
- (5) endorsement of play or risk management strategies,
- (6) the salience, frequency, and influence of thoughts, urges, biases and difficulty managing urges, and
- (7) perceived vulnerability to environmental or mental cues.

Seven separate Exploratory Factor Analyses (EFA) reduced the structure of each decision making domain. Independent Confirmatory Factor Analyses (CFA) substantiated factor structures. Factor analyses are outlined in part 1 below.

Procedure

Participants were presented with the PGSI and the 181-item GRDQ, and information outlining the purpose, format and consent for the study. The University of Sydney Human Research Ethics Committee approved the study. Data analyses and model development was conducted using the SPSS and AMOS (Version 21) software packages.

Data analysis and results

Part 1: Factor analysis refinement of decision making content and process items in the 181-item GRDQ

Exploratory factor analyses

An initial item-level screen was conducted to reduce the item pool for the seven identified decision making content and process domains. One hundred and thirty-nine items across these seven domains were drafted, each with 5-point Likert scale responses. Each construct was examined independently. Items that were unreliable (i.e., had low item-total correlations, or low factor loadings in an exploratory factor analysis) were removed. Principal axis factoring with oblimin rotation analysis was applied. Solutions were resolved according to parallel analysis and scree plot identification of potential number of factors. All possible solutions, including plus and minus one factor, were run (Preacher & MacCallum, 2003). Final solutions were selected based on conceptual integrity of factor item content, low correlations between factors, high item primary loadings ($>.30$), and low cross loadings ($<.20$) (Fabrigar, Wegener, MacCallum, & Strahan, 1999; Floyd & Widaman, 1995). Through this process, the initial pool of 139 items was reduced to 85 items loading on ten content and eight process factors (presented in table 9 below).

Table 9

Factor analysis solutions for seven decision making content and process domains

Domain / item	Factor		Communalities
Decision making 'content'			
(Domain a) estimation of outcome likelihood	1	2	
LIKELIHOOD (Financial, work, or legal problems)	.899	-.083	.762
LIKELIHOOD (Relationship difficulties, losing respect or approval from others)	.896	-.054	.772
LIKELIHOOD (Losing control)	.850	.054	.248
LIKELIHOOD (Stress, depression, anxiety, or other bad feelings)	.834	.012	.703
LIKELIHOOD (Feeling guilt, shame, or bad about who I am)	.809	-.057	.625
LIKELIHOOD (Losing money)	.475	.057	.248
LIKELIHOOD (Having fun, socializing)	-.256	.774	.525
LIKELIHOOD (Reducing boredom)	.083	.684	.515
LIKELIHOOD (Feeling excitement, feeling a 'rush')	.259	.629	.578
LIKELIHOOD (Feeling powerful, proud, or confident)	.156	.617	.473
LIKELIHOOD (Winning money)	-.195	.535	.250
LIKELIHOOD (Gaining respect or approval from others)	.134	.493	.308
(Domain b) perception of the temporal impact of outcomes	3	4	
IMMEDIACY OF IMPACT (Financial, work, or legal problems)	.968	-.094	.853
IMMEDIACY OF IMPACT (Relationship difficulties, losing respect or approval from others)	.919	-.036	.812
IMMEDIACY OF IMPACT (Losing control)	.866	.023	.771
IMMEDIACY OF IMPACT (Stress, depression, anxiety, or other bad feelings)	.929	-.031	.834
IMMEDIACY OF IMPACT (Feeling guilt, shame, or bad about who I am)	.899	-.039	.773
IMMEDIACY OF IMPACT (Losing money)	.639	.129	.510
IMMEDIACY OF IMPACT (Having fun, socializing)	-.155	.765	.487
IMMEDIACY OF IMPACT (Reducing boredom)	.045	.669	.481
IMMEDIACY OF IMPACT (Feeling excitement, feeling a 'rush')	-.052	.704	.461
IMMEDIACY OF IMPACT (Feeling powerful, proud, or confident)	.299	.521	.522
IMMEDIACY OF IMPACT (Winning money)	-.009	.611	.368
IMMEDIACY OF IMPACT (Gaining respect or approval from others)	.317	.443	.443
(Domain c) the perceived influence on outcomes in decision making	5	6	
INFLUENCE (Financial, work, or legal problems)	.841	-.007	.705
INFLUENCE (Relationship difficulties, losing respect or approval from others)	.848	.046	.737
INFLUENCE (Losing control)	.816	-.013	.661
INFLUENCE (Stress, depression, anxiety, or other bad feelings)	.854	-.010	.725
INFLUENCE (Feeling guilt, shame, or bad about who I am)	.818	.042	.684
INFLUENCE (Losing money)	.605	-.116	.353
INFLUENCE (Having fun, socializing)	-.183	.742	.532
INFLUENCE (Reducing boredom)	-.016	.705	.493
INFLUENCE (Feeling excitement, feeling a 'rush')	.004	.781	.611
INFLUENCE (Feeling powerful, proud, or confident)	.118	.706	.544
INFLUENCE (Winning money)	-.111	.635	.388
INFLUENCE (Gaining respect or approval from others)	.193	.595	.436
(Domain d) personal and game causal attributions and rationalizations	7	8	
I know the correct strategies to win	.822	-.129	.624
I win at gambling due to my skill at gambling	.749	-.040	.544
I can predict game outcomes when I am tuned in or observant	.744	-.088	.519
I am a skilled gambler	.740	-.169	.497
I win at gambling due to factors related to myself	.697	.001	.486
Correct strategies will make someone win	.694	.075	.524
I win at gambling due to knowing/following the right strategy or set of rules	.677	.114	.520
I can control the outcome of games	.665	-.046	.424
I am luckier than most people	.549	.029	.312
A gambler can win over the long term	.543	.093	.336
if you lose, you are more likely to win next time	.540	-.006	.290
You usually need to invest a certain amount before you win	.392	.170	.225
Gambling has predictable outcomes	.348	.237	.230
Losing profit from gambling is not really losing money	.345	.092	.148
I win at gambling, due to the laws of probability	.006	.671	.452
I win at gambling, due to factors not related to myself	-.075	.661	.411
I win at gambling, due to the house advantage, or book-keeper's profit margin	.239	.466	.345
Most gambling is designed so that the punter loses	-.064	.319	.093

Domain / item	Factor					Communalities
Decision making 'content'	9	10				
(Domain e) endorsement of play or risk management strategies						
I leave credit cards at home	.772	-.012				.594
I set an overall spending limit for each gambling session	.827	.052				.697
I set bet limits, e.g., small bets	.836	.022				.704
I use thinking strategies, e.g., reminding myself I cannot win	.812	.006				.661
I self-exclude from venues	.812	-.035				.654
I avoid particular places, e.g., clubs	.859	-.027				.732
I avoid particular triggers, e.g., drinking alcohol	.820	.015				.676
I use other rules	.790	.008				.626
I look for patterns among gambling outcomes	-.085	.736				.534
I apply different strategies depending on my instincts, or my gut feeling	-.039	.788				.616
My strategies for winning have changed a lot since I began gambling	.046	.567				.330
I follow rules or strategies to win	.006	.699				.489
I follow rules or set limits to avoid losing too much	.134	.493				.278
I follow my instincts and gut feelings to make gambling decisions	-.002	.685				.469
Decision making 'processes'	11	12	13	14	15	
(Domain f) the salience, frequency, and influence of thoughts, urges, biases, discomfort and difficulty managing urges						
Right at this moment, how strong is your urge to gamble	.996	.049	.018	-.034	-.073	.911
Right at this moment, how strong is your intent to gamble	.934	-.082	-.011	.015	.019	.870
How difficult is it to follow your own rules or plans during gambling sessions?	-.032	.715	.091	-.066	-.019	.472
How difficult is it to ignore or dismiss thoughts about gambling?	-.011	.744	-.109	.070	.099	.690
How difficult is it to resist the urge to gamble?	.034	.823	-.111	.075	.002	.732
How uncomfortable do you find conflict between goals related to gambling?	-.037	.564	.277	-.103	-.078	.346
How frequently do you think about negative effects of gambling on your life?	.032	.079	.723	.032	-.035	.575
How frequently do you focus on the bad aspects of gambling?	-.022	-.108	.834	-.036	.126	.672
How frequently do you try to forget about the good aspects of gambling?	.015	.061	.629	.111	-.072	.477
How frequently do you have competing urges or goals related to gambling?	-.039	.129	.049	.557	.136	.596
How frequently do you focus on the good things about gambling?	.003	-.076	.039	.733	.095	.600
How frequently do you try to forget about the bad aspects of gambling?	-.009	.034	.043	.862	-.174	.614
How much time each week do you think or fantasize about good gambling outcomes?	-.075	.033	.012	-.044	.905	.738
How much of your spare time do you spend gambling?	.123	.112	-.039	.204	.455	.589
How often do you have thoughts about gambling without any prompting?	.210	.142	.067	.019	.431	.495
(Domain g) perceived vulnerability to environmental or mental cues						
you're alone at home	.682	.022	.150			.651
you had an argument with your partner, friend, or family member	.832	-.046	.013			.667
you feel low or depressed	.951	.017	-.088			.811
you feel anxious, stressed, or on edge	.895	-.015	-.047			.732
you feel bored	.495	.076	.329			.654
you see an advertisement, or sign for gambling	.231	.619	-.075			.522
you're at a casino, race track, or other gambling venue	-.171	.909	.043			.723
you're at a sporting event, or a venue where gambling may be available	-.003	.762	.053			.625
you had a recent, large gambling win	.066	.745	-.045			.573
you're socializing with friends	-.018	.117	.651			.504
you feel excited	.154	-.013	.747			.728
you feel content and happy	-.054	-.068	.895			.678

Confirmatory factor analysis

Eighty-five items addressing 18 factors, were subjected to seven confirmatory factor analyses (CFA), using the Maximum-Likelihood estimation method (Stevens, 1996). Model fit was assessed using the Chi-square test of Goodness of Fit, the Root-Mean-Square Error of Approximation (RMSEA), the Comparative Fit Index (CFI), the Goodness of Fit Index (GFI), and the Adjusted Goodness of Fit Index (AGFI). The Chi-squared statistic tends to provide unrealistic values for large sample sizes; therefore additional fit indices were included (Khasawneh, Alrjoub, & Al Zawahreh, 2010).

Requirements for correlation quality were met. Data provided Kaiser-Meyer-Olkin Measure of Sampling Adequacy values ranging from meritorious (MSA=.863) to marvellous (MSA=.938), and significant values for all Bartlett's Tests of Sphericity ($p < .001$) (Dzuiban & Shirkey, 1974; Preacher & MacCallum, 2003).

Seventy-seven items from the original 85 items were retained following CFA, reducing the GRDQ to 173 items. Cronbach's alpha coefficients for final scales demonstrated adequate to excellent internal reliability across factors ($\alpha = .77-.95$). Initial model fit to data varied from poor to good (RMSEA = .07 to .27; CFI = .88 to .95; GFI = .87 to .93; AGFI = .82 to .89). Modification indices suggested addition or removal of several latent factor-item paths, resulting in rearrangement of factor loadings, and removal of cross-loading items and one poorly identified factor. Following recommended modifications, model fit of all models was adequate to good (RMSEA = .05 to .08; CFI \geq .96; GFI \geq .95; AGFI \geq .90), explaining 50.65 and 74.76% of variance in data, with generally moderate to high loading factors (.38 to .95) and communalities (.18 to .83), low cross-loadings (.00 to .27) and mostly low correlations between factors (.02 to .66).

Taken together, these final analyses suggest eighteen distinct latent variables across the seven factor analyses were identified (Preacher & MacCallum, 2003).

CFA solutions are presented in tables 10 and 11, categorized according to decision making content and processes respectively, with bold text denoting item factor loadings onto primary factors. Tables 12 and 13 show model fit and variance statistics for CFAs, and inter-correlations between factors, respectively.

Latent variables were included as summed scale scores of items during part 2 of the study involving development of a gambling decision making model using path analysis.

Table 10

Communalities, factor loadings, and reliability of factors by domain for five confirmatory factor analyses addressing decision making content using Principal Axis Factoring with Promax rotation

	Decision making 'content'								
	Estimation of outcome likelihood			Estimation of outcome impact			Estimation of outcome influence		
	Factor 1	Factor 2	Communalities	Factor 1	Factor 2	Communalities	Factor 1	Factor 2	Communalities
Cronbach's α	.77	.91	.85	.78	.95	.91	.82	.91	.84
Item									
Feeling excitement, feeling a 'rush'	.645	.043	.441	.738	-.124	.456	.787	-.096	.571
Reducing Boredom	.745	-.069	.516	.689	-.041	.444	.653	-.073	.395
Feeling powerful, proud, or confident	.728	.003	.531	.689	.122	.586	.760	.103	.648
Gaining respect or approval from others	.598	.047	.383	.568	.166	.458	.557	.241	.471
Winning money	-	-	-	-	-	-	.595	-.177	.304
Financial, work, or legal problems	-.009	.813	.656	-.085	.946	.810	-.020	.812	.647
Relationship difficulties, losing respect or approval from others	.010	.830	.695	-.014	.895	.787	.054	.818	.706
Stress, depression, anxiety, or other bad feelings	.033	.823	.700	.028	.892	.826	-.067	.880	.732
Feeling guilty, shame or bad about who I am	-.023	.836	.683	-.004	.877	.765	.054	.823	.714
Losing control	-	-	-	.086	.804	.733	-.021	.864	.734
Losing money	-	-	-	-	-	-	-.144	.493	.209

	Decision making 'content'								
	Personal & game causal attribution, explanation, rationalization				Play & risk management strategies & rules				
	Factor 1	Factor 2	Commun.	Item	Factor 1	Factor 2	Factor 3	Commun.	
Cronbach's α	.87	.79	.84		.90	.82	.92	.83	
Item				Item					
I win at gambling due to following the right strategy or set of rules	.826	-.060	.617	Rules: avoiding particular places, e.g., club	.938	-.022	-.076	.794	
I win at gambling due to my skill at gambling	.925	-.099	.735	Rules: self-exclusion from venues	.753	-.019	-.011	.549	
I win at gambling due to factors related to myself	.671	.097	.552	Rules: avoiding particular triggers, e.g., drinking alcohol	.661	.046	.080	.526	
I am a skilled gambler	.461	.266	.456	Rules: leave credit cards at home	.598	.008	.084	.424	
Gambling has predictable outcomes	.076	.378	.189	I apply different strategies based on my instincts, or my gut feelings	-.021	.829	-.072	.638	
A gambler can win over the long term	.214	.398	.324	I look for patterns among gambling outcomes	.005	.711	.027	.524	
I can predict game outcomes when I am tuned in or observant	.241	.516	.499	I follow rules or strategies to win	.075	.706	-.034	.514	
I can control the outcome of games	.169	.525	.430	I follow my instincts and gut feelings to make gambling decisions	-.071	.680	.064	.471	
I am luckier than most people	.066	.550	.358	My strategies for winning have changed a lot since I began gambling	.021	.605	.031	.390	
You usually need to invest a certain amount before you win	.003	.495	.247	Rules: setting an overall spending limit for each gambling session	.041	.043	.791	.694	
Losing profit from gambling is not really losing money	-.001	.423	.178	Rules: setting bet limits, e.g., small bets	.018	-.031	.870	.754	
If you lose, you are more likely to win next time	-.150	.763	.443						

Table 11
Communalities, factor loadings, and reliability of factors by domain for two confirmatory factor analyses addressing decision making ‘processes’ using Principal Axis Factoring with Promax rotation

Decision making ‘processes’						
Salience, frequency, and influence of thoughts, urges, & biases						
Cronbach’s α	.94	.81	.80	.81	.79	.88
Item	Factor 1	Factor 2	Factor 3	Factor 4	Factor 5	Communalities
Right at this moment, how strong is your urge to gamble	.911	-.050	.093	-.040	.021	.829
Right at this moment, how strong is your intent to gamble	.872	.074	-.104	.048	-.013	.797
How much time each week do you think or fantasize about good gambling outcomes?	.018	.766	.114	-.045	.038	.713
How much of your spare time do you spend gambling?	.065	.409	.245	.157	-.028	.598
How often do you have thoughts about gambling without any prompting?	.109	.508	.214	-.005	.025	.577
How difficult is it to follow your own rules or plans during gambling sessions?	.027	-.050	.810	-.137	.099	.543
How difficult is it to ignore or dismiss thoughts about gambling?	-.036	.168	.702	.096	-.123	.705
How difficult is it to resist the urge to gamble?	.034	.021	.818	.076	-.141	.735
How uncomfortable do you find conflict between goals related to gambling?	-.062	-.053	.652	-.046	.202	.439
Frequency: Have competing urges or goals related to gambling?	-.030	.202	.218	.376	.113	.603
Frequency: Focus on the good things about gambling?	.040	.092	-.078	.749	.037	.652
Frequency: Try to forget about the bad aspects of gambling?	-.007	-.139	.087	.787	.085	.639
Frequency: Think about negative effects of gambling on your life?	.061	-.020	.122	-.036	.736	.601
Frequency: Focus on the bad aspects of gambling?	-.063	.219	-.131	-.056	.767	.586
Frequency: Try to forget about the good aspects of gambling?	.023	-.152	.041	.197	.636	.524

Short & long-term stability or change in decision making				
Perceived vulnerability to specific contextual cues				
Cronbach’s α	.91	.85	.83	.91
Item	Factor 1	Factor 2	Factor 3	Communalities
you feel low or depressed	.908	.001	-.025	.798
you feel anxious, stressed, or on edge	.898	-.014	-.012	.781
you had an argument with your partner, friend, or family member	.831	-.001	-.061	.631
you're alone at home	.704	.028	.187	.724
you're at a casino, race track, or other gambling venue	-.117	.893	.009	.705
you're at a sporting event, or a venue where gambling may be available	-.017	.754	.038	.589
you had a recent, large gambling win	.060	.747	-.032	.582
you see an advertisement, or sign for gambling	.182	.596	-.013	.496
you feel content and happy	-.041	-.099	.950	.761
you feel excited	.079	.039	.779	.730
you're socializing with friends	-.011	.175	.586	.484

Table 12

Factor extractions, rotations, variance accounted for, fit indices, reliability, communalities, factor loadings, and factor descriptions by decision making domain for seven confirmatory factor analyses

	Decision making 'content'				'Decision making processes'			
	Estimation of outcome likelihood	Perception of the temporal impact of outcomes	Perceived influence of outcomes	Personal & game causal attributions and rationalizations	Endorsement of play & risk management strategies	Salience, frequency, and influence of thoughts, urges, & biases	Perceived vulnerability to environmental and mental cues	
Variance accounted for (%)	69.03	74.58	65.20	50.65	73.17	74.26	74.76	
X ²	133.86 (19), <i>p</i> <.001	135.82 (26), <i>p</i> <.001	192.45 (43), <i>p</i> <.001	160.71 (53), <i>p</i> <.001	171.98 (41), <i>p</i> <.001	228.27 (80), <i>p</i> <.001	173.25 (41), <i>p</i> <.001	
CFI	.96	.98	.96	.96	.97	.97	.97	
GFI	.95	.95	.95	.96	.95	.95	.95	
AGFI	.90	.92	.92	.94	.92	.93	.92	
RMSEA	.09, <i>p</i> <.001	.08, <i>p</i> <.001	.07, <i>p</i> <.001	.06, <i>p</i> =.15	.07, <i>p</i> =0.01	.05, <i>p</i> =.234	.07, <i>p</i> =.001	

Table 13

Inter-correlations between factors

	Likelihood (positive outcomes)	Likelihood (negative outcomes)	Immediacy (positive outcomes)	Immediacy (negative outcomes)	Influence (positive outcomes)	Influence (negative outcomes)	Belief in skill and personal control	Belief in luck	Risk avoidance strategies	Win strategies	Risk limit strategies	Motivation to gamble	Obsession	Lack of control	Positive bias	Negative bias	Cue sensitivity (emotional)	Cue sensitivity (venue)	Cue sensitivity (social)
Likelihood (positive outcomes)	1	.418**	.652**	.318**	.119**	.142**	.121**	.232**	-.259**	.194**	-.358**	.259**	-.238**	.215**	.113**	.038	.301**	.160**	.109**
Likelihood (negative outcomes)	.418**	1	.394**	.537**	-.009	.456**	.420**	.408**	-.001	.459**	-.035	.303**	.077	.131**	.293**	.172**	.256**	.430**	.331**
Immediacy (positive outcomes)	.652**	.394**	1	.524**	.008	.238**	.125**	.197**	-.219**	.227**	-.311**	.236**	-.230**	.238**	.068	-.002	.215**	.201**	.115**
Immediacy (negative outcomes)	.318**	.537**	.524**	1	.053	.323**	.327**	.356**	-.015	.351**	-.116**	.284**	.009	.171**	.217**	.165**	.329**	.255**	.329**
Influence (positive outcomes)	.119**	-.009	.008	.053	1	.223**	-.009	.118**	.058	-.033	-.039	.128**	.056	-.018	.101	.133**	.161**	.038	.116**
Influence (negative outcomes)	.142**	.456**	.238**	.323**	.223**	1	.250**	.249**	.073	.323**	.048	.186**	.168**	.053	.224**	.169**	.248**	.340**	.259**
Belief in skill and personal control	.121**	.420**	.125**	.327**	-.009	.250**	1	.573**	.019	.654**	-.016	.436**	.132**	.240**	.490**	.379**	.391**	.486**	.487**
Belief in luck	.232**	.408**	.197**	.356**	.118**	.249**	.573**	1	.024	.656**	-.023	.451**	.088*	.265**	.447**	.341**	.425**	.353**	.468**
Risk avoidance strategies	-.259**	-.001	-.219**	-.015	.058	.073	.019	.024	1	.075	.573**	.073	.600**	.005	.175**	.199**	.011	.058	.120**
Win strategies	.194**	.459**	.227**	.351**	-.033	.323**	.654**	.656**	.075	1	.087*	.418**	.120**	.317**	.456**	.312**	.334**	.523**	.425**
Risk limit strategies	-.358**	-.035	-.311**	-.116**	-.039	.048	-.016	-.023	.573**	.087*	1	-.035	.557**	-.012	.145**	.166**	-.091	.126**	.059
Motivation to gamble	.259**	.303**	.236**	.284**	.128**	.186**	.436**	.451**	.073	.418**	-.035	1	.246**	.294**	.572**	.589**	.626**	.451**	.550**
Obsession	-.238**	.077	-.230**	.009	.056	.168**	.132**	.088*	.600**	.120**	.557**	.246**	1	-.057	.342**	.498**	.174**	.190**	.253**
Lack of impulse control	.215**	.131**	.238**	.171**	-.018	.053	.240**	.265**	.005	.317**	-.012	.294**	-.057	1	.405**	.240**	.287**	.281**	.274**
Positive bias	.113**	.293**	.068	.217**	.101	.224**	.490**	.447**	.175**	.456**	.145**	.572**	.342**	.405**	1	.606**	.515**	.430**	.525**
Negative bias	.038	.172**	-.002	.165**	.133**	.169**	.379**	.341**	.199**	.312**	.166**	.589**	.498**	.240**	.606**	1	.559**	.419**	.520**
Cue sensitivity (emotional)	.301**	.256**	.215**	.329**	.161**	.248**	.391**	.425**	.011	.334**	-.091	.626**	.174**	.287**	.515**	.559**	1	.476**	.580**
Cue sensitivity (venue)	.160**	.430**	.201**	.255**	.038	.340**	.486**	.353**	.058	.523**	.126**	.451**	.190**	.281**	.430**	.419**	.476**	1	.465**
Cue sensitivity (social)	.109**	.331**	.115**	.329**	.116**	.259**	.487**	.468**	.120**	.425**	.059	.550**	.253**	.274**	.525**	.520**	.580**	.465**	1

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

Eighteen final factors emerged from the seven decision making CFAs examining estimation of outcome likelihood, impact, and influence, causal attributions, strategies, salience of urges and biases, and cue sensitivity respectively. The eighteen factors included:

- (1) expectancy of negative outcomes (individuals' estimation of the likelihood of negative gambling events),
- (2) expectancy of positive outcomes (estimation of the likelihood of positive gambling events),
- (3) immediacy of negative outcomes (perception of the immediacy versus long term impact of potential negative outcomes),
- (4) immediacy of positive outcomes (perception of the immediacy versus long term impact of potential positive outcomes),
- (5) influence of negative outcomes (personal preference for potential negative outcomes),
- (6) influence of positive outcomes (personal preference for potential positive outcomes),
- (7) belief in skill (confidence in personal skill and strategies enabling gamblers to win),
- (8) belief in luck and personal control (confidence in game predictability, personal control of outcomes, and personal luck),
- (9) risk management strategizing (individuals' attempts to avoid triggers or pre-set limits to manage risk),

- (10) win strategizing (individuals' use of intuition, perceived patterns, and personal rules to win),
- (11) motivation to gamble (urge or intention to gamble),
- (12) lack of impulse control (difficulty and discomfort controlling gambling related urges or thoughts),
- (13) negative bias (negative biases in gambling related thought processes),
- (14) positive bias (positive biases in gambling related thought processes),
- (15) obsession (intensity & frequency of prompted or spontaneous thoughts about gambling),
- (16) emotional cue sensitivity (sensitivity to negative emotional mental states),
- (17) venue cue sensitivity (sensitivity to environmental situations or states), and
- (18) social cue sensitivity (sensitivity to social cues and positive emotional states).

Part 2: Development of a gambling risk decision model

Data analysis

A model of gambling risk decision making was developed, based on the 173-item GRDQ data, through multiple regression, relative importance analysis, path modelling, and correlation analysis procedures. Non-gambler participants were excluded from analyses. Model analyses tested expectation (1) that both individuals' gambling involvement, and decision making would explain significant variance in negative gambling consequences, (2) that involvement and decision making would contribute both unique and shared explanation of this variance, and also

(3) that gambling decision making factors would mediate the impact of background risk factors for disorder.

To address the first hypothesis, negative gambling consequences (based on PGSI subgroup classification) were regressed onto scale scores measuring individuals' decision making (content, process, and stability). Non-significant scales were then removed one by one in further repeated regressions until only significant predictors remained, such that explanation of PGSI variance was maximized. Significant predictors were subjected simultaneously to Relative Importance Analysis (RIA) (using pairwise deletion, 10,000 bootstrap replications, $\alpha=.05$; Tonidandel & LeBreton, 2011) to determine the size and significance of each factor's unique contribution to explanation of PGSI variance (Tonidandel, LeBreton, & Johnson, 2009). PGSI group was then regressed onto individuals' current gambling involvement.

To address the second hypothesis, mediation was tested by gambling involvement of the relationship between each significant decision making predictor and gambling consequences.

To address the third hypothesis, PGSI group was regressed onto the group of common, background individual differences. Next, mediation was tested by the group of significant decision making factors of the relationship between background individual differences and consequences. Mediation was tested using the bootstrapping method with bias-corrected confidence estimates, using 95% confidence intervals for indirect effects, with 5000 bootstrap resamples (Preacher & Hayes, 2004; 2008).

Current gambling involvement and significant decision making and background predictors were retained in a final 48-item version of the GRDQ. Significant decision making factors, behaviour and consequences were included in the final gambling decision making

model. Significantly correlating decision making factors (see table 13) included in the final model were covaried in the final AMOS model.

Test-retest correlations were computed for the final GRDQ scales for a subset of 51 respondents completing the 48-item GDRQ two months after first completing the original questionnaire study.

Significant predictors of gambling consequences

When PGSI group was regressed against gambling decision making factors, ten significant factors emerged, explaining 55% of variance in PGSI scores ($\Delta R^2 = .549$, $F[10,379] = 44.96$, $p < .001$).

Significant factors included: expectancy of negative outcomes, perceived immediacy of positive outcomes, belief in luck and control of outcomes, motivation to gamble, lack of impulse control, cue sensitivity (emotional), cue sensitivity (venue), self-monitoring deficit (problems), self-monitoring deficit (spending), and variance across contexts. Cue sensitivity (venue) and belief in luck contributed significantly lower explained variance than other significant predictors. All significant PGSI predictors are listed by domain in table 14, along with: the proportion of group variance in PGSI scores accounted for by each variable; β , t , df , and p values; and normative descriptive statistics for each participant group.

Several decision making factors did not have significant relationships with PGSI scores ($p > .05$) and were consequently excluded from the final model and GRDQ, including: expectancy of positive outcomes, perceived immediacy of negative outcomes, perceived influence of positive outcomes, perceived influence of negative outcomes, belief in skill, risk avoidance

strategies, win strategies, risk limit strategies, obsession, positive bias, negative bias, cue sensitivity (social).

Table 14
Normative data for decision making and risk factor scales for gambler and non-gambler subgroups

Predictors	% variance explained (by domain)	t	df	p	β	Non-gamblers			All gamblers		
						M	SD	Range	M	SD	Range
<i>N</i>						248			402		
Behaviour factors											
Gambling involvement (current)	100	-11.32	359	.000	.52	0	0	0-0	1.48	.78	1-5
Decision making factors											
Risk decision content											
Expectancy of negative outcomes	11.93	5.41	386	.000	.21	12.33	3.86	4-19	7.86	3.74	4-20
Perceived immediacy of positive outcomes	7.86	3.06	384	.000	.12	9.31	2.37	4-20	7.69	2.70	4-16
Belief in Luck and control of outcomes	1.68	-4.76	400	.002	-.21	15.48	5.02	0-29	13.43	5.56	0-28
Risk decision processes											
Motivation to gamble	22.53	7.83	400	.000	.32	0	0	0-0	2.67	1.83	0-10
Lack of impulse control	12.85	3.72	400	.000	.20	7.41	3.05	0-15	6.28	3.46	0-20
Cue sensitivity (emotional)	12.65	3.30	400	.001	.17	5.94	3.30	0-20	5.06	3.06	0-20
Cue sensitivity (venue)	1.85	-3.60	400	.001	-.17	11.27	4.87	0-20	10.63	5.12	0-20
Self-monitoring deficit (problems)	11.66	9.09	400	.000	.34	-.86	.96	-5.89-0	.59	.79	-3.96-3.32
Self-monitoring deficit (spending)	14.21	-5.67	400	.000	-.23	0	0	0-0	-.13	1.24	-4.36-14.09
Risk decision stability											
Variance across contexts	2.77	2.13	400	.000	.09	.97	1.16	0-5.67	1.08	1.20	0-6.92
<i>Total</i>	<i>100</i>										
Background individual differences											
Demographic / Individual differences											
Gender	22.30	-4.032	400	.000	-.20	1.26	.44	1-2	1.32	.49	1-2
Mental health issues	13.58	3.737	400	.000	.19	.31	.65	0-2	.48	.78	0-2
Gambling experience and exposure											
Experience of early wins or losses	29.48	-3.716	360	.000	-.19	0	0	0-0	2.15	.90	1-3
Gambling involvement (long term)	18.09	3.963	400	.000	.26	5	0	5-5	1.96	1.23	1-5
Gambling career length	9.11	-3.608	400	.000	-.23	0	0	0-0	10.01	12.50	0-63
<i>Total</i>	<i>100</i>										

N	Gamblers											
	No problem			Low risk			Hazardous			Problem		
	M	SD	Range	M	SD	Range	M	SD	Range	M	SD	Range
	243			114			12			33		
Behaviour factors												
Gambling involvement (current)	1.22	.49	1-5	1.59	.69	1-4	2.08	.97	1-3.5	2.61	1.26	1-5
Decision making factors												
Risk decision content												
Expectancy of negative outcomes	7.09	3.49	4-20	8.21	3.17	4-18	7.64	3.93	4-17	12.44	3.97	4-20
Perceived immediacy of positive outcomes	6.87	2.53	4-15	8.73	2.35	4-16	9.45	2.73	6-16	9.63	2.70	6-16
Belief in Luck and control of outcomes	12.47	5.00	0-27	14.81	5.37	0-28	16.25	6.89	0-24	14.73	7.84	0-28
Risk decision processes												
Motivation to gamble	2.09	1.25	0-8	2.96	1.68	0-8	4.08	2.61	2-10	5.24	2.73	2-10
Lack of impulse control	5.21	2.36	0-14	7.06	2.94	0-14	7.92	4.42	0-15	10.85	6.09	0-20
Cue sensitivity (emotional)	4.18	1.39	0-11	5.52	3.13	0-18	7.25	3.74	0-14	9.15	6.09	0-20
Cue sensitivity (venue)	9.51	4.68	0-20	12.25	4.82	0-20	12.33	5.80	0-20	12.64	6.71	0-20
Self-monitoring deficit (problems)	.35	.38	-3.59-.42	1.09	.709	-3.96-1.39	1.15	1.17	-.32-2.35	.38	1.74	-2.03-3.32
Self-monitoring deficit (spending)	.16	1.08	-3.17-14.09	-.26	1.06	-4.29-.55	-.52	1.00	-1.98-.40	-1.68	1.71	-4.36-.40
Risk decision stability												
Variance across contexts	.84	1.00	0-4.25	1.43	1.36	0-6.92	1.50	1.58	0-3.58	1.52	1.40	0-4.25
Background individual differences												
Demographic / Individual differences												
Gender	1.35	.48	1-2	1.46	.50	1-2	1.67	.49	1-2	1.70	.47	1-2
Mental health issues	.45	.75	0-2	.43	.76	0-2	.08	.29	0-1	1.06	.97	0-2
Gambling experience and exposure												
Experience of early wins or losses	2.32	.88	1-3	2.05	.90	1-3	1.83	.84	1-3	1.48	.76	1-3
Gambling involvement (long term)	1.86	1.35	1-5	1.95	.97	1-5	2.21	.84	1-3.5	2.70	1.01	1-4.5
Gambling career length	11.24	13.47	0-63	6.86	9.96	0-52	12.42	14.53	0-47	11.03	10.62	0-42

PGSI regression onto gambling involvement (current) explained 27% of variance in PGSI scores ($\Delta R^2 = .268$, $F[1,350] = 128.08$, $p < .001$) (see table 14). When PGSI group was regressed onto background individual differences, five significant factors explained 16% of variance in PGSI scores ($\Delta R^2 = .163$, $F[5,344] = 13.73$, $p < .001$): gender, mental health issues, experience of early wins or losses, gambling involvement (long term), gambling career length (see table 14).

RIA revealed gender, experience of early win or loss, and gambling involvement (long term) each explaining significantly more variance than mental health issues and gambling career length. Non-significant background individual differences excluded from the final model and GRDQ ($p > .05$), included: age, ethnic background, highest level of education, current income, history of offending, current level of drug use, current level of alcohol use, current employment status, main type of gambling (skilled or unskilled), and source of gambling knowledge.

Mediation

Bootstrap estimates confirmed the mediating role of gambling involvement (current) in eight of ten relationships between decision making predictors and gambling consequences. Results indicated gambling involvement (current) fully mediated relationships between gambling consequences and cue sensitivity (venue), and partially mediated relationships with expectancy of negative outcomes, perceived immediacy of positive outcomes, motivation to gamble, lack of impulse control, cue sensitivity (emotional), self-monitoring deficit (problem), and variance across contexts).

Similarly, decision making variables fully mediated the relationship between consequences and three of five significant background variables (gender, mental health issues, and experience of early wins or losses). Indirect effect size estimates and bias corrected confidence intervals are shown in table 15 for all significant mediators/mediated relationships.

Figure 1 shows the final model of gambling risk decision making, including significant predictors, direct and indirect pathway coefficients, and model fit statistics.

Test-retest reliability of the revised 48-item GRDQ

Test-retest reliability analyses between the first and retested samples revealed strong correlations for all sixteen factors of the final 48-item GRDQ (gambling involvement (current), $r=.77, p<.001$; expectancy of negative outcomes, $r=.90, p<.001$; perceived immediacy of positive outcomes, $r=.86, p<.001$; belief in luck and control of outcomes, $r=.91, p<.001$; motivation to gamble, $r=.82, p<.001$; lack of impulse control, $r=.85, p<.001$; cue sensitivity (emotional), $r=.88, p<.001$; cue sensitivity (venue), $r=.92, p<.001$; self-monitoring deficit (problems), $r=.96, p<.001$; self-monitoring deficit (spending), $r=.90, p<.001$; variance across contexts, $r=.93, p<.001$; experience of early wins and losses, $r=.91, p<.001$, gambling involvement (long term), $r=.90, p<.001$) (Dancey & Reidy, 2004). Retest of static variables showed very strong or perfect correlations (age, $r=1.00, p<.001$, mental health diagnosis and treatment, $r=1.00, p<.001$, gender, $r=1.00, p<.001$; gambling career length, $r=.99, p<.001$) (Dancey & Reidy, 2004).

The final 48-item, 16-factor GRDQ therefore measured current gambling involvement, ten significant decision making predictors and five background individual differences.

Normative data for the current sample is included in table 14. The 48-item GRDQ questionnaire and scoring protocol are presented in appendices C and D.

Table 15

Indirect effect size estimates, including 95% confidence interval bias correction, for significant mediators between gambling factor relationships

Factor–consequence relationship	Mediator / mediator group						
	Gambling involvement (current)						
Expectancy of negative outcomes	.02 (.01; .03)						
Perceived immediacy of positive outcomes	.04 (.02; .06)						
Motivation to gamble	.12 (.07; .17)						
Lack of impulse control	.04 (.03; .07)						
Cue sensitivity (emotional)	.05 (.03; .07)						
Cue sensitivity (venue)	.02 (.01; .04)						
Self-monitoring deficit (problems)	-.11 (-.26;-.01)						
Variance across contexts	.06 (.02;.11)						
	Estimation of negative outcomes	Motivation to gamble	Lack of impulse control	Cue sensitivity (emotional)	Self-monitoring deficit (problems)	Self-monitoring deficit (spending)	
Gender		-.09 (-.18:-.03)	-.10 (-.18:-.03)	-.07 (-.14:-.03)		-.07 (-.15:-.00)	
Mental health issues	-.02 (-.04:-.00)	-.04 (-.09:-.01)	-.06 (-.12:-.03)	-.05 (-.10:-.02)		-.05 (-.08:-.02)	
Experience of early wins or losses		.03(.00:.09)	.08 (.02:.16)	.06 (.01-.12)	.15 (.06:.27)		

N.B. Relationships and numerals in bold identify fully mediated relationships, all other relationships identified in the table were significantly partially mediated

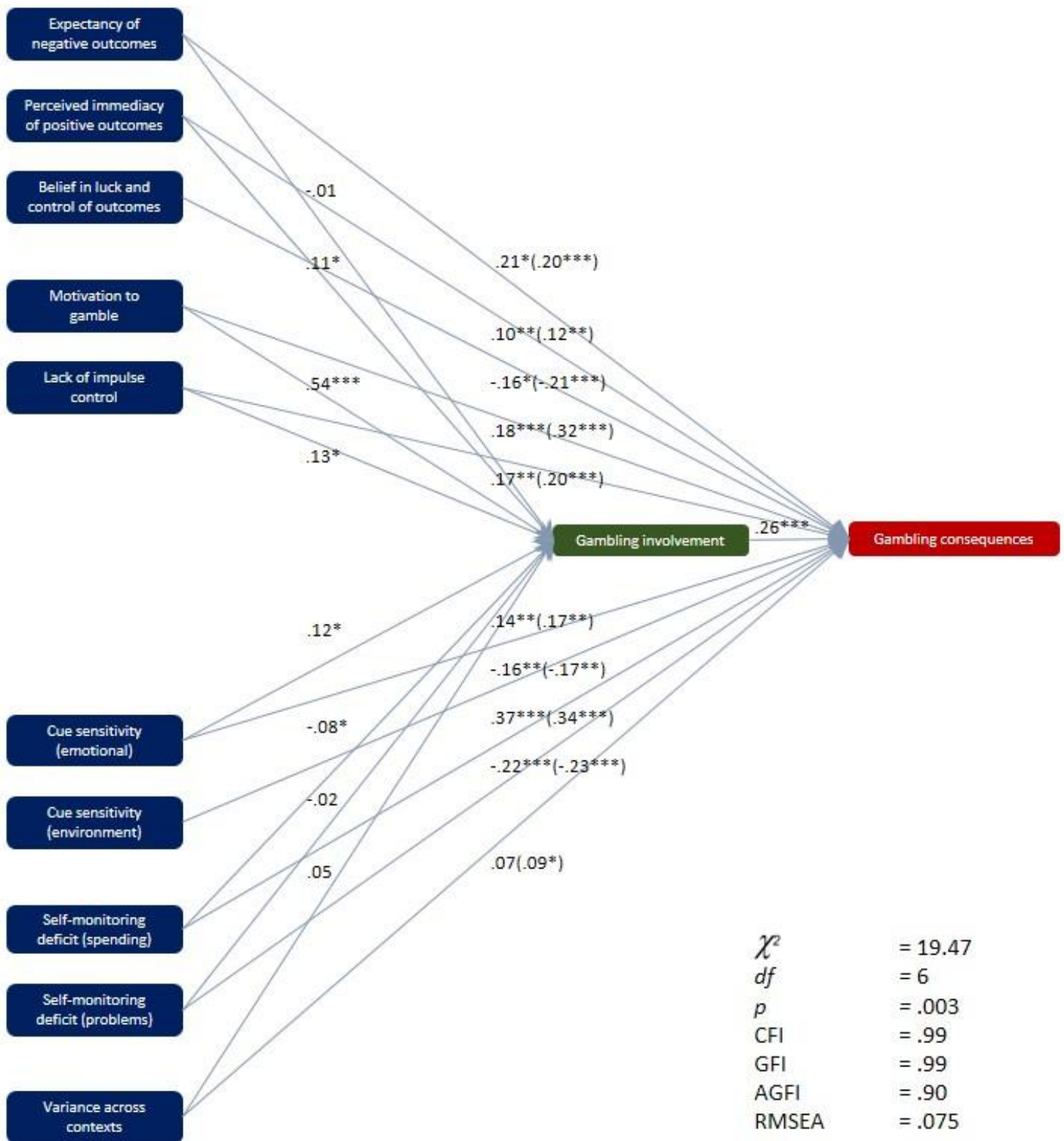


Figure 1. Model of gambling risk decisions with standardized path coefficients, with model fit indices, (N=402). Significantly correlating exogenous variables were allowed to covary. Direct paths are presented in parentheses for comparison with indirect pathways (with a dotted line indicating full mediation).

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

Discussion

The current study highlights the importance of risk perception and decision making in gambling. Decision making factors fully mediated relationships between three of five significant risk factors and disordered gambling. In addition, differences across ten gambling decision making variables predicted a majority of variance in disordered gambling. Further, decision making and behaviour explained substantial variance in disordered gambling, both uniquely, and when decision making was mediated by gambling involvement, suggesting that while decision making influenced gambling involvement, it did not completely predict how frequently or for how long individuals gambled. Hence, both the amount people gamble and how people gamble appear critical to gambling consequences. Taken together, the findings of the current study support the relevance and plausibility of a gambling model with a central focus on risk decisions.

The composition of the ten core decision making factors of the model provides a number of further insights into gambling decision making, discussed below.

Perceptions of the likelihood of negative outcomes and the immediacy of positive outcomes

All three factor analyses addressing outcome estimations (perceived likelihood, immediacy and preference) split similarly into loadings onto 'positive' versus 'negative' outcomes. Such a duality has previously been assumed, but not tested in the literature (Spurrier & Blaszczynski, 2013). These findings therefore suggest that a positive/negative division is common and meaningful among gamblers.

This duality is not absolute, however, with some items apparently more ambiguous than others. For example, 'switching off, escaping' cross-loaded onto both positive and negative factors in each of the three factor analyses, and was consequently removed from final scales, whereas other items loaded highly and more unitarily onto either positive or negative scales (e.g., 'financial, work, or legal problems'). Therefore, outcomes have positive/negative perceptual qualities of varying intensity; individuals perceive outcomes in idiosyncratically varied ways, or both.

Other findings suggested individuals attribute other important perceptual qualities to gambling outcomes. Both, the perceived immediacy of positive outcomes (but not negative outcomes), and underestimation of the likelihood of negative outcomes (but not positive) were significant in predicting harmful gambling outcomes. Differences in the way gamblers interpret the value, meaning, or immediacy of potential outcomes has not previously been examined in the gambling literature (Spurrier & Blaszczynski, 2013), though several studies have shown the relevance of outcome interpretation in substance use (Aarons, et al., 2001; Goldberg & Fischhoff, 2000).

Belief in luck and personal control of gambling outcomes

Model factors also addressed content relevant to other cognitive constructs common in the gambling literature, specifically disordered gamblers' overestimation of winning (Wohl, 2008; Wood & Clapham, 2005, Joukhador, Blaszczynski, & Maccallum, 2004), and overestimation of control (Jacobsen, Knudsen, Krogh, Pallesen, & Molde 2007; Murseth, Brunborg, & Eidem, 2010). In the current study however, variation in these beliefs or biases loaded onto a single significant factor. Nonetheless, one that explained only a small amount of variance in disordered gambling overall. In addition, while belief in luck correlated weakly

to moderately with several other decision making constructs, other aspects of decision making each explained significantly greater unique variance in gambling consequences. This finding therefore highlights both the importance of gamblers' beliefs about game causality, as well as the need for expansion of cognitive gambling models to incorporate other aspects of risky decision making identified in this study.

Motivation to gamble and lack of behavioural control

Gamblers' motivation and control were identified as important predictors of gambling involvement and consequences. The presence of urges difficult to resist, and identification of a lack of control over behaviour, implies that individuals are using, or being dominated by, implicit, automatic reasoning processes in preference to analytic, systematic reasoning (Toplak, Liu, MacPherson, Toneatto, & Stanovich, 2007). A number of studies have identified that gamblers may leave themselves vulnerable to harm not only via explicit reasoning errors (e.g., holding erroneous beliefs about luck and control), but also by misapplying 'automatic' reasoning (e.g., applying 'pattern recognition' heuristics to random events), or ineffectively managing implicit processes with explicit reasoning (e.g., failing to inhibit implicit motivation, or failing to correct implicit reasoning errors) (Toplak, et al., 2007; Stewart, 1999). Results of the current study therefore indicate that lower decision making processes explained an important and significant portion of behavioural outcomes, distinct from problematic systematic decision making. Hence, the process by which gamblers resolve conflict between, or apply implicit versus explicit risk decision making has important implications for accurate risk estimation, and vulnerability to harm.

Poor insight regarding problems and spending

As expected, riskier gambling was associated generally with greater discrepancy between reported versus actual problems and spending. Such results indicate poorer monitoring, greater minimization, or both. For example, individuals may rationalize problems as being typical in the community, thereby downplaying their significance and justifying continued gambling.

At the most extreme ends of the PGSI scale, however, the accuracy of problem self-monitoring was comparable. That is, problem gamblers acknowledged higher levels of problems, with problem monitoring accuracy similar to non-problem gamblers. This may be the result of greater exposure and severity of issues faced by this more disordered gambler subgroup being more difficult to ignore or rationalize, suggesting more harmful gamblers must maintain gambling involvement through alternate decision making mechanisms (Delfabbro, 2004).

Overall more disordered gamblers also tended to estimate their spending as higher relative to other people. An explanation for this apparent discrepancy between patterns of perceived spending and perceived problems may be that monitoring of spending represents an 'extension' of a general underestimation of problems. That is, problematic gamblers may overestimate how much others spend on gambling, due to poor insight or effort to minimize their own spending.

Future research may clarify these issues, for example, through examination of the origins of inaccurate self-perceptions, in erroneous or incomplete beliefs, biased self-monitoring, or a combination of both (Engwall, Hunter, & Steinberg, 2004; Brown, 1998).

Cue sensitivity and variance across contexts

As expected, more hazardous gamblers reported greater variance in behaviour across contexts, as well as greater sensitivity to particular contextual cues associated with negative consequences, specifically negative mental states and gambling related environmental cues (Baudinet & Blaszczynski, 2012). Moderate correlations between decision variance and cue sensitivity suggest sensitivity to cues is associated with destabilization of decision making processes, responsible for greater risk taking and harm.

In addition, sensitivity to emotional cues was a stronger predictor of gambling problems than venue cues. This may be reflective of more widespread sensitivity to emotional cues, or the greater influence of emotional cues in decision making. Again, further research may clarify this situation, as well as whether sensitivity originates from innate individual differences versus conditioning processes, or both, as has been suggested in the literature (Blaszczynski & Nower, 2002; Baudinet & Blaszczynski, 2012).

Limitations of the study

Several limitations of the current study are noted. The study included a contingent of university psychology students, potentially limiting generalizability of findings. However, to reduce sampling bias, the sample included a large number of both treatment experienced and inexperienced gamblers, and individuals ranging in exposure from minimal to high-intensity, long-term gambling. In addition, many students were non-gamblers used for questionnaire validation procedures, but excluded from model analyses.

Measurement issues also potentially limited the strength of findings. Due to the substantial number of items evaluated in the study, no additional questionnaires were included except the PGSI (Ferris & Wynne, 2001). While the validity and reliability of the

PGSI is well established (Holtgraves, 2009), diagnostic accuracy may have been improved by inclusion of clinical interviews, or additional self-report measures, such as the South Oaks Gambling Scale (SOGS) or the Victorian Gambling Screen (VGS) (Lesieur & Blume, 1987; Wenzel, 2004).

Self-report may also have been confounded by rationalization or minimization of harms and behaviour (Peretti-Watel, 2003; Schneider & Wright, 2004; Rebelo, 1999). However, attempts were made to ensure the questionnaire and model was extensively evaluated via a large selection of evidence-based and reliable items and constructs with good final model fit, including items specifically evaluating accuracy of self-report data (e.g., insight regarding problems and spending).

Nevertheless, inclusion of few validated measures may have contributed to a small number of non-decision making risk factor variables being identified in the study, and the high level of mediation observed. Validation evidence for the questionnaire and model, and understanding of gambling disorder would therefore likely benefit from further evaluation and integration of data around the central focal point of risk decision making, inclusive of other variables (e.g., social, biological, behavioural), and other methodological approaches (e.g., longitudinal measurement) (Johansson, et al., 2009).

Practical applications and future directions

The value of clinical models comes not only from the cohesiveness, comprehensiveness, or accuracy of representation of observations, but also through capacity to effectively guide adaptive change (Quine, 1951). While many models of gambling addiction and disorder draw from and cohere rich and detailed gambling research (Redish, Jensen, & Johnson, 2008), their theoretical perspectives are not necessarily mindful of

relationships between clinician and patient. Translation of abstract concepts such as neurophysiological processes, are therefore left dependent on the varied perspectives and training of clinicians, thereby contributing to error and unreliability.

The methodology used to identify and describe core factors of the risk decision model was not only based on thorough review of the literature and mixed qualitative and psychometric analyses, but also deliberately grounded in the shared language of both clinicians and lay gamblers (Chiovitti & Piran, 2003). Such a model enables clinicians to explain core concepts in real world terms.

As such, the ten core risk decision factors identified in the current study, by design, constitute valid, reasonable and important targets for assessment, formulation and treatment. It is suggested therefore that the GRDQ may be a valuable tool when used in conjunction with other diagnostic measures (such as the PGSI or SOGS), for building individual decision making vulnerability profiles, identifying relevant treatment targets, and acting as a guide for intervention via public policy or clinical tools (Cowlshaw, et al., 2012; Thomas, et al., 2011).

Conclusion

The research presented here yielded various clinically valuable insights regarding Gambling Disorder. Findings identify the importance of gamblers' perception and interpretation of game causal operations, and negative versus positive potential outcomes, along with other factors affecting use of gambling data, such as sensitivity to mental and contextual cues. Development of individualized assessment, formulation and treatment methods addressing specific risk decision making factors, and the expansion of the risk

decisions model through integration of data from across the gambling literature, represent two important topics for future research.

CHAPTER 8: Discussion

Summary of major findings

Cognitive and biopsychological research has identified a significant relationship between perception, decision making and the negative consequences associated with sustained gambling (Raylu & Oei, 2002). Drug and alcohol research has further suggested that how individuals navigate decisions involving motivating but risky activities involves several important, distinct but interrelated aspects of cognition (Aarons, Brown, Stice, & Coe, 2001). Remarkably, despite the clear importance, investigation of gambler risk perception and decision making has been rare (Spurrier & Blaszczynski, 2013). While there has been some limited recent interest in perceptions of negative versus positive outcomes, risk perception and other key risk decision constructs remain a largely overlooked area of the gambling literature.

The broad aim of this thesis therefore was to investigate risk perception in gambling, and to present a model of gambling decision making that extensively examined and included important risk perception concepts.

The thesis presented four studies that followed sequential steps in the Mental Models methodology (Morgan, Fischhoff, Bostrom, & Atman, 2002). First, existing evidence about the potential hazard was reviewed, next, qualitative methods examined expert and lay concepts about the hazard, and finally, a model of important factors impacting on exposure to the hazard was outlined, including means by which these factors could be systematically measured.

Study one (reported in chapter four) involved systematic review of the literature on risk perception in gambling. The review aimed to identify all extant evidence about how gamblers perceive risk, and to outline what evidence revealed about the relationship between gambling risk perception and behaviour.

Study two (reported in chapter five) involved qualitative interviews with gambling expert clinicians, researchers and policy makers ($N_{study\ 2} = 11$), based on Mental Models and Grounded Theory methodologies (Strauss & Corbin, 1998; Morgan, et al., 2002). The study aimed to construct an extensive 'map', based on comprehensive expert opinion, detailing all relevant factors mediating gamblers' exposure to risk of harm.

The study identified that, unlike in studies investigating other hazards (Bostrom, Fischhoff, & Morgan, 1992; Gentner & Stevens, 1983), conflicting goals significantly affect gamblers' decision making. That is, gamblers attempt not only to avoid harm, but also to gain benefits. As a result, gamblers' exposure to harm is determined not only by the accuracy of risk perception, but also by a number of other decision making processes and mechanisms that may potentially conflict with each other, and be unstable over time and across different contexts.

Study three aimed to test these findings in a lay sample of gamblers, again using qualitative interview data ($N_{study\ 3} = 15$) (Strauss & Corbin, 1998). The study compared gamblers' views against the risk decision 'map' outlined by experts in study two, to identify patterns, similarities, gaps or differences in decision making associated with risky versus safe gambling. Individual gamblers were highly idiosyncratic in how they represented gambling decision making, but largely confirmed the importance of factors identified by experts as the critical arbiters of harm.

Study four (reported in chapter seven) aimed to test the findings of studies one, two and three in a larger sample ($N_{study\ 4} = 650$), using quantitative methods to develop a model of gambling decision making factors mediating risk of harm, along with a systematic measure of decision making factors for use by clinicians and researchers (Preacher & Hayes, 2004; Preacher & MacCallum, 2003). Results indicated that ten core decision making

variables: (1) mediated the influence of other factors associated with gambling harm, (2) explained a large proportion of negative gambling consequences, and (3) influenced whether, how, and how much individuals gambled, each bearing significant consequences for gamblers.

Taken together, these four studies provide strong evidence of the importance of risk perception and decision making in gambling. There were a number of significant findings from the thesis: (1) Harmful gambling is associated with differences in how some gamblers evaluate and manage gambling risk; (2) Problem gamblers sustain motivation to gamble, despite higher negative expectancy, via various cognitive processes emphasizing positive, or reducing negative aspects of gambling; (3) Cognitive factors impacting on how gamblers use risk data include individual differences in: estimation and interpretation of outcomes, strategizing and planning, motivation and control of urges, insight or self-monitoring, sensitivity to gambling triggers, and inconsistency across contexts; (4) Individual expression of vulnerabilities to gambling disorder may vary substantially at an individual or group level, but collectively explain a substantial portion of gambling behaviour, its consequences, and dependence, and; (5) At the same time, gambling decision making represents an important mediator between identified risk factors and gambling disorder, and a valid and meaningful focal point for clinical theories of Gambling Disorder (American Psychiatric Association, 2013).

The findings across these four studies therefore confirm the importance of relationships between decision making, behaviour, consequences, and disorder, with disorder largely predictable based on a few core decision making factors, despite individual variation in clinical presentation.

The following section reviews (1) sampling, (2) design and (3) measurement issues within the current thesis, and how potential limitations may be ameliorated by research to expand the research findings.

Limitations of the research

(1) Sample selection

All studies followed evidence-based methodologies aiming for rigour, validity, and reliability (Chiovitti & Piran, 2003; Morgan, et al., 2002; Strauss & Corbin, 1998).

Nevertheless, research presented here was inevitably limited by participant selection. As previously discussed, study three sampling was potentially biased towards younger, university-educated gamblers, and treatment experienced, older, male gamblers. Study four also included a sizeable contingent of university students, despite overall including a diverse selection of participants with varied demographic attributes, gambling with little to high intensity, with and without treatment experience. Importantly, while students made up a substantial proportion of the sample used in questionnaire validation, they made up a considerably smaller proportion of the sample used in development of the model, since non-gamblers were excluded from these analyses.

(2) Cross-sectional designs

Practical convenience concerns (high relative recruitment costs, high dropout rates among disordered gamblers) led to selection of cross-sectional designs in all studies in the current thesis (Melville, Casey, Kavanagh, 2007). This approach is relatively typical in gambling research, though it imposes limits on causal inference (Raylu & Oei, 2002).

Causal direction and measurement in the model was therefore largely determined based on logical evaluation of included variables. For example, life events or demographic factors influencing decision making temporally preceded decision making, allowing causal direction to be assumed. In turn, decision making processes must precede behaviour resulting from these decision making processes, which in turn must precede the consequences of these behaviours.

In addition, some items and constructs in the GRDQ were used to generate quasi-experimental conditions, also enabling causal inference. For example, participants were asked to imagine how they would respond to different scenarios, with variance in responses enabling estimation of potentially influential decision making instability (Mischel, 2004).

(3) Measurement issues

Careful attention was given to choosing the most reliable, valid and appropriate measures (Ferris & Wynne, 2001), a task made difficult by the dearth of relevant, reliable formal gambling cognition measures (Moodie, 2007). The PGSI was selected as the most efficient, nuanced, and sample-appropriate measure of disordered gambling, since it was specifically designed for use by non-clinical samples, demonstrating good overall reliability (Ferris & Wynne, 2001; Holtgraves, 2009).

Given that self-report inaccuracy is a potential confound in gambling research, a number of additional steps were also included to avoid bias (Peretti-Watel, 2003; Rebelo, 1999; Schneider & Wright, 2004): (1) study three included flexibility in the interview protocol allowing scope for examination of participant reporter accuracy, (2) study four included direct measurement of participant reporting accuracy and variability, while (3) the overall questionnaire and model included a number of stages of validation overall

(systematic literature review, interviews with two distinct samples, exploratory and confirmatory factor analysis, path modelling) designed to compare, test and confirm findings across the studies (Preacher & MacCallum, 2003).

Nevertheless, time requirements of the studies led to inclusion of no extraneous formal measures other than the PGSI. While, there is no universally agreed gold standard for diagnosis of Gambling Disorder (Productivity Commission, 2010), inclusion of additional self-report measures (e.g., the South Oaks Gambling Screen or Victorian Gambling Screen) in studies three and four may have improved diagnostic reliability.

Future research

The potential limitations of the current studies suggest that the Gambling Risk Decisions Questionnaire (GRDQ) and gambling risk decision model may be effectively expanded and improved via several processes. Despite reasonable sample diversity relative to other gambling research (Johansson, Grant, Kim, Odlaug, & Gotestam, 2009; Gooding & Tarrrier, 2009), it may be of value to gather further data for comparison across cultural groups not targeted in these studies.

In addition, inter-factor or backwards causation may also be possible among some of the variables identified in the model. While not formally tested or represented in the model, except as covariance among correlated decision making variables, the investigation of further patterns of causation (e.g., between decision making factors) may be a valuable area of future research elucidating valuable detail about decision making processes.

Further, the gambling model may also be expanded through inclusion of additional formal measures. In particular, psychobiological, sociological, or actuarial 'risk factors' for Gambling Disorder may be included, allowing further integration of risk decision making

concepts within the broader gambling literature (Johansson, et al., 2009; Andrews, Bonta, & Wormith, 2006).

A number of specific strengths and practical applications flowing from the current research are discussed below.

Practical applications and strengths of the research

Clinical profiles and interventions

The methodology used to develop the GRDQ and model presented in the research was deliberately grounded in the shared language of both clinicians and lay gamblers (Chiovitti & Piran, 2003). As such, disordered gambling was explained via a model based in 'real world' terminology, referring to cognitive and behavioural experiences common to both clinicians and gamblers.

The central concept and core factors of the risk decision model are therefore founded in description both comprehensible and relevant in a clinical treatment setting, forming common axes around which adaptive change typically takes place, through contemporary evidence-based psychological interventions (Gooding & Tarrier, 2009). For this reason, the ten core risk decision factors identified make valid, reasonable and important targets for assessment, formulation and treatment. That is, the GRDQ estimates areas of critical risk decision vulnerability. In conjunction with diagnostic tools measuring gambling problems and disorder, such as clinical interview or psychometric measures (e.g., the PGSI), the GRDQ may be used to build an individualized decision making profile for clients, identifying specific areas of vulnerability to harm and Gambling Disorder.

Conceivably, evidence-based treatment tools may then be matched and applied to address these core areas of vulnerability.

For example, Cognitive Behavioural Therapy (CBT), the current 'gold standard' for gambling treatment (Cowlshaw, et al., 2012; Thomas, et al., 2011), constitutes a large repertoire of clinical 'tools', many of which are relevant to the ten core vulnerabilities outlined in the model. Exaggerated belief in luck and personal capacity to control game outcomes for example represents a maladaptive, erroneous understanding of game causal operations likely to lead to negative consequences. A large body of evidence suggests that guided clinical interview, cognitive monitoring and cognitive challenging techniques may be used to effectively target and correct erroneous beliefs, such as exaggerated overestimation of positive outcomes, and may therefore constitute an appropriate component of treatment for individuals scoring highly on this scale on the GRDQ (See appendices A and B: Gambling Risk Decisions Questionnaire and scoring protocol) (Gooding & Tarrier, 2009).

Alternatively, imaginal or in situ exposure has been shown to be effective in reducing unhelpful sensitivity to environmental cues and mental states - another potential area of individual vulnerability identified by the GRDQ, and therefore another target for tailored treatment (Cowlshaw, et al., 2012; Thomas, et al., 2011). Similarly, CBT-oriented interventions may be applied to other areas of vulnerability identified in the model, while factors with low scores may be excluded from clinical intervention. Through such a process, treatment may be systematically and efficiently customized around the specific needs of individual clients.

It is suggested therefore that not only should treatment for gambling disorder in general include treatment tools specifically addressing the ten important areas of vulnerability identified in the risk decision model, but individuals' personal vulnerability

profiles should be used to guide patient formulation and intervention content. Clinical interventions addressing vulnerability factors of the risk decisions model therefore constitute an important area for future research, not only involving tailored CBT interventions, but also other potential avenues for harm reduction, treatment or prevention, such as psychoeducative inoculation, public policy, non-CBT psychological or medical treatment, or integrative approaches (Productivity Commission, 2010).

Strengths of the model and implications for mental health diagnosis and treatment

The risk decision model outlined in this thesis expanded on previous cognitive literature and avoids many of its methodological and conceptual limitations. The model also has a number of other strengths deserving of attention, with implications for mental health diagnosis more broadly.

The mixed qualitative-quantitative method applied in these studies provides solid ecological grounding and an extensive review of relevant factors, demonstrated by high explained variance and mediation of risk factors (Driscoll, Appiah-Yeboah, Salid, & Rupert, 2007). The current model therefore effectively integrates and expands on concepts identified in controlled but ecologically unrealistic laboratory studies, and psychometric cognitive studies. Further, concepts identified in the model expand on previous cognitive theories, including heuristic/bias conceptualizations of gambling as the product of a limited number of core cognitive biases (Toneatto, Blitz-Miller, Calderwood, Dragonetti, & Tsasnos, 1997), as well as more recent research addressing expectancy (Wickwire, Whelan, & Meyers, 2010; Wong & Tsang, 2012). In contrast to both of these approaches, the risk decisions model identifies significant predictors of gambling decisions beyond concepts such as exaggerated estimation of winning or control, and expectancy of specific outcomes.

Further, the model integrates these concepts within a broader conception of decision making that takes into consideration variables that may modify the salience and interpretation of perceptions.

The model avoids the conceptual restrictions of previous cognitive gambling theories, such as the unreasonable demands of normative rationality models, instead basing core concepts in language comprehensible to key stake holders (Chiovitti & Piran, 2003). Further, it preserves individual heterogeneity, while nevertheless reducing Gambling Disorder to meaningful core variables, by presenting a model and instrument that produce unique profiles of the variation along specific axes of maladaptation and change (Gooding & Tarrier, 2009). Such an approach de-pathologises and destigmatises the disordered gambler, alternatively recognizing hazardous gambling as the result of harmful but changeable aspects of choice (Gooding & Tarrier, 2009).

Finally, concepts are presented in a manner that is integrative, inherently expandable, and therefore relevant to the broader gambling literature. That is, not only does the model include decision making factors, but it considers the pathways of association between decision making and factors bringing about decision making. For example, the relationship between comorbid mental health issues and disordered gambling was fully mediated in study four by motivation to gamble, lack of impulse control, emotional cue sensitivity and deficits in the monitoring of spending, implying that the role of mental health issues in Gambling Disorder comes through vulnerability based on these four factors.

Therefore, the risk decision model may conceivably act as a central focal point from which other gambling research can be meaningfully integrated with clinically usable concepts. For example, neurophysiological dysfunction may be tested against and explained in terms of specific decision making vulnerabilities comprehensible to gambling treatment

clients. Hence the model may be gradually expanded to reflect the broader gambling literature with further research.

As a result, the theoretical approach taken in this thesis has a number of advantages over previous attempts to model gambling, and may even potentially represent a process by which we reconsider the diagnostic systems and clinical models in common usage (American Psychiatric Association, 2013). The recently published DSM-5, for example, has been criticized by a number of researchers. Specifically, DSM conceptualizations of stable versus acute aspects of psychological disorder, and reduction of disorders to criteria based thresholds fail to represent heterogeneity of disorder presentations in a cohesive, meaningful way (Aragona, 2009a, 2009b; New, Triebwasser, & Charney, 2008).

An alternative and possibly more effective method for assessing and cohesively diagnosing disorder may be achievable through: (1) profiling individuals' mental health disorders according to the specifically identified problem (in the case outlined here: persistent, recurrent gambling resulting in harm and loss of control), and (2) orienting intervention directly towards decision making factors specifically identified as important to the maintenance of maladaptive functioning.

This process might be applied with equivalent effectiveness to other risky or harmful behaviour, such as unhealthy eating, social conflict, or intrusive obsessional activity, with assessment and treatment of core decision making factors associated with the behaviour, such as biased self-evaluations or social values, unhelpful beliefs and expectations, sensitivity to cues, or self-regulation strategies. As outlined in this thesis, this approach has a number of advantages, such as de-pathologising of the patient through emphasis and normalization of clinical problems, functional description of problems in relation to treatable psychological variables, potential for integration of the literature around

treatment targets, and capacity for meaningful subtyping along axes of change. As such the process of theoretical model development outlined here in relation to Gambling Disorder might also be effectively applied in other areas of mental health.

Summary and concluding remarks

This thesis was developed as a response to the clear gap in the literature and logical place for risk perception and decision making in Gambling Disorder. Through a series of four studies, a number of important findings were made relating to understanding and modelling risk perception and decision making in gambling disorder, as well as the relevance of issue-focused decision making models in mental health.

The most significant findings are summarized below:

- (i) Risk and benefit perception plays an important role in gambling, protecting against or increasing vulnerability to harm and disordered gambling. Idiosyncratic beliefs among disordered gamblers result in insufficient prioritization of needs, planning and implementation of risk management strategies.
- (ii) Disordered gamblers hold both: more optimistic overall perceptions of risk, and a mixture of more positive and more negative specific outcome expectations. Disordered gamblers appear able to sustain motivation to gamble, despite more negative overall expectation and experience, through cognitive processes preferentially emphasising positive over negative outcomes, resulting in persistent or recurrent overvaluation of gambling.

- (iii) Gambling decision making predicts a large proportion of the variance in negative behavioural outcomes and disorder, including variance both overlapping and distinct from gambling involvement. Gambling decision making therefore influences both the amount, and the way individuals gamble, both of which significantly influence gambling outcomes.

- (iv) Gamblers' beliefs about causality, meaning, motivation, and strategy may be complex and highly idiosyncratic, with differences even within groups regarding beliefs, interpretation, planning, sensitivity to cues, or variability across contexts.

- (v) Nevertheless, more disordered gambling is specifically predicted by: lower expectations of negative outcomes, perception of positive outcomes as more immediate, and a stronger belief in personal luck, capacity to control game outcomes, and overall likelihood of positive gambling outcomes. In addition to specific beliefs, disordered gamblers tend to process risk and make decisions differently having: stronger impulses to gamble, lower reported control of these impulses, greater sensitivity to contextual/environmental and mental/emotional cues, making greater use of automatic decision making strategies rather than applying systematic reasoning. More risky gambling was also associated with over-estimating relative spending, but underestimating relative problems.

- (vi) Gambling decision making represents an important mediator between identified risk factors and gambling disorder, and a valid and meaningful focal point for clinical theories of gambling disorder. Socio-cultural and biological individual differences influence instantiation of beliefs and cognitive processes affecting decision making.

In conclusion, it is clear that the research presented here has yielded various clinically valuable insights into the nature of Gambling Disorder. Specifically, the findings stress the importance of gamblers' perception and interpretation of game causal operations and negative versus positive potential outcomes, along with factors impacting on how gamblers use gambling data. Development of individualized assessment, formulation and treatment methods addressing specific risk decision making factors, and expansion of the risk decision making model by integrating data from other areas of gambling research are likely to be important topics for future research.

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APPENDICES

APPENDIX A: Published manuscript

Spurrier, M. & Blaszczynski, A. (2013). Risk Perception in Gambling: A Systematic Review.

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Risk Perception in Gambling: A Systematic Review

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Abstract Perception of the consequences of risk affects motivation and behaviour. In gambling, distorted expectations and preferences towards outcomes are associated with significant social and clinical harms. A systematic review was conducted to examine the relationship between gambling risk perception and behaviour. Sixteen studies met inclusion criteria. Studies provided evidence that disordered gamblers hold both more optimistic overall perceptions of risk, and a mixture of more positive and more negative specific outcome expectations. Preliminary evidence suggests a range of contextual and individual differences moderate risk perception affecting decision-making. Disordered gamblers appear to sustain motivation to gamble, despite more negative expectations and experiences, via cognitive processes that result in preferential emphasis on positive over negative outcomes. Given potential differences in the perception of risk between various categories of gamblers, clinicians should take into account how gamblers in treatment view gambling as a risky behaviour. Improving the accuracy of such perceptions may reduce the propensity for risk-taking behaviours.

Keywords Gambling · Pathological Gambling · Harm · Risk perception · Cognition · Decision making

Introduction

Gambling is a widely available, commonly accessed hazard, associated with significant social costs (Productivity Commission 2010). Yet, only some individuals gamble long enough, or with large enough sums, that they experience significant harm (Walker 2005). A large body of research argues that attitudes, perceptions and beliefs about risk play an important role in risky behaviour (Breakwell 2007; Glanz et al. 2008; Binde 2009). Understanding how gamblers perceive risk is likely to be important in understanding why

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specific subgroups of gamblers expose themselves to gambling-related harm (Johansson et al. 2009).

Risk Perception, Decision-Making and Gambling Behaviour

A key feature of gambling is that it involves risky choice, in that outcomes are typically both uncertain, and potentially harmful. Evidence from risk and health behaviour research suggests that when faced with risky choices, agents' perceptions of risk play a significant role in determining intention, and subsequent behaviour (Ajzen 2011; Breakwell 2007; Morgan et al. 2002; Oei and Jardim 2007; Siegrist et al. 2005). Central to risky choice and behaviour is how agents perceive critical risk parameters: the range of potential outcomes; the meaning of potential outcomes; and factors that determine the likelihood of outcomes (e.g., the agents' cognition, and behavioural control, or game mechanics determining probability) (Ajzen 2011; Weber et al. 2002).

In uncertain systems, agents must estimate one or more of the parameters defining outcomes. By its nature, such estimation is open to error. Estimation may relate to parameters determining outcomes, e.g., the likelihood of one side of a die facing up instead of another. However, estimation may also be involved in the interpretation of potential outcomes (Campbell 2006). That is, individuals may accurately or inaccurately perceive the potential impact of particular outcomes, such as the harm caused by losing a wager, or series of wagers.

Risky choice may expose people to harm, via underestimation of risk related to how outcomes are determined, error in the meaning assigned to outcomes, or through conscious engagement with risk-bearing systems. However, while agents may knowingly make choices that carry risk of negative consequences, the accuracy of risk estimation in itself may have important consequences for behaviour related to hazards (Breakwell 2007). Understanding how agents estimate risk parameters, and how estimations are used in decision-making and behaviour, is important in assisting people to safely negotiate hazards. An empirically-based understanding of gambling risk-perception would be useful for guiding treatment or developing preventative education for individuals who experience harm as a result of systematic errors in risk estimation. What then does the existing literature tell us about how individuals perceive gambling-related risk parameters, and the role of risk perception in choice and behaviour?

Risk and Positive Perception of Gambling

Research suggests that users' expectations of potential outcomes are important to the maintenance or moderation of risky behaviours such as alcohol (Oei and Jardim 2007; Smith et al. 1995); and drug use (Aarons et al. 2001; Julie Goldberg and Fischhoff 2000). Similarly, cognitive research in gambling has shown that gamblers' perceptions about risk play a significant role in gambling behaviour. Gamblers hold preferences (Lee et al. 2007; Binde 2009) and make predictions (Fortune and Goodie 2011) about particular game outcomes.

Gamblers report different motivations for engaging in, or avoiding gambling (Clarke et al. 2007). Preferences for particular outcomes are reflected in idiosyncratic motivation for gambling. When gambling, individuals or subgroups appear to be differentially motivated by potential outcomes, such as: winning money (Rosecrance 1985); the 'dream' of a substantial win (Cotte 1997); intellectual challenge (Cotte 1997; Lee et al. 2007); emotion

regulation (Shead et al. 2008); avoiding loss (Hing and Breen 2008); and social rewards (Cotte 1997; Lee et al. 2007).

In addition, gamblers hold detailed representations of the causality within gambling systems. Causal representations of gambling operations have been examined in the literature in the form of explicit beliefs about: luck (Wohl 2008; W. S. Wood and Clapham 2005); determinism (Joukhador et al. 2004); strategies for playing (Luengo et al. 2000); and the perceived impact that the gambler has on game-play and outcomes (Jacobsen et al. 2007; Myrseth et al. 2010).

Evidence suggests that there is considerable individual variation in perceptions of gambling-related preference (Clarke et al. 2007; Shead et al. 2008) and causality (Delfabbro 2004). Further, some types of perceptions about gambling have been explicitly linked to disordered gambling (Toneatto 1999). For example, more preoccupied, disordered gamblers were both: more likely to perceive gambling as a means of escape from stress or problems (Clarke et al. 2007) or augmentation of positive mood states (Shead et al. 2008); and, more likely to overestimate skill (Fortune and Goodie 2011), and the chance of positive outcomes (Delfabbro 2004). Such research provides evidence of a relationship between risk perception, motivation, and gambling although it does not provide sufficient data for a comprehensive model of how individuals think and behave in relation to perceived gambling risk.

Highly-cited reviews (e.g., Crockford and el-Guebaly 1998; Goudriaan et al. 2004; Raylu and Oei 2002; Toneatto et al. 1997), and models (e.g., Blaszczynski and Nower 2002; Sharpe 2002) of gambling typically discuss gambling cognitions in relation to: beliefs or heuristics related to overestimation of either the likelihood of positive outcomes; the gamblers' capacity to favourably control outcomes; or both. However, gambling models have not to date included consideration of gamblers' explicit perceptions, beliefs or attitudes about potential negative outcomes. Representing risk perception in this way fails to include important components of perception and choice, according to many, well-supported models of risky choice across other disciplines, e.g., the Theories of Planned Behaviour and Reasoned Action (Ajzen 2011; Albarracin et al. 2001); the Health Belief Model (Glanz et al. 2008), The Psychometric Paradigm of Perceptions of Hazards (Siegrist et al. 2005), the Mental Models approach (Morgan et al. 2002); and Choice theory (Skog 2000).

Theories of risky choice highlight several factors warranting further attention in gambling theories such as gamblers' perceptions of beneficial versus harmful outcomes (Morgan et al. 2002), the risk of harmful outcomes (Glanz et al. 2008), and the meaning of outcomes (Ajzen 2011); and influence between risk perception, motivation and behaviour. The aim of this systematic review was to evaluate existing evidence related to: gamblers' perceptions of gambling risks and harms; and the relationship between risk perception and behaviour. Specifically, we attempted to determine what research tells us about: (1) the harmful outcomes gamblers expect from gambling; (2) the role of gambling outcome expectations in decision-making and behaviour; and (3) cognitive factors that moderate relationships between outcome perception and choice behaviour.

Method

A literature search was conducted using the electronic databases MEDLINE, PsycINFO, Web of Science, and Google Scholar were searched using keywords: 'risk*', 'harm*', and 'outcome*', combined with 'gambling'. There were no limits placed on the years for

searched articles. All subject headings were auto-exploded to broaden the search for relevant studies. Article reference lists were reviewed to identify research not captured in the initial screening process.

Studies were included if they made reference to: perception of negative or harmful consequences of gambling; perception of risk or likelihood of potentially harmful consequences of gambling; appraisal or comparison of different gambling outcomes.

Studies were excluded if they: did not include human participants; were not published in English; were not available as full-text (e.g., published conference abstracts with no associated article); or were not published in a refereed format (excluding government reports). Studies were not included if they were limited to discussion of only: risks or harms to society or non-gamblers (e.g., family members of gamblers); perceptions of purely beneficial consequences of gambling; general attitudes about gambling; non-gamblers' perceptions of risks or harms (e.g., expert opinion, general public sample); examination of past, but not current or future-oriented gambling consequences.

In all, 2,814 articles were identified through the search strategy. Titles and abstracts were reviewed to determine the relevance of studies to the inclusion and exclusion criteria. 84 articles were read in full. Articles meeting inclusion criteria (as described above) were retained and reviewed in detail.

Results

Of the 2,814 articles identified, 16 studies met criteria for inclusion, and their characteristics are summarized in Table 1. Year of publication ranged from 2003 to 2012. Of the 16 articles reviewed, three were carried out in Australia, four in Canada, three in China, one in Switzerland, one in the UK, and four in the USA. 11 studies included some measure of gambling behavior (e.g., self-report of gambling activity or spending), psychopathology (e.g., psychometric measures such as the SOGS (Lesieur and Blume 1987) and DSM-IV-MR-J (Fisher 2000), or both behaviour and psychopathology. It is noted that Gillespie et al. (2007a, b) published two papers using the same sample of participants, but reporting different comparative breakdown of data. Articles were analyzed according to how they addressed the three aims of the review.

General Limitations of the Gambling Risk Perception Literature

Based on the literature review, very few studies evaluated or made reference to risk perception, in contrast to the wealth of literature addressing other forms of addiction (Ajzen 2011; Breakwell 2007; Glanz et al. 2008), and cognitive distortions contributing to overestimation of winning (Delfabbro 2004; Fortune and Goodie 2011; Jacobsen et al. 2007; Raylu and Oei 2002). Most studies reviewed made only tangential reference to risk perception, and were limited by several common methodological issues.

First, all reviewed articles reported findings from cross-sectional empirical studies, meaning that inference could not be made about the causal influence between perception, intention and behaviour (Baron and Kenny 1986; Weinstein 2007). Several of the studies included indirect or no measurement of gambling psychopathology (Dean 2011; Gillespie et al. 2007a; Inglin and Gmel 2011; Li et al. 2010) or gambling behaviour (Dean 2011; Gillespie et al. 2007a; Li et al. 2010), therefore relationships between risk perception and behaviour could not be evaluated in many of the studies reviewed.

Table 1 Summary of articles reviewed

Author	Sample and study design	Measures ^a	Gambling risk perception and behavioural variables	Key findings about risk perception in gambling
Wong and Tsang (2012)	<p><i>Study 1</i>: $N = 14$ (28.6 % female) ($M_{age} = 16.5$ years, $SD = 0.8$, Range = 13–18). Purposive sampling from three public children and youth services in Hong Kong. Focus group interviews</p> <p><i>Study 2</i>: $N = 258$ (25.2 % female) ($M_{age} = 16.1$ years, $SD = 2.0$). See <i>Study 1</i>. Self-report survey.</p> <p><i>Study 3</i>: $N = 1218$ (43.8 % female) ($M_{age} = 14.8$ years, $SD = 1.3$, Range = 12–18). Hong Kong public school students. Self-report survey</p>	<p><i>Study 1</i>: Focus group interviews</p> <p><i>Study 2</i>: CAGES (38 items)</p> <p><i>Study 3</i>: CAGES (18 items)</p> <p>SOGS-RA</p>	<p><i>Study 1</i>: qualitative focus group interviews: expectations from gambling, including benefits and risks. Participant gambling behaviour classified based on self-report</p> <p><i>Study 2</i>: 38-item (9 factors), forced-choice Chinese Adolescent Gambling Expectancy Scale (CAGES) measured gambling expectations</p> <p><i>Study 3</i>: 18-item (5 factors) version of the CAGES</p>	<p><i>Study 1</i>: Two main themes emerged: positive (material gain, social benefit, enjoyment/arousal, self-enhancement, tension/boredom reduction) and negative gambling consequences (relational cost, out of control, money loss, behavioural problems)</p> <p><i>Study 2</i>: Principal Components Analysis reduced CAGES to 18 items loading on five factors (relational, social benefit, material gain, out of control, money loss)</p> <p><i>Study 3</i>: Chinese adolescents held well-formed gambling expectations. Individuals with greater gambling involvement reported higher expectations of positive outcomes (social benefit and material gain) and some negative outcomes (being out of control); reported weaker expectations of other types of negative outcomes (relational costs, money loss)</p>

Table 1 continued

Author	Sample and study design	Measures ^a	Gambling risk perception and behavioural variables	Key findings about risk perception in gambling
Tao et al. (2011)	<i>N</i> = 791 (42.2 % female) (Age = ≥18 years). Chinese-speaking Macau residents; gambled in the last 12 months. Telephone numbers randomly selected from Residential Telephone Directory. Standardized telephone self-report survey	GMAB^b	110-item, forced-choice Gambling Motives, Attitudes and Behaviour (GMAB) scale for Chinese gamblers measured: superstitious beliefs; techniques for winning; behavioral control; arousal; involvement; DSM-IV PG symptoms; motivations to gamble. GMAB includes 10 items about perceived negative consequences of gambling; summed as single factor denoting perceived unfavourability of gambling	Perception that gambling has negative consequences significantly negatively correlated with: self-worth, sensation-seeking; superstitious beliefs and behavior; gambling involvement; positively correlated with: female gender, increased age, beliefs that gambling outcomes are determined by luck, chance or fate. No significant relationship between PG and perception of negative gambling consequences
Inglin and Gmel (2011)	<i>N</i> = 2500 (51.2 % female) (<i>M</i> _{age} = 43 years, Range = 15–74). Random-quota sampling and interviewing using computer-assisted telephone interviewing; Switzerland	Attitudes scale ^b Self-reported gambling activity and spending	Attitudes scale evaluated various attitudes to gambling: gambling policy, purpose of gambling, typical gamblers' personality. Scale includes: 1 item assessing perceived addictiveness of gambling, 7 items assessing perceived dangerousness of various games	Gamblers compared to non-gamblers rated some games (poker, video lottery, scratch cards, lottery, sport toto) significantly less dangerous. No significant differences in perception of table games and slot machines. Gamblers compared to non-gamblers perceived gambling and tobacco as less addictive

Table 1 continued

Author	Sample and study design	Measures ^a	Gambling risk perception and behavioural variables	Key findings about risk perception in gambling
Dean (2011)	<p>$N = 103$ (53.4 % female) ($M_{age} = 21.6$ years, $SD = 1.3$). Convenience sample of undergraduate business students; ≤ 24 years; some experience of blackjack; Albuquerque, USA. Self-report survey</p>	<p>Socio-demographic characteristics Self-reported risk and skill related to playing blackjack</p>	<p>Questionnaire evaluated perceived: financial risk for an average player; personal financial risk; enjoyment of playing; personal experience; skill at playing</p>	<p>Authors reported that perceived financial risk to self was both significantly correlated and significantly different to perceived risk to an average other player. Self-reported level of experience significantly associated with skill, but not risk to self. Higher perceived vulnerability to loss associated with perception of lower skill and fun</p>
Wickwire et al. (2010)	<p><i>Study 1:</i> $N = 35$ (58.8 % female) ($M_{age} = 16.9$ years, $SD = 0.8$, Range = 16–19). High school students; Memphis, USA. 33 participants self-identified as African-American. Self-report survey <i>Study 2:</i> $N = 1076$ (55.9 % female) ($M_{age} = 16.2$ years, $SD = 1.1$, Range = 13–19). Urban, public high school students; Memphis, USA. Self-report survey</p>	<p><i>Study 1:</i> Open-ended expectancy questionnaire Fixed-list questionnaire Draft expectancy items Gambling Activity <i>Study 2:</i> Gambling expectancies SOGS-RA</p>	<p><i>Study 1:</i> Participants listed all potential outcomes of gambling; rated expectancy of outcomes identified in literature review. <i>Study 2:</i> Participants rated expectancy of 50 specific gambling outcomes (20 items from Study 1, 30 items from literature review)</p>	<p>Adolescents hold well formed expectations of gambling. All five expectancy domains accounted for significant variance in gambling problems and frequency, and together accounted for a majority of variance in gambling frequency, and approximately half of variance in gambling problems. More frequent gamblers and Problem Gamblers had higher expectation of material gain, negative emotions, self-enhancement; and lower expectations of negative social consequences, parental disapproval</p>

Table 1 continued

Author	Sample and study design	Measures ^a	Gambling risk perception and behavioural variables	Key findings about risk perception in gambling
Nower and Blaszczyński (2010)	N = 1601 (49.8 % female) (Range = 21–79 yrs). Problem gamblers voluntarily self-excluding; Missouri casinos from 2001–2003	Application for self-exclusion	Application for exclusion from casinos included information about: gambling involvement and behavior (including PG status); reasons for self-exclusion (i.e., perceived negative consequences of continued gambling)	Participants across all age groups endorsed hitting rock bottom, needing help, and gaining control as three primary reasons for self-exclusion. Older adults were less likely to self-exclude because they hit rock bottom, recognized they needed help, or wanted to save their marriage or job; and more likely to self-exclude because they wanted to prevent suicide
Mishra et al. (2010)	N = 240 (50 % female) ($M_{age} = 20.3$ years, $SD = 1.9$, Range = 18–25). Canadian undergraduate psychology students. Self-report survey	SSS-V EIS RBS Choice Task VPT BART DOSPERT PGSI Self-reported gambling activity	50 item Domain Specific Risk Taking Scale (DOSPERT; Weber, Blais, and Betz, 2002) measured risk attitudes across five domains: financial, health/safety, recreational, ethical, social. Participants rated perceived: riskiness; benefit; likelihood of engaging in activity. 'Financial' subscale included four gambling items	PG and gambling involvement associated with greater gambling risk-acceptance, and overall risk-acceptance. Gambling risk acceptance significantly associated with risk acceptance in most other domains
Li et al. (2010)	N = 373 (58.7 % female) (Range = 18–55 yrs). Macau University of Science and Technology students. Self-report survey	Perceived risk of gambling, anticipated regret, and intention to gamble	Questions measured: perceived risk of losing, anticipated regret attached to gambling loss, intention to gamble (across 13 game types). N.B. No explicit measures of gambling behavior or psychopathology included	Anticipated regret, risk perception, and type of gambling significantly predicted intention to gamble in 12 out of 13 game types. Anticipated regret was more predictive of gambling intentions than gambling type, or risk perception. Higher risk perception associated with greater regret anticipation

Table 1 continued

Author	Sample and study design	Measures ^a	Gambling risk perception and behavioural variables	Key findings about risk perception in gambling
Derevensky et al. (2010)	<p><i>N</i> = 1147 (49.9 % female) (<i>Range</i> = 12–19 years). Secondary school students; middle-class regions of Quebec and Ontario, Canada. Self-report survey</p>	<p>EGAQ^b GAQ DSM-IV-MR-J</p>	<p>Effects of Gambling Advertising Questionnaire (EGAQ) evaluated: exposure, recall, and attitudes related to gambling and gambling advertising (including five positive attitudes, one general negative attitude)</p>	<p>PG compared to non-gamblers and social gamblers held more positive attitudes about gambling, and perceived gambling as less harmful. Males and older students held more positive attitudes to gambling, and perceived gambling as less harmful</p>
Orford et al. (2009)	<p><i>N</i> = 8880 (<i>Range</i> = ≥16 years). Addresses randomly selected by postcode across UK regions. Standardized telephone self-report survey</p>	<p>ATGS^b Socio-demographic, health and lifestyle characteristics Family gambling behavior Self-reported gambling activity PGSI DSM-IV</p>	<p>14-item Attitude Towards Gambling Scale (ATGS) measured: attitudes about gambling; perception of harms and benefits. Items summed as single factor denoting general favorability towards gambling</p>	<p>Overall attitude towards gambling correlated with: socio-demographic status variables, gambling behaviour, health-related behavior, gambling psychopathology. PG, ‘At Risk’ gamblers, and more frequent gamblers tended to hold more favorable general attitude to gambling</p>
Delfabbro et al. (2009)	<p><i>N</i> = 2669 (49.2 % female) (<i>M_{age}</i> = 14.6yrs, <i>SD</i> = 1.4, <i>Range</i> = 12–17). South Australian high-school students. Self-report survey</p>	<p>Perceptions of skill Understanding of objective odds Misperceptions of randomness Attitudes towards gambling Gambling habits DSM-IV-J</p>	<p>9-item attitudes towards gambling subscale adapted from Delfabbro and Thrupp (2003) (<i>see below</i>), summed as single factor denoting perceived unprofitability of gambling</p>	<p>Adolescents had generally poor knowledge of gambling odds, chance and randomness. Adolescent PG reported significantly less ‘risk aversion’ than ‘At Risk’ gamblers, who in turn were less risk averse than non-problem gamblers. Adolescent PG compared to non-PG: were significantly less accurate in estimation of skill in chance tasks, coin sequences, EGM outcomes; more accurate about roulette odds; not significantly different in estimating odds of lottery, coin tosses, die tosses</p>

Table 1 continued

Author	Sample and study design	Measures ^a	Gambling risk perception and behavioural variables	Key findings about risk perception in gambling
Wickwire et al. (2007)	$N = 302$ (60.6 % female) ($M_{age} = 20.5$ years, $SD = 1.5$, Range = 18–25). Adult psychology undergraduates. Self-report survey	Perceived availability of gambling products and services Perceived likelihood of engaging in gambling Perceived benefits of gambling Socio-demographic characteristics SOGS GEQ trial items	Perceived harmfulness of gambling scale measured perception of general harmfulness of gambling	No significant relationship between perception of harm and PG status; perception of availability and PG status. PGs held greater expectation of benefit from gambling
Gillespie et al. (2007a)	$N = 1013$ (57.4 % female) ($M_{age} = 14.8$ years, $SD = 1.5$, Range = 11–18). High school students; Montreal and Ottawa, Canada. Self- report survey	48-item Gambling Expectancy Questionnaire (GEQ) assessed expectations of various, specific gambling consequences	Principal Components Analysis suggested retention of 23 items: three 'positive' factors (enjoyment/arousal, self- enhancement, money); two 'negative' factors (over- involvement, emotional impact)	

Table 1 continued

Author	Sample and study design	Measures ^a	Gambling risk perception and behavioural variables	Key findings about risk perception in gambling
Gillespie et al. (2007b)	Same sample as Gillespie, et al. (2007a) (see above). Self-report survey	GAQ DSM-IV-MR-J GEQ	23 item GEQ, developed by Gillespie, et al. (2007aa) (see above)	Gamblers versus non-gamblers reported different expectations about all five types of outcome. Probable Pathological Gamblers (PPGs) and at-risk gamblers more strongly anticipated positive outcomes (winning, enjoyment, self-enhancement) than social gamblers, who in turn anticipated positive outcomes more than non-gamblers. Non-gamblers expected negative emotional outcomes more than gamblers. Both PPGs and non-gamblers anticipated losing control significantly more than social, or at risk gamblers. Older adolescents more strongly endorsed the positive expectancy scale (enjoyment/arousal), and more weakly endorsed negative expectancy scale (emotional impact). Overall, males compared to females more strongly endorsed two positive expectancy scales (enjoyment/arousal and money); and more weakly endorsed one negative expectancy scale (emotional impact). For males, positive (enjoyment/arousal, self-enhancement, money) and negative (over-involvement) expectancy scales all significantly predicted gambling severity; with enjoyment/arousal the strongest predictor. For females, positive expectancies (enjoyment/arousal and money) significantly predicted gambling severity
Delfabbro et al. (2006)	$N = 926$ (48.4 % female) ($M_{age} = 14.5$ years, $SD = 1.6$, Range = 11–19). South Australian high-school students. Self-report survey	Gambling habits DSM-IV-J VGS Attitudes towards gambling Perceptions of skill Understanding of odds and probabilistic concepts	9-item attitudes towards gambling subscale adapted from Delfabbro and Thrupp (2003) (see below), summed as single factor denoting perceived unprofitability of gambling	Adolescents had poor general knowledge of gambling odds, chance and randomness. Adolescent PGs were more optimistic about gambling than non-problem gamblers. Adolescent PG compared to non-PG: had similar overall mathematical knowledge; were significantly less accurate in understanding the randomness of a die toss; were more accurate at calculating binary odds

Table 1 continued

Author	Sample and study design	Measures ^a	Gambling risk perception and behavioural variables	Key findings about risk perception in gambling
Delfabbro and Thrupp (2003)	$N = 505$ (53.5 % female) ($M_{age} = 16.5$ yrs, $SD = 0.8$, Range = 14–17). South Australian high-school students. Self-report survey	Gambling habits Future gambling intentions Peer and family approval of gambling Attitudes towards gambling DSM-IV-J Money management and economic socialization Initial gambling experiences	12-item Attitudes towards gambling subscale assessed attitudes towards gambling. Nine items retained following Principal Components Analysis loaded on two factors: perceived unprofitability; perceived profitability	PG and 'At Risk' gamblers compared to other adolescents perceived gambling as more profitable, and less likely to involve 'throwing money away'. Low future intention to gamble was associated with perception of gambling as: risky, not profitable, a waste of money, likely to lead to loss. Experience of early wins, higher frequency of gambling, and future intention to gamble was associated with perception of gambling as profitable

PG denotes Pathological or Problem Gambler status. All articles reported findings from cross-sectional, empirical studies

^a All studies recorded some socio-demographic data on participants (e.g., gender, age, income). Standardized questionnaire names abbreviated. Measures without acronyms represent non-standardized question batteries developed through the study. Measures of gambling pathology, behaviour and involvement highlighted in bold

^b Measure validated in summarised study. References were provided when study validating stated questionnaire has been included in this review

Second, assessment of risk perception in all of the studies relied exclusively on subjective, self-report data. Gambling research has demonstrated that gamblers often deliberately misrepresent (Kuentzel et al. 2008; Rosenthal 1986) or have poor insight into (Kuentzel et al. 2008; Yi and Kanetkar 2010) cognitions and behavior related to gambling. Further, many of the studies assessed risk perception constructs poorly via single (Derevensky et al. 2010; Inglin and Gmel 2011), or small numbers of specifically targeted questionnaire items (Dean 2011; Li et al. 2010; Wickwire et al. 2007) not checked for reliability and validity via theoretically-supported statistical methods (Floyd and Widaman 1995). Various risk perception constructs were therefore poorly identified among many of the studies.

Finally, most studies included specific, non-representative samples due either to recruitment procedures or research goals, e.g., university students (Li et al. 2010; Mishra et al. 2010; Wickwire et al. 2007), adolescents (Dean 2011; Delfabbro et al. 2006, 2009; Delfabbro and Thrupp 2003; Gillespie et al. 2007a, b; Wickwire et al. 2010; Wong and Tsang 2012), self-excluding problem gamblers (Nower and Blaszczynski 2010), and blackjack players (Dean 2011). Many of the restrictions placed on samples (e.g., age, history and experience of gambling problems) relate to well-established risk factors associated with biased cognition or excessive gambling behaviour (Johansson et al. 2009; Raylu and Oei 2002), limiting the relevance of research findings to specific subpopulations in many cases.

Gamblers Expectations About Harmful Outcomes

Expectations about harmful gambling consequences have typically been dichotomized into: (1) perceptions about relative, overall consequences (e.g., Orford et al. 2009); and (2) expectations about specific types of outcome (e.g., Gillespie et al. 2007a).

Gamblers' Relative Expectations of Harm Versus Benefit

Five studies have assessed the relationship between overall negative, or negative-versus-positive expectations, and gambling behaviour (Derevensky et al. 2010; Inglin and Gmel 2011; Orford et al. 2009; Tao et al. 2011; Wickwire et al. 2007). Each study gathered relative attitudinal ratings of risks and benefits of gambling (e.g., participant agreement that 'gambling can become a problem' Derevensky et al. (2010)), compiling group mean scores that represented perception of the general harmfulness of gambling. Overall, studies provided evidence that heavier and more disordered gamblers hold more positive relative expectations of gambling. (Orford et al. 2009) found that more favourable attitudes towards gambling were associated with greater time and money spent gambling, as well as problem and 'at risk' gambling status. Similarly, Derevensky et al. (2010) and Wickwire et al. (2007) reported that pathological gamblers were more likely to perceive gambling as beneficial, than non-gamblers, or social gamblers. Partial support was provided by Tao et al. (2011), who found that a perception that gambling carried negative consequences was associated with less gambling involvement, but not with pathological gambling status.

Inglin and Gmel (2011) included a single question investigating gamblers' perceptions that gambling may be addictive. In line with other 'relative attitude' studies, results suggested that gamblers compared to non-gamblers expected gambling to be less addictive, though expectations did not vary based on proportion of income spent on gambling.

Gamblers' Expectations About Specific Types of Outcomes

Four recent studies investigated gambling outcome expectancy with greater specificity than 'relative attitude' research (Gillespie et al. 2007a, b; Wickwire et al. 2010; Wong and Tsang 2012). Each study attempted to comprehensively investigate the full range of specific outcomes gamblers expect of gambling. Those who gambled excessively whether responsibly or not at all perceived gambling expectancy differently. Overall, studies found: heavier and more disordered gamblers expected greater benefits from gambling; disordered gamblers and non-gamblers expected some harmful outcomes to a greater degree than less experienced gamblers. All four studies were limited to exclusively adolescent populations, and followed a similar methodology (related to Gillespie et al. (2007a)). Each study compiled a questionnaire assessing the most commonly expected types of outcome (based on literature review, qualitative investigation, and factor analysis); then used their questionnaire to assess outcome expectancy among groups of gamblers and non-gamblers.

Gillespie et al. (2007a) classified the most commonly expected gambling outcomes according to three positive categories (enjoyment or arousal; positive feelings of self-enhancement; financial gain) and two negative categories (over-involvement or preoccupation; negative feelings of shame, guilt, and loss of control). Gamblers versus non-gamblers reported different expectations of all five types of outcome. Probable Pathological Gamblers (PPGs) and at-risk gamblers more strongly anticipated positive outcomes (winning, enjoyment, self-enhancement) than social gamblers, who in turn anticipated positive outcomes more than non-gamblers. Non-gamblers expected negative emotional outcomes more than gamblers. However, both PPGs and non-gamblers anticipated losing control significantly more than social, or at risk gamblers. All five expectancy scales accounted for significant variance in gambling involvement, although patterns differed between males and females. For males, both positive (enjoyment/arousal, self-enhancement, money) and negative (over-involvement) expectancies significantly contributed to prediction of gambling severity; with enjoyment/arousal being the strongest predictor of gambling behaviour. For females, the predictive value of outcome expectancies was weaker. However, positive expectancies (enjoyment/arousal and money) were significant predictors of gambling severity.

A similar, mixed pattern of expectations was found by Wong and Tsang (2012), and Wickwire et al. (2010). Chinese Adolescents with greater gambling involvement reported higher expectations of positive outcomes (social benefit and material gain) and some negative outcomes (being out of control); but reported weaker expectations of other types of negative outcomes (relational costs, money loss) (Wong and Tsang 2012). Wickwire et al. (2010) reported that more frequent and more problematic gambling related to more positive and negative expectations, including: greater expectancies of material gain, negative emotions, and self-enhancement; and lower expectations of negative social consequences, and parental disapproval. Wickwire et al. (2010) found that all five expectancy domains accounted for significant variance in gambling problems and frequency, and together accounted for a majority of variance in gambling frequency, and approximately half of variance in gambling problems.

Taken together, these studies suggest a complex pattern of mixed expectations, or ambivalence, among higher frequency and more disordered gamblers, with stronger expectations of positive outcomes (e.g., excitement, financial reward) and some negative outcomes (e.g., loss of control), at least among adolescents. Both positive and negative expectancies were important predictors of gambling behaviour and problems (Gillespie et al. 2007b; Wickwire et al. 2010). However, positive expectancies

(particularly emotional arousal) were more influential in decision making than perception of negative outcomes (Gillespie et al. 2007b), in line with ‘general attitude’ research showing disordered gamblers to be more optimistic overall about their expectations of gambling.

The Role of Outcome Expectancy in Decision Making and Behavior

Disordered Gamblers Hold more Optimistic Overall Expectations

Despite few studies and poor identification of risk perception in some cases, ‘relative attitude’ research provided evidence that gamblers’ expectations relate to behaviour. Specifically, that a more optimistic outlook on gambling is associated with heavier and more disordered gambling. Several possible explanations are possible for the relationship between risk perceptions and gambling. Lower relative risk estimation or awareness may expose individuals to harm, e.g., because attitudes result in poor management and over-investment of resources (time, money). Alternatively, high investment or disordered cognition may cause gamblers to under-report or lack insight about risk, based for example, on a wish to justify behavior, or because of the greater salience of desired outcomes. Overall, cross-sectional ‘relative-attitude’ research alone allows little more than speculation about cognitive processes underlying beliefs, or about causal influence between cognition and behaviour (Weinstein 2007).

Evidence from a range of sources supports the assumption that attitudes influence behaviour, and vice versa. Research has shown that poor risk estimation increased risk-taking behaviour, resulting in increased risk of harm (Breakwell 2007). Individuals have demonstrated several types of estimation error that result in riskier behaviour and higher rates of harm, e.g., inaccurate calculation of personal vulnerability or likelihood of harmful outcomes (Jones et al. 2001; Leigh 1999; Lipkus et al. 2011; Weinstein 1987), or exaggerated emphasis on low probability outcomes, or vivid, immediate consequences (Leigh 1999; Slovic et al. 1978).

Evidence from drug, alcohol, and offending research also supports the alternative, i.e., that riskier behaviour is associated with deception (Hall and Poirier 2001; Magura and Kang 1996); and leads to denial of harm (Auslander 1999; James et al. 1996) via cognitive strategies that inhibit risk perception (Howard et al. 2002; Peretti-Watel 2003; Rebelo 1999), and neuro-physiological changes associated with impaired insight and awareness of risk (Goldstein et al. 2009; Rinn et al. 2002). Although, further research is needed to clearly elucidate the influence between gambling-risk cognition and behaviour, more specific outcome expectancy research had provided preliminary evidence that expectations of gamblers may help to explain gambling behaviour.

Disordered Gamblers Expect a Range of Negative and Positive Outcomes

Outcome expectancy research suggests that not only do disordered gamblers hold more optimistic expectations overall, they expect a range of both positive and negative specific outcomes with differing influence on gambling behaviour.

Little research has investigated how disordered gamblers may maintain greater optimism and continued motivation to gamble, despite ambivalent expectations. Risk and addiction research suggests that individuals may continue to engage in risky behaviour due to the greater weighting of positive-over-negative outcome expectancies based on the greater personal significance or salience of positive outcomes (Goldberg and Fischhoff 2000;

Leigh 1999; Redish et al. 2008; Slovic et al. 1978). At least one study provided evidence that gamblers may perceive positive expectancies to be more important than negative (Gillespie et al. 2007b).

Alternatively, automatic ‘urges’ to gamble may overwhelm attempts to critically evaluate the potential consequences (Grant et al. 2006; Potenza et al. 2003). How individuals respond to mental states and environmental cues may therefore influence salience, and subsequent framing, of positive versus negative expectancies (Goldstein et al. 2009; Stanovich and West 2008; Toplak et al. 2007).

It is therefore possible that disordered gamblers, exposed to negative gambling experiences, learn to expect more negative outcomes than other gamblers (e.g., preoccupation), but continue to gamble due to dominant positive expectancies, automatic urges, or some combination of these factors (Baudinet and Blaszczynski 2012). Similarly, negative expectancies among low or non-gamblers may protect individuals from gambling problems, by inhibiting motivation to engage in gambling, and thereby limited exposure to loss, problems, and conditioning processes (Blaszczynski and Nower 2002; Jessor 1998).

The Meaning of Outcomes is Idiosyncratic and Important to Decision Making

Outcome expectancy research also revealed important idiosyncratic variation in risk perception that may influence decision-making. Despite similarities in sample and methodology, outcomes identified among specific outcome studies varied considerably, and differences between samples appeared to reflect cultural differences related to sample demographics. For example, Chinese adolescents (Wong and Tsang 2012), unlike their Canadian (Gillespie et al. 2007a) and African-American counterparts (Wickwire et al. 2010), did not identify affective and self-referent expectancies as discrete gambling expectancies, but perceived gambling as an activity through which they may impress peers or gain approval. Such a difference in emphasis follows well-established ‘value’ differences between Asian and North American populations (Markus and Kitayama 1991; Morris and Peng 1994).

Demographic profiles of gambler risk perception further support the relevance of personal experience and individual difference in development of risk perception. Certain static demographic variables (i.e., younger age, male gender) correlated consistently with more optimistic risk perception (Derevensky et al. 2010; Gillespie et al. 2007b; Inglin and Gmel 2011; Orford et al. 2009; Tao et al. 2011), in line with established patterns among disordered gambling (Johansson et al. 2009; Raylu and Oei 2002). Gillespie et al. (2007b) in particular identified that, while male adolescents exhibit higher rates of disordered gambling than females, there were significant gender differences in expectations above and beyond those associated with gambling severity. For example, males more strongly expected some positive outcomes (enjoyment/arousal, money), while females were more perceptive of some harms (emotional impact).

Perception of lower risk was also associated in at least one study with other static and dynamic factors: lower education and occupational status; better general health; higher levels of drinking and smoking; lower family history of gambling problems; higher sensation seeking and self-worth; stronger belief in superstition and luck; superstitious behaviour (Derevensky et al. 2010; Orford et al. 2009; Tao et al. 2011). Overall, these findings suggest that risk perception among gamblers is not homogenous in the general population, and that particular demographic factors (and possibly socio-cultural and cognitive-behavioural factors) predispose gamblers to develop particular beliefs associated with greater exposure to risk and harm.

No research to date has directly assessed the value individuals place on gambling outcomes. Nevertheless, evidence from four other studies further support the assertion that individual differences and context predispose gamblers to frame outcomes in particular ways, and that the meaning of outcomes play a role in expectation, motivation and risk-taking. In a study of self-excluding problem gamblers, participants reported a number of reasons for self-exclusion from casinos related to perception of the harmful consequences of gambling (e.g., ‘hitting rock bottom’, loss of control) along with anticipation and desire to avoid future harm (e.g., wanting to prevent suicide) (Nower and Blaszczynski 2010). Gamblers’ personal experience therefore informed their anticipation of future emotional or cognitive states, and thereby acted as a deterrent to future gambling. Similarly, Li et al. (2010) found that intention to gamble in a lay sample was predicted by both the level of regret anticipated in relation to losing a day’s wages, and perception that a game was risky; with regret anticipation more predictive than risk perception of gambling intentions overall. Likewise, blackjack players found games less fun if they perceived themselves to be personally vulnerable to financial harm (Dean 2011), while frequent and disordered gamblers were found to be more tolerant of risk than others, both overall and in relation to gambling (Mishra et al. 2010). This evidence is consistent with drug and alcohol research indicating that the meaning of outcomes to individuals is important in the way that expectations influence motivation and risk-taking. For example, ‘positive’ expectancies are better predictors of alcohol consumption than ‘negative’ expectancies. (Goldberg et al. 2002; Stacy et al. 1990).

Taken together the research discussed here suggests that gamblers may frame consequences, overall attitudes, and decisions based on what they find important or salient, in itself influenced by cultural experience (Dhillon et al. 2011; Kim 2012), mental state (Raylu and Oei 2002), environmental context (Baudinet and Blaszczynski 2012), or other individual differences.

Given, the heterogeneity of outcome meaning across subgroups, the importance of meaning in motivation and behaviour, and exclusive use of lay adolescent samples; it is doubtful that measures developed in outcome expectancy studies comprehensively identify outcomes meaningful to the decision making of important gambler subgroups (e.g., disordered gamblers versus long-term, responsible non-problem gamblers). For example ‘parental disapproval’ (Wickwire et al. 2010) is unlikely to be one of the five most easily identifiable, important or salient outcomes for a 50 year old with a 30 year history of gambling, and comorbid mood disorder or antisocial personality traits (Milosevic and Ledgerwood 2010).

Further, the ‘value’ of outcomes identified in expectancy studies may not necessarily adhere to simple ‘positive–negative’ polarizations, or other categorizations imposed through factor analytic modeling, and instead may vary dependent on context or individual preferences. For example, ‘escape’ or tension reduction is a well-established effect or goal in gambling (Rockloff and Dyer 2006) with both positive and negative potential effects for mood and behaviour (Wood and Griffiths 2007). Yet, during development of the Gambling Expectancy Questionnaire, Gillespie and colleagues (Gillespie et al. 2007a) removed six escape/tension reduction items from their scale, due to loadings on both positive and negative emotional scales. Such an omission follows well-established statistical guidelines (Floyd and Widaman 1995), but may have nevertheless preemptively removed important information that may predict decision-making and behaviour among disordered gamblers (Lee et al. 2007).

Idiosyncratic variation in risk perception should be taken into account in cognitive-behavioural and demographic formulations of disordered gambling (Milosevic and

Ledgerwood 2010; Sharpe 2008). Further, it is important to consider what research suggests are factors that may moderate or influence the role of risk perception in decision making and behaviour, including factors that influence the meaning of outcomes, as well as how gamblers resolve conflicting motivations and expectations.

Factors that Influence the Role of Risk Perception in Decision Making and Behaviour

The Perceived Qualities of Gambling Outcomes

Gambling risk perception research has tended to apply positive–negative labels to anticipated outcomes on the basis of assumptions about normative belief (e.g., Gillespie et al., 2007a; Wong and Tsang 2012). However, research suggests that a number of outcome qualities may influence what outcomes mean to individuals, such as: the impact of consequences; the likelihood of outcomes occurring; and the presence or absence of particular environmental cues and mental states.

The Perceived Impact of Consequences A number of researchers have argued that positive outcomes of addictive (Goldberg et al. 2002) or impulsive behaviours (Ainslie 1975) are often more immediate and direct, and as a result more powerful reinforcers and predictors of behaviour (Stacy et al. 1990). The immediacy and directness of consequences is highly relevant in gambling, where consequences vary, in terms of when and how directly outcomes affect individuals (Hing et al. 2012; Nussbaum et al. 2011; Wardle et al. 2012), and how different aspects of the gambling experience (e.g., sensory stimuli) reinforce cognition and behaviour (Rockloff et al. 2007). Nevertheless, no studies to date have looked directly at how gamblers' perceptions of risk are influenced by the immediacy or personal relevance of consequences.

The Perceived Likelihood of Outcomes The importance of particular consequences may also be affected by the perceived likelihood of an event occurring. Several studies have measured the relationship between perceived risk and gambling activity. All but one of these studies (Wickwire et al. 2007), provided evidence that lower estimation of likelihood of harm was associated with higher gambling involvement (Inglin and Gmel 2011) or psychopathology (Delfabbro et al. 2006, 2009; Delfabbro and Thrupp 2003; Derevensky et al. 2010), despite comparable risk estimation skills (Delfabbro et al. 2006, 2009).

All six studies considered 'likelihood' in a general sense, referring to perception of the overall likelihood of negative outcomes, similar to 'general attitude' research. Therefore, 'overall likelihood' studies may in fact be measuring the same conceptual domain as 'general attitude' studies. Differentiating 'likelihood' from 'attitude' constructs is a difficult task. Few gambling studies have measured more than one risk perception construct among a single experiment enabling comparison of conceptual constructs; those studies that did (Derevensky et al. 2010; E. Wickwire et al. 2007) present mixed results. Derevensky et al. (2010) for example, included questions that addressed perceived benefits, risk of long-term problems, and likelihood of beneficial outcomes, and found problem gamblers to be more optimistic across all factors. Wickwire et al. (2007) measured perceived riskiness distinct from the perceived benefit of gambling, and found problem/pathological gamblers to expect greater benefit from gambling with no differences from other groups in perceived riskiness. Therefore, one study showed perceived of the likelihood of harm to be distinct and subordinate to expectations of benefit in predicting problem

behaviour (Wickwire et al. 2007), but this distinction was not necessarily consistent (Derevensky et al. 2010).

Therefore, evidence suggests that lower estimation of risk is associated with greater gambling involvement and psychopathology, but to date estimation of likelihood has not been clearly differentiated from other attitudes or beliefs about harm.

The Presence of Perceptual Cues and Mental States Investigators have also suggested that the salience and meaning of particular expectations may be influenced by subjective experience, and the presence of particular environmental cues or mental states. Gambling research highlights the importance of subjective arousal to development of disordered gambling (Baudinet and Blaszczynski 2012). Gambling triggers states of arousal (e.g., through intermittent rewards, and sensory cues (Rockloff et al. 2007)), and individuals learn to associate arousal with environmental stimuli via classical and operant conditioning processes (Blaszczynski and Nower 2002). Exposure to environmental stimuli, particularly when individuals are in vulnerable mood states, may therefore come to trigger particular expectations, as well as precipitating emotional responses associated with the urge to gamble (Sharpe 2002; Wood and Griffiths 2007). Hence individual experiences of gambling, in conjunction with the presence or absence of particular environmental cues or vulnerable mental states is likely to impact on the salience and motivational power of particular gambling outcomes (Freidenberg et al. 2002). Nevertheless research is yet to investigate the influence of psychological states or environment on gambling risk perception.

Therefore, while there is reason to believe that a number of factors may affect the perceived meaning of gambling consequences, there is limited research about how these affect gambling risk perception.

Lack of Insight and Resolution of Conflicting Expectations

Although risk assessment may be influenced by various qualities of outcomes, risk perception is also affected by individuals' knowledge or information processing in relation to gambling. Evidence suggests that particular individuals are prone to processing gambling wins and losses differently (Gilovich 1983; Toneatto et al. 1997), and in doing so unrealistically enhancing expectations of positive outcomes (Joukhador et al. 2004). Regardless of individual differences in cognitive biases, all gamblers appear to hold poor understandings of the mechanics determining outcomes (Delfabbro 2004; Delfabbro et al. 2009; Lambos and Delfabbro 2007). It is likely that processing biases that inhibit awareness of harmful outcomes, along with poor insight about risk, may result in some gamblers underestimating risk and exposing themselves to risk and harm. However, while research has explored the range of processing biases and erroneously beliefs of gamblers, no studies to date have explicitly tested the accuracy of expectations about gambling harm, beyond tests of mathematical ability.

In addition, it is likely that gamblers further expose themselves to risk through attempts to justify desire to gamble in the context of distressing expectations or conflicting cognitions. Addiction research suggests that some anticipated outcomes in risky scenarios are motivating enough that individuals become dependent on substances or activities (Freidenberg et al. 2002; Gawin 1991; Grant et al. 2006; Toplak et al. 2007). Individuals nevertheless report regret or distress in response to perceived dependence, as well as other consequences of risky behaviours (Anderson et al. 2011; Li et al. 2010; Yi and Kanetkar

2011). It is likely that individuals are therefore motivated to both: continue gambling due to expected positive outcomes, and reduce negative emotions such as regret and cognitive dissonance.

Research suggests that individuals may appease conflicting motivations through behavioural change (e.g., by discontinuing gambling (Slutske 2010; Sobell et al. 2001)) or on a cognitive level (e.g., by altering existing beliefs, adding new beliefs, or reducing the importance of a cognitive element (Cooper 2012; Jarcho et al. 2011)). This process of minimising negative expectations, or bolstering positive expectations, may mean that gamblers do not take adequate steps to avoid risk. In line with these expectations, disordered gamblers have been shown to hold a mix of negative and positive unconscious expectations, but explicitly report only positive expectations (Yi and Kanetkar 2010), implying that disordered gamblers are unconsciously denying negative outcomes, or deceptively reporting expectations.

Conclusions

Despite an extensive focus in the literature on cognitive biases and errors associated with disordered gambling, there has been a paucity of research addressing gamblers' perceptions of potential harms and risk related to gambling. The extant research provides evidence that disordered gamblers hold both: more optimistic overall perceptions of risk, and a mix of more positive and more negative specific expectations about outcomes. Despite holding more negative expectations, disordered gamblers maintain motivation to gamble, and hence we may assume that this group is discounting risks in some way, such as by attributing preferential importance to positive outcomes.

Research suggests that risk perception varies based on contextual factors or individual differences, such as gamblers' cultural experiences and exposure to gaming. A range of factors may moderate the role of risk perception in decision-making and behaviour such as the perceived qualities of anticipated outcomes, awareness of consequences, and responses to conflicting cognitions. Given potential differences in the perception of risk between various categories of gamblers, clinicians should take into account how gamblers in treatment view gambling as a risky behaviour. Improving the accuracy of such perceptions may reduce the propensity for risk-taking behaviours.

Further research is needed to identify the range of outcomes expected by important subgroups of gamblers, how gamblers interpret and use information about risk perception, and the influence of individual differences and context on gambling risk perception and behaviour.

The current literature is limited in a number of ways, related to sample specificity, cross-sectional study design, and methodological approach to the identification of risk perception parameters. Future research should work to address these issues in study design and implementation.

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APPENDIX B: Published manuscript

Spurrier, M., Blaszczynski, A., & Rhodes, P. (2014). Gambler risk perception: A mental model and grounded theory analysis. *Journal of Gambling Studies*, DOI 10.1007/s10899-013-9439-9.

An Expert Map of Gambling Risk Perception

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Abstract The purpose of the current study was to investigate the moderating or mediating role played by risk perception in decision-making, gambling behaviour, and disordered gambling aetiology. Eleven gambling expert clinicians and researchers completed a semi-structured interview derived from mental models and grounded theory methodologies. Expert interview data was used to construct a comprehensive expert mental model ‘map’ detailing risk-perception related factors contributing to harmful or safe gambling. Systematic overlapping processes of data gathering and analysis were used to iteratively extend, saturate, test for exception, and verify concepts and emergent themes. Findings indicated that experts considered idiosyncratic beliefs among gamblers result in overall underestimates of risk and loss, insufficient prioritization of needs, and planning and implementation of risk management strategies. Additional contextual factors influencing use of risk information (reinforcement and learning; mental states, environmental cues, ambivalence; and socio-cultural and biological variables) acted to shape risk perceptions and increase vulnerabilities to harm or disordered gambling. It was concluded that understanding the nature, extent and processes by which risk perception predisposes an individual to maintain gambling despite adverse consequences can guide the content of preventative educational responsible gambling campaigns.

Keywords Gambling · Pathological gambling · Harm · Risk perception · Cognition · Decision making · Qualitative · Grounded theory · Mental models

Introduction

Gambling is a risky behaviour associated with harmful consequences for a proportion of participants (Productivity Commission 2010). Although evidence from studies on

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offending, and drug and alcohol use indicates that risk perception plays an important role in risk taking behaviours (Glanz et al. 2008), few studies have investigated the role played by an individual's perceptions of risk and harm in gambling (Spurrier and Blaszczynski 2013).

Data derived from risk perception studies suggests that gamblers' perceptions of negative consequences play an important role in decision-making, behaviour, and disordered gambling aetiology (Spurrier and Blaszczynski 2013). Studies have reported the presence of a functional relationship between disordered gambling and a mix of positive ('material gain', 'social benefits') and negative expectations ('loss of control') (Gillespie et al. 2007; Wickwire et al. 2010), and lower overall risk expectancies (Derevensky et al. 2010; Inglin and Gmel 2011).

Findings that gamblers maintain greater optimism about gambling, despite the experience and expectation of negative consequences (Wickwire et al. 2007; Wong and Tsang 2012; Yi and Kanetkar 2010), suggest that disordered gambling cannot be fully explained by gamblers overestimating positive outcomes or personal control (Fortune and Goodie 2011; Toneatto 1999). Instead, both positive and negative perceptions play independent but interrelated roles in motivation and risky decision making (Wickwire et al. 2007; Yi and Kanetkar 2010). Disordered gamblers appear to maintain maladaptive optimism through, either, dominance in magnitude, salience, or significance of positive over negative perception, or implicit or explicit manipulation of perceptual data (Gillespie et al. 2007; Wickwire et al. 2010). Yi and Kanetkar (2010) for example, showed disordered gamblers hold more positive and negative implicit expectations than other gamblers, but explicitly acknowledge only positive expectations—suggesting implicit or explicit resolution of tension between conflicting perceptions, via suppression of negative expectations, deceptive reporting, or both.

Related drug, alcohol and offending research also suggest that stronger positive and weaker negative perceptions relate to riskier behaviour, also at times a consequence of users' manipulation of risk data. Problematic users and offenders exaggerate emphasis on low probability outcomes and vivid, immediate consequences (Leigh 1999; Slovic 1978), and underestimate personal vulnerability, and likelihood of harmful outcomes (Jones 2001; Lipkus 2011; Weinstein 1987). In addition, harmful users exhibit greater deception of self and others (Hall and Poirier 2001; Magura and Kang 1996) and denial of harm (Auslander 1999; James 1996), employ cognitive strategies that inhibit risk perception (Howard 2002; Peretti-Watel 2003; Rebelo 1999) and experience neurophysiological change associated with impaired risk awareness (Goldstein et al. 2009; Rinn 2002).

Findings in the gambling literature are compatible with drug, alcohol and offending research. However, comparable conclusions about gambling risk perception are limited by a paucity of relevant research, and design issues potentially biasing or restricting results (cross-sectional and self-report designs, limited risk perception construct measurement, non-representative sampling) (Baron and Kenny 1986; Spurrier and Blaszczynski 2013; Weinstein 2007). Therefore, despite a clear relationship between risk perception and gambling, the available research allows only limited inference about cognitive, behavioural, social, biological or environmental processes underlying risk perception and risky decision making in gambling (Spurrier and Blaszczynski 2013; Weinstein 2007).

The aim of this study was to investigate the perspectives of expert gambling clinicians and researchers about how disordered versus recreational gamblers perceive, interpret and use risk information in gambling decision making and behaviour.

Methods

Participants

A convenience sample of eleven experts were invited to participate. Selection criteria included local and international experts known to the second author, with gambling-specific research or clinical experience >4 years, and specific expertise in gambler perceptions, beliefs, or appraisals. Eight participants were located in Australia, two in Canada, and one in the USA.

Three experts accepted an email invitation to participate in the first round of interviews. Six experts were subsequently recruited after preliminary data analysis was completed in order to clarify and extend emergent themes until theoretical saturation was achieved (Strauss and Corbin 1994). Two final interviewees were recruited post-saturation, to check if any new themes or concepts emerged (Strauss and Corbin 1994).

Table 1 lists expert participants' descriptive information. Pseudonyms were used for all participants to protect anonymity.

Measures

A semi-structured interview based on a combination of Grounded Theory and Mental Models methodologies (Morgan et al. 2002; Strauss and Corbin 1994, 1998) was used to elicit expert perspectives. Initial interview questions were open-ended and attempted to explore participants' beliefs about the content and influence of gambler risk perception cognition (see "Appendix 1" for sample questions) (Strauss and Corbin 1998). Coding overlapped with interviews such that as analysis developed interview content and participant selection was modified to affirm, modify, add, elaborate, clarify, and find exceptions in emerging themes (Strauss and Corbin 1994). Interviews lasted 40–90 min. Six interviews were conducted in person, four via Skype, and one by telephone. With the permission of the participants, all interviews were digitally audio-recorded and transcribed. The University of Sydney Human Research Ethics Committee approved the conduct of the study.

Procedure

The study combined the mental models (MMs) approach to risk perception evaluation (Morgan et al. 2002), with data collection and interpretation based in grounded theory (GT) (Strauss and Corbin 1994, 1998).

The MM approach aims to identify incomplete or inaccurate content in lay mental models associated with the use of specified hazards; where this content is assumed to be responsible for potentially harmful outcomes among users (Fischhoff 1995). The MM approach has demonstrated efficacy in the development of effective, evidence-based risk communication interventions (Jungermann et al. 1988), and was therefore deemed appropriate for investigating gambling risk perception (gambling as a hazardous activity).

The study followed the step-by-step MM procedure outlined by Morgan et al. (2002). First, semi-structured interviews were conducted with gambling experts. Second, interview data was compiled into a comprehensive mental model 'map' that detailed vulnerability and protection factors contributing respectively to harmful or safe gambling. Within each phase, systematic overlapping processes of data gathering and analysis were used to

Table 1 Experts' professional experience

Name	Gambling-specific and years of experience
Expert 1	Counsellor, trainer/educator, policy development
Expert 2	Clinical psychologist, researcher (cognition)
Expert 3	Counsellor
Expert 4	Researcher (sociological factors, technology/EGMs)
Expert 5	Researcher (reinforcement/behaviour, technology/EGMs)
Expert 6	Clinical psychologist, researcher (cognition)
Expert 7	Trainer/educator, policy development
Expert 8	Clinical psychologist, trainer/educator, researcher (individual differences, sociological factors)
Expert 9	Researcher (cognition, reinforcement/behaviour, risk decision-making, technology/EGMs), policy development
Expert 10	Researcher (behaviour, individual differences, technology/EGMs, cognition)
Expert 11	Clinical psychologist, policy development, researcher (individual differences, risk decision-making)

>30 years

7 years

>10 years

>10 years

>10 years

>10 years

>4 years

>10 years

20 years

>10 years

>10 years

>10 years

iteratively extend, saturate, test for exception and verify the content of mental model maps (Strauss and Corbin 1994, 1998; Hayes 1997).

Data Analysis

NVivo qualitative data analysis software was used to apply open, axial and selective coding analyses (QSR International, Version 9; Richards 2005; Strauss and Corbin 1994, 1998). Coded concepts were linked based on similarity or themes among the concepts identified, after which data was subject to open coding. As the interviews progressed, recurrent themes were explored in subsequent interviews to enable theoretical sampling. Conceptual relationships were assembled through a process of axial coding whereby initial categories were linked to subcategories along the lines of their properties and dimensions. Finally, selective coding integrated and refined final categories, in order to provide a detailed, complete explanation of situated gambling risk perception. Two additional participants confirmed that theoretical saturation was achieved. A comprehensive expert influence map emerged from the coding process (see Fig. 1).

Controlling for Bias

Several strategies were employed to reduce potential researcher bias based on Chiovitti and Piran’s (2003) recommendations. Interview paradigms were initially based on open

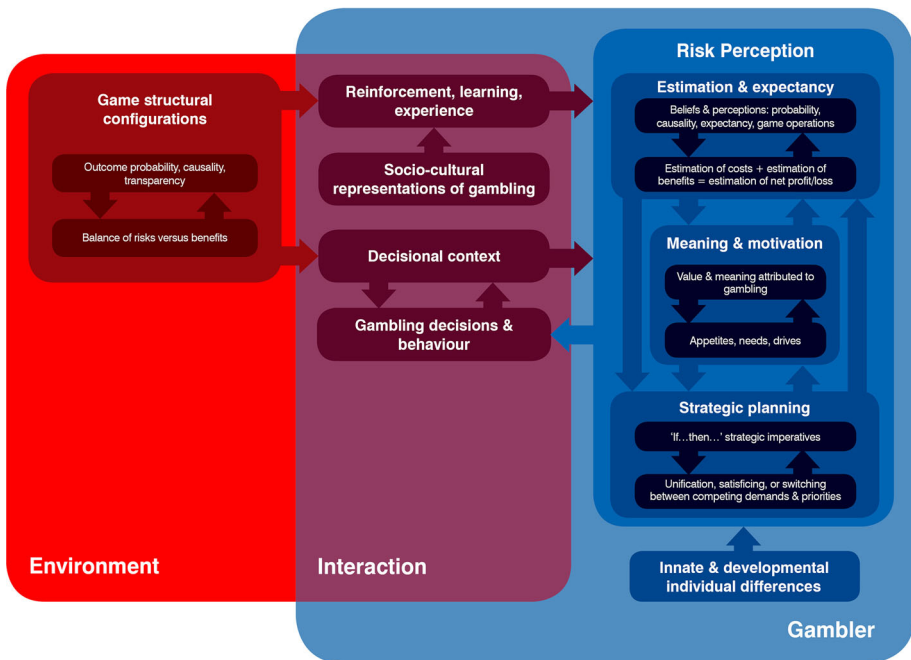


Fig. 1 Expert map of gambling risk perception, decision making, and behavioural operations. Perception and decision making processes involve both implicit and explicit cognition, and may be subject to deliberate or automatic distortion or manipulation. Risky operations within the gambler’s cognition or interaction with the environment may result in disordered gambling

questions. The author kept notes during interview, transcription, and analysis, to detail emergent concepts and identify potential personal bias. At the same time, participants' own language was used where possible to label and describe concepts. Following initial coding, two randomly selected interviews were blind-coded by a co-author, and used to refine coding and theory development. Finally, within-interview member checking tested interviewer interpretation of participant data. Participant statements were selected and included below to represent either typical, exemplar, or contrasting viewpoints on a particular topic.

Results

Experts' Model of Risk Perception

Responses were consistent with the hypothesis that experts view gambler perceptions of risk and value as having adaptive or maladaptive influence on decision-making and behaviour (Spurrier and Blaszczynski 2013). Coding of interviews with experts revealed eight major themes (represented in Fig. 1 below). Three of these themes related to the core functional components of gambler risk perception content and processes:

- (1) Estimation and expectancy: beliefs or estimations about how gambling systems operate and generate outcomes combine with perception of the benefit versus cost of expected or possible event outcomes.
- (2) Meaning and motivation: perception of the meaning or value of gambling and its consequences combine with individuals' wants, motivation drives and goal seeking.
- (3) Strategic planning: understanding of how operating rules and strategies are prioritised and integrated according to internal goals.

Five additional themes described environmental and individual factors mediating or moderating relationships between risk perception, decision making and behaviour:

- (4) Reinforcement, learning and experience: exposure to gambling reinforcement schedules, and resultant cognitive changes.
- (5) Decisional context and available choice: availability, salience and sensitivity to internal and external cues.
- (6) Implicit versus explicit cognition: the comparative application and control of implicit versus explicit cognitive processes.
- (7) Ambivalence and manipulation of risk data: perception and implicit or explicit suppression or amplification of positive and negative perceptions.
- (8) Innate and developmental individual differences: experiential or dispositional differences between individuals.

Themes are presented here as modular schema to enable meaningful discussion of decision-making processes. However, it is important to bear in mind that individual risk perceptions had referential overlap, that is, perceptions related concurrently to multiple themes, with aspects of risk perception potentially occurring simultaneously, sequentially, and/or with reciprocal influence during sessions of play.

Certain types of risk perception content relating to key themes were believed by experts to either increase or decrease risk of harm (summarised respectively as 'vulnerability' and 'protection factors' in Table 2 below). In the following sections, expert accounts of each of the key themes will be summarised and contrasted.

Table 2 Vulnerability and protection factors associated with specific individual and environmental domains related to gambling risk perception

Domain	Vulnerability factor	Protection factor
Estimation and expectancy	Inaccurate risk estimation (low erudition, expectation, emphasis on negative outcomes; high erudition, expectation, emphasis on positive outcomes; inconsistent estimation; inaccurate causal understandings; overall underestimation of negative outcomes and long term loss)	Accurate or cautious risk estimation (detailed, consistent, heightened negative expectations; consistent low erudition, expectation, emphasis on positive outcomes; overestimation or accurate expectations of outcomes and long term loss)
Meaning and motivation	Low emphasis or value attributed to risk management High value attributed to risky gambling goals (e.g., winning, emotion regulation, other non-monetary goals) Difficulty resisting impulse to gamble Presence of intense urges to gamble Increasing will to manipulate risk perception (exposure to problems and consequent need for emotion regulation, avoidant coping, rationalization of gambling behaviour and its consequences)	High value attributed to risk management Low emphasis or negative attributions towards gambling Competing gambling-inconsistent goals Increasing will to decrease gambling with exposure to negative outcomes
Strategic planning	Insufficient risk management emphasis (low or inconsistent prioritization of risk management goals; failure or inconsistency setting or following sustainable limits; high prioritization of conflicting, risky goals, e.g., winning money, emotion regulation)	Consistent, high risk management emphasis (prioritization of risk management goals; consistent, cohesive, precise limit setting)
Reinforcement, learning, experience	Exposure to high value representations of gambling Significant exposure to reinforcement schedules (intermittent wins; money-independent rewarding outcomes; game configurations and events distorting perception of causality, softening punishment, or amplifying intensity or rate of rewards)	Exposure to meaningful negative consequences
Decisional context & available choice	Availability of internal or external triggers Presence of risky mental states or significant stressors (e.g., low mood)	
Implicit versus explicit cognition	Implicit reasoning problems (overuse of implicit reasoning; lack of error correction; dominance of implicit over explicit reasoning) Hypersensitivity to gambling cues (presence of risky mental states, sensitivity to internal or external triggers, presence of intense urges) Increasing automaticity of gambling with experience	
Ambivalence and manipulation of risk data	Perceptual or attentional distortion (implicit or explicit suppression of negative outcome expectancy or value, implicit or explicit amplification of positive outcome expectancy or value; deception)	Increasing awareness of probability of negative outcomes with exposure to negative outcomes

Table 2 continued

Domain	Vulnerability factor	Protection factor
Innate and developmental individual differences	Individual differences amplifying vulnerability factors (Overvaluation and hypersensitivity to gambling rewards; hypersensitivity to punishment; vulnerability to erroneous associations; vulnerability to processing biases; poor gratification delay skills; need for emotion regulation, escape, hope, money)	Individual differences amplifying protection factors (Low valuation and sensitivity towards gambling rewards; hypersensitivity to punishment)

Functional Components of Gambler Risk Perception

Estimation and Expectancy

Two experts (*Experts 9 and 10*) argued that common, contemporary models (e.g., Fortune and Goodie 2011; Toneatto 1999) of disordered gambling cognition lack concepts of risk perception, and only a handful of studies explicitly address outcome expectancy (see Spurrier and Blaszczynski 2013). As a result, attempts to predict outcomes are based on only a partial picture of disordered gamblers' excessive optimism about specific aspects of gambling, such as luck, or the controllability of outcomes, without due attention to independent positively versus negatively motivating content, or contextual factors influencing decisions. Current models therefore remain "controversial", because commonly discussed gambling cognitions (e.g., the gamblers' fallacy, the availability heuristic) remain "circular" (*Expert 9*) or descriptive rather than predictive, because they lack clear guidelines for when gamblers apply particular principles.

Several experts cited evidence that gamblers hold highly idiosyncratic mental models of causality, outcome, and game structural configurations, used to estimate outcomes and make decisions (Moodie 2007). A majority of experts cited either clinical experience or research showing the influence of both positive and negative perceptions on decision-making (e.g., Aarons et al. 2001).

High attention or importance, along with accurate or overestimated estimation of risks was interpreted to lead to protective gambling choices and behaviours:

People who are not convinced of winning, of course approach gambling, as: "I'm going to lose this, so can I afford it, and what will happen if I do?" Assessment of risk is more practiced, likely to be more accurate, and certainly more realistic in its conclusion that "I am likely to lose and therefore am I OK with losing it?" (*Expert 2*).

In contrast, experts reported problem and disordered gamblers place low emphasis on risk evaluation, underestimate likelihood or magnitude of negative outcomes, or both:

Problem gamblers do not put a great deal of well-considered effort into risk management (*Expert 1*).

There's a naive view out there that the rules of probability don't actually operate the way mathematicians think they do (*Expert 4*).

Experts also reported that low prioritisation of risk or underestimation of risk, may be, but is not always due to over-prioritisation, or over-estimation of positive outcomes. That is, any or all of these four factors may independently contribute to increased vulnerability to harmful gambling. However, how these factors combine as overall optimism or pessimism about gambling is critically important to predicting gamblers' vulnerability to harm—this importantly relates to the meaning or value gamblers attribute to cognitions, goal-prioritisation and planning.

Meaning and Motivation

The majority of expert perspectives described overvaluation of gambling and gambling outcomes as intrinsically risky, and a core, or the core feature of gambling disorder:

Not many things are true for every single person who gambles, but I think one is they overvalue gambling as an activity. I think every single person who has a gambling

problem has their perception of themselves in the world somehow out of line with reality, like their value as people... I think part of what that thinking—that cognitive distortion is—about their own values, is they over-attribute how much better they will feel about themselves if they were good at this gambling thing. I think that's true for everybody (Expert 8).

Over-valuation of gambling was referenced by a majority of experts who discussed two aspects of gamblers' cognition: (1) evaluation or interpretation of gambling information, including the value and importance attributed to perceived benefits and costs (discussed above), and (2) motivation, or the goals and needs of individuals, and how this motivation related to the value attributed to anticipated outcomes. That is, how gambling outcomes are perceived to help or hinder individuals from attaining goals, and how needs or goals are prioritised by individuals ultimately determines how much motivation individuals have to gamble. Hence, evaluation and motivation were represented by experts as highly influential aspects of risk perception.

Participants argued that evaluation and motivation may influence risk perception, and hence decision making, in several harmful or protective ways. For example, evaluation of outcomes and intrinsic motivational drives lead gamblers to attend to, or value particular outcomes as important or insignificant, and based on this, prioritise particular goals in strategic planning within gambling systems—increasing vulnerability or protection from risk, depending on the type of goals prioritised.

Experts cited a number of specific examples, increasing or decreasing vulnerability to problematic or disordered gambling. Overall, high value or importance attributed to risk-management, and non-gambling life goals are likely to protect individuals from harm by leading gamblers to limit time and money expenditure. Alternatively, high value attributed to goals that failed to prioritise risk management (e.g., winning money), particularly if goals were achieved through gambling but were independent of monetary outcomes (e.g., emotion regulation), are likely to increase vulnerability to harm and disordered gambling, since these goals respectively lead gamblers to perceive expenditure on gambling as an important priority, increase sensitivity to risky cues, or gamble with low attention or importance attributed to spending.

Strategic Planning

Experts cited evidence that gamblers make gambling decisions according to personal compilations of cognitive-behavioural 'if...then...' imperatives—labelled "stratagems" by one expert (*Expert 2*). Stratagem imperatives derive from causal understanding, estimation, meaning, and motivation. Stratagems aim to achieve goals, according to gamblers understanding of outcome determination. Reciprocally, strategic planning may influence attention and importance attributed to risk data.

Experts typically described stratagems as dynamic and flexible, since gamblers must often unify, satisfice (attempt to meet a threshold of acceptability rather than find an optimal solution), or switch between competing or contradictory motivations, beliefs, and contextual demands. Like other aspects of risk perception, the salience and composition of stratagem content may change over the short- or long-term, according to how experiential and contextual input affects perception, motivation, and available choice.

A majority of experts made reference to at least three significant themes when discussing stratagem goals that differentiated recreational from disordered gamblers: (1) risk management, (2) winning, and (3) emotional or self-regulation.

Experts argued that preferential, consistent emphasis on risk exposure management is associated with protection from harm and disordered gambling. Gamblers may achieve this through specific strategies such as setting firm, realistic, consistent, and sustainable spending limits:

Most people enjoy playing the pokies, but don't appear to be experiencing harm, or experience it only sporadically. They manage their risk by managing their exposure to that risk, they almost religiously refuse to get any money out, and when that's gone they go and have a drink and go home, or whatever (Expert 4).

In contrast, experts stated that gamblers leave themselves vulnerable to harm and disordered gambling if: stratagems contain erroneous, inconsistent or contradictory content; are easily influenced by contextual demands or mental states; or prefer strategic goals other than risk management—particularly 'winning' or short term monetary goals, or emotional or self-regulation. Prioritisation of non-risk-management strategies, even if only for short periods, leaves gamblers vulnerable to harm, since goal-directed behaviour becomes detached from monetary outcomes associated with gambling problems. Further, decisions may be reinforced by outcomes despite losses. For example, gamblers are likely to experience intermittent wins and motivating emotional outcomes regardless of overall loss, sustaining motivation to gamble. Emotional and self-regulation goals in particular are likely to contribute to downward spiralling into disordered gambling, since exposure to loss and problems are likely to trigger individuals to gamble to manage distress.

Factors Mediating or Moderating Risk Perception

Reinforcement, Learning and Experience

A majority of experts reported that various well-documented learning processes, involving exposure to sociocultural representations of gambling, and game reinforcement schedules contingent on game structural configurations (Brevers et al. 2011), have significant, often unhelpful influence on gambler risk perception:

We know that [games] are designed to engage people and to keep people playing with the intermittent reinforcement that is always present with gambling, and I think people's expectations become very distorted (Expert 1).

I think the single biggest factor seems to be exposure (Expert 4).

Experts noted evidence of maladaptive distortion of risk perception processes with exposure to reinforcement, observed in neurophysiological (Brevers et al. 2011), cognitive (Toplak et al. 2007), and behavioural change (Griffiths 1995), results in decreased volitional control (Toplak et al. 2007), attentional biases for positive and negative outcomes (Stanovich and West 2008), and hypersensitivity to mental states and environmental triggers associated with gambling (Baudinet and Blaszczynski 2012). In turn, the increasing automaticity of play decreases the mindfulness with which gamblers make choices, and leads to myopic life focus and approach to problem solving (Stanovich and West 2008; Toplak et al. 2007).

Participants argued that long term, repeated exposure to gambling is likely to lead to net loss based on structural configurations of commercially available games (Walker 1998), and therefore also experience and awareness of negative game contingencies. Such experience was expected to be protective if it results in decreased motivation to gamble, or

an increased risk management focus. However, gamblers may increase vulnerability to harm by avoiding responsibility for losses, suppressing negative perceptions, or focusing on non-monetary, 'emotional' reasons for gambling.

Decisional Context and Available Choice

A majority of experts made reference to evidence, that: (1) individuals' sensitivity to contextual cues, along with the (2) contextual cues available to individuals, each influence risk perception in significant, often harmful ways (Baudinet and Blaszczyński 2012). First, dispositional or learned sensitivities to internal and external contextual cues may trigger fluctuations in perceptions that increase vulnerability to harm. That is, gamblers exposed and sensitive to vulnerable emotional states, or other internal or environmental cues, are likely to make greater use of incidental information in decision-making, or give into fantasies or urges to gamble, resulting in riskier choices:

Hope can initiate a session. I mean if things are looking dire for somebody financially, if their depression is related to a financial situation, then initiating a session based on the hope of winning can occur, and then certainly within session there would still be that factor of the hope of winning (Expert 10).

Second, the availability of gaming services and other environmental triggers, along with in-game structural configurations, influence the salience and motivational valence of risk perceptions that promote gambling. With exposure this may reinforce risk perceptions promoting continued gambling (Productivity Commission 2010). Decisional context was therefore represented as potentially important to shaping and motivating increased or continued gambling involvement, not only through the availability of behavioural options and triggers, but also by increasing individuals' preoccupation and sensitivity to environmental cues and mental states with exposure.

Implicit Versus Explicit Cognition

Several experts cited the importance of implicit risk perception within gambling reasoning and decision-making. Gamblers may leave themselves vulnerable to harm not only via explicit reasoning errors (e.g., underestimating risk), but also by misapplying 'automatic' reasoning (e.g., applying 'pattern recognition' heuristics to random events), or ineffectively managing implicit processes with explicit reasoning (e.g., failing to inhibit implicit motivation or failing to correct implicit reasoning errors) (Coventry and Norman 1998).

For example, common reasoning processes such as pattern recognition enable adaptive, quick judgement, but apply automatic reasoning prone to error dependent on correction by higher analyses. Gamblers that fail to apply, or:

...suppress the natural checking and controls, or oversight, imposed by high level cognitive, cortical processes are more susceptible just to that basic instinctual low level processing, which tends to be associated with forming false associations. You know, taking unrepresentative information as being more important than it really is and those sorts of things (Expert 9).

How gamblers apply and resolve conflict between implicit and explicit risk perception may have important implications for accurate risk estimation, and therefore for the riskiness of decisions and behaviour.

Ambivalence and Manipulation of Risk Data

A majority of experts outlined ways that repeated, long term gambling provides a mix of positive and negative contingencies, particularly a tendency towards overall loss interrupted intermittently by wins. Long-term gamblers responses to ambivalent or dissonant experiences and perceptions of gambling were believed to have significant implications for risky decision-making. Dominant negative perceptions motivate change or decreased gambling, likely to protect against harm. However, dominant positive perception, or difficulty accepting negative experiences, may trigger implicit or explicit strategies that amplify positive perceptions, reduce negative perceptions, or both. Gamblers may engage in mental rehearsal or fantasy around experience, blame others, or satisfice short-term goals (getting a bonus feature tonight) over long term goals (paying the rent tomorrow), or may adjust and increase the complexity of strategies rather than challenge faith in winning. Several experts noted that positive manipulation of risk perceptions may be highly motivating for gamblers with negative experiences, as a means of “neutralising their anxiety about their losses through the hope that they’re going to win it back” (*Expert 6*). Alternatively:

There’s a psychological protection that happens for people, that props up the belief that the win is going to happen for them. I think once you take it away it’s really, really scary psychological material (*Expert 8*).

Positive manipulation strategies however, tend to further compound problems, distress, and dependence on gambling, by underestimating risk, increasing expenditure and motivation to gamble, and de-prioritising risk management strategies, particularly if gambling is an important emotion regulation or coping mechanism for individuals.

Innate and Developmental Individual Differences

All experts discussed evidence that individual differences predispose gamblers to: (1) develop risk beliefs, and (2) process data, in ways that are more or less protective. The important role of individual differences in shaping risk perception, means that gambler presentations are highly idiosyncratic:

The problem I think generally that I’ve discovered with problem gamblers is that whatever theory you develop the next two or three clients will always disprove it, so I think it’s very hard to nail it down to any particular population or to any particular variable that just happens. I think it’s more a combination of variables, features that will push them in that direction (*Expert 1*).

Experts argued that evidence suggests “how someone gets culturally indoctrinated into a particular stream of gambling” is critical in the development of risk beliefs, and the consequent choices that gamblers make (Raylu and Oei 2002) (*Expert 8*). Sociocultural representations of gambling contain various embedded values and causal explanations that shape decision making, by exposing individuals to particular associations with meaning. Socio-demographic background (e.g., gender, ethnicity, experience of peer and familial interaction, mental illness, or socioeconomic hardship) is therefore important in the development of implicit and explicit beliefs about gambling causality, meaning, value, and strategic choice (e.g., concepts of luck, will, or fate) (Johansson et al. 2009).

Similarly, a number of experiential and dispositional individual differences were believed to unhelpfully influence risk perception and vulnerability to harm, according to

processing differences that shape the salience and meaning of risk data. Experts cited a number of attributes that increase risky decision making, supported in the literature, such as: relative sensitivity to short-term rewards and punishment, processing biases, ability to delay gratification, emotion regulation needs, and vulnerable mental states. Such attributes were considered likely to influence other mediating or moderating risk perception factors, such as: individuals' responsiveness to internal or external contextual cues, the likelihood of giving into urges, fantasy, or deception, changeability of mental states, and the relative influences of implicit and explicit volitional control.

Discussion

The current study has several important implications for theory and treatment of gambling disorder. Expert participants cited clinical experience and research showing the importance of lack of consideration for risk to disordered gambling. Gambling theories, however, commonly reduce harmful processes to exaggerated biases or errors, exaggerating overall positive expectations (Fortune and Goodie 2011), or single dimensions (e.g., approach/avoidance) (Nussbaum et al. 2011), without due attention to: important risk perception factors, e.g. attention to harmful contingencies (Gillespie et al. 2007), variation in decision making across contexts and individuals (Moodie 2007), or interplay between perception, value attribution and other processes (Delfabbro 2004; Delfabbro and Winefield 1999). Despite a clear role in literature addressing other risky behaviours (Goldberg and Fischhoff 2000; Smith et al. 1995), risk perception is referenced in only a handful of gambling studies (Wong and Tsang 2012). It is likely therefore that more thorough investigation and integration into gambling models will improve the predictivity of disordered gambling models (Delfabbro and Winefield 1999).

The present study also suggests that even the more detailed picture of risk perception represented in recent 'outcome expectancy' studies (Wickwire et al. 2010), may unhelpfully reduce cognitions to 'positive/negative' valence, or categorical 'types' (e.g., social benefit), and thereby fail to completely capture the variable role expectations play in decision making. Results suggest that gamblers attribute more personally varied meaning and value to risk perceptions, based on complex personal dispositional and experiential factors (e.g., family history), and that these varied meanings shape how risk data is used to satisfice complex, multifaceted goals. Therefore, there is clear need for future research to investigate how risk perception and meanings vary among individuals and cultural groups.

In addition, historically, cognitive models of gambling have struggled to reliably and validly outline how observed perceptions relate to, or predict decisions. Cognitive gambling research, limited by the poor ecological validity of laboratory experiments (Rachlin 1990; Wagenaar 1988), controversial normative assumptions of naturalistic studies (Delfabbro 2004), and limited utility of extant psychometric measurement (Strong et al. 2004), nevertheless acknowledges variation in decision making across contexts (Delfabbro and Winefield 1999) and over the short and long term (LaPlante et al. 2008). Future research is needed to explore and model how gamblers satisfy multiple, individually varied strategic goals, in the context of complex motivational, environmental, and cognitive demands (e.g., decisional context, game structural configurations, personality, implicit and explicit processing).

The findings of this study also have important implications for psycho-educative and other interventions for gambling disorder. Gambling assessment and treatment would benefit from: expanding treatment models to include multifactorial risk perception

concepts; identifying and targeting personally relevant risk belief, motivation, and strategy ‘vulnerability’ factors, along with relevant moderating and mediating factors; identifying and amplifying individuals’ ‘protection’ factors; and potentially to identify holistic patterns among vulnerability and protection factors, such that, critical vulnerability factors are addressed, and protective factors are strategically employed to override vulnerability factors.

Future Directions, Limitations

Mental models theory outlines valuable, future steps for developing a comprehensive model of gambling risk perception and decision making, following on from the findings of this study. Specifically, expert risk concepts should be tested among lay gamblers using qualitative and quantitative methods, and this data should be used to develop tailored intervention (Morgan et al. 2002).

The themes presented in the current study focused primarily on risk perception and decision making affecting gambling behaviour, due in part to selection processes for participants and research questions. Further research regarding risky gambling decision making may also benefit from investigation of how types of factors affecting gambling behaviour that were not considered in the current study interact with risk perception and cognition to generate harm (e.g., psychobiological, sociological, or actuarial vulnerability factors for gambling disorder) (Andrews et al. 2006).

Conclusions

Findings suggest that perception, evaluation, and utilisation of risk information may play an important role in the development of disordered gambling, powerfully mediated or moderated by individuals’ location within a dispositional, socio-cultural context. The current study is the first to discuss the role of value and meaning in gambling risk perception.

Conflict of interest The authors declare that they have no conflict of interest.

Appendix 1: Sample Interview Questions

1. How do people scan, filter and interpret information about gambling risks and problems (particularly in relation to their own vulnerability to or experience of harm)?
2. Do beliefs and thoughts mediate how people measure benefits/problems associated with gambling? If so do these beliefs therefore mediate how vulnerable people are to harm? How?
3. Do beliefs/thoughts about gambling risks change during the process of gambling? How? Why? How do these beliefs/thoughts influence gambling behaviour?
4. What do people do to address or compensate for gambling risks or problems?
5. Does experience mediate people’s schema/beliefs about gambling risk? How?
6. Do disordered gamblers have patterns of significantly different:
 - Experiences
 - Evaluations of those experiences
 - Cognitions while gambling
 - Stable beliefs about the nature of gambling, risks and hazards

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APPENDIX C: Published manuscript

Spurrier, M., Blaszczynski, A., & Rhodes, P. (2014). An expert map of gambling risk perception. *Journal of Gambling Studies*, DOI: 10.1007/s10899-014-9486-x

Gambler Risk Perception: A Mental Model and Grounded Theory Analysis

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Abstract Few studies have investigated how gamblers perceive risk or the role of risk perception in disordered gambling. The purpose of the current study therefore was to obtain data on lay gamblers' beliefs on these variables and their effects on decision-making, behaviour, and disordered gambling aetiology. Fifteen regular lay gamblers (non-problem/low risk, moderate risk and problem gamblers) completed a semi-structured interview following mental models and grounded theory methodologies. Gambler interview data was compared to an expert 'map' of risk-perception, to identify comparative gaps or differences associated with harmful or safe gambling. Systematic overlapping processes of data gathering and analysis were used to iteratively extend, saturate, test for exception, and verify concepts and themes emerging from the data. The preliminary findings suggested that gambler accounts supported the presence of expert conceptual constructs, and to some degree the role of risk perception in protecting against or increasing vulnerability to harm and disordered gambling. Gambler accounts of causality, meaning, motivation, and strategy were highly idiosyncratic, and often contained content inconsistent with measures of disordered gambling. Disordered gambling appears heavily influenced by relative underestimation of risk and overvaluation of gambling, based on explicit and implicit analysis, and deliberate, innate, contextual, and learned processing evaluations and biases.

Keywords Gambling · Pathological gambling · Gambling disorder · Risk perception · Grounded theory · Mental models

Introduction

Despite the paucity of studies and methodological limitations associated with cross-sectional and self-report data (Baron and Kenny 1986; Weinstein 2007), risk perception

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research suggests that gamblers' perceptions of negative consequences play an important role in decision-making, behaviour, and disordered gambling aetiology (Spurrier and Blaszczynski 2013). Several studies have demonstrated a functional relationship between disordered gambling and a mix of positive ('material gain', 'social benefits') and negative expectations ('loss of control') (Gillespie et al. 2007; Wickwire et al. 2010), along with lower overall risk expectancies (Derevensky et al. 2010; Inglin and Gmel 2011).

It appears disordered gamblers maintain greater optimism about gambling, despite greater experience and expectation of at least some negative consequences (Wong and Tsang 2012; Wickwire et al. 2007; Yi and Kanetkar 2010), implying disordered gambling cannot simply be explained by gamblers overestimating positive outcomes, or personal control (Fortune and Goodie 2011; Toneatto 1999). Instead, both positive and negative perceptions independently influence perception of risk (Wickwire et al. 2007; Yi and Kanetkar 2010), and disordered gamblers preference or amplify positive representations of gambling, discount negative perceptions, or both, to hold more optimistic overall viewpoints consistent with motivation to gamble (Gillespie et al. 2007; Wickwire et al. 2010), presenting a picture of gambling risk perception compatible with findings in related drug, alcohol, and offending research (Goldstein et al. 2009; Jones et al. 2001; Leigh 1999; Rinn et al. 2002).

Spurrier et al. (Submitted) applied a mental models (MM) and grounded theory (GT) methodology to develop a 'map', outlining the role of risk perception on gambling decision making and behaviour, based on experts' evaluation of relevant research and clinical experience (Morgan et al. 2002; Strauss and Corbin 1994, 1998). The expert 'map' identified a number of factors influencing risky decision-making, relating to risk perception and how context influenced use of risk data.

The current study aimed to test this expert 'map', via interviews with regular gamblers that: detail lay risk perception concepts, compares lay concepts against expert map content, and identifies benign and maladaptive systematic gaps or errors in lay MM of gambling held by recreational versus disordered gamblers.

Methods

Participants

Fifteen regular gamblers participated in a second phase of data collection (5 females, $M_f = 22.40$ years, $SD_f = 3.58$ years; 10 males, $M_m = 29.80$ years, $SD_m = 16.53$ years, $t(13) = .972$, $p = .349$). Participants were only included if they: spoke fluent English; were over 18 years of age; gambled at least once a week for the past 2 months or for any period greater than 5 years. Participants were invited to participate via face-to-face contact or third party referral. Three participants were recruited through gambling treatment clinics, eleven through the University of Sydney undergraduate psychology student research participation program, and one was referred by a previous participant.

Three gamblers accepted initial invitations and completed the first round of interviews. Following preliminary interview analysis, ten of thirteen further volunteers were accepted as participants based on provided demographics information, with the goal of maximally diversifying perspectives within the data. Again, two additional interviews were finally recruited at saturation, to check that no new themes or concepts emerged (Strauss and Corbin 1998).

Table 1 lists participants' descriptive information. Pseudonyms were used for all participants to protect anonymity.

Measures

Fourteen semi-structured interviews were conducted in person and one by telephone (Morgan et al. 2002; Strauss and Corbin 1994, 1998). Initial interview questions were open-ended and explored participants' beliefs about the content and influence of risk perception cognition (Strauss and Corbin 1998). Coding overlapped with interviews such that as analysis developed interview content and participant selection was modified to affirm, modify, add, elaborate, clarify, and find exceptions in emerging themes (Strauss and Corbin 1994). Interviews lasted 30–90 min. With the permission of the participants, all interviews were digitally audio-recorded and transcribed.

Participants also completed a demographics questionnaire and the Problem Gambling Severity Index (PGSI; Ferris and Wynne 2001). The demographics questionnaire gathered details about: age, gender, ethnicity, and relationship status, gambling and gambling treatment experience. The PGSI is a nine-item self-report subscale of the Canadian Problem Gambling Index (CPGI; Ferris and Wynne 2001) measuring severity of problem gambling (low risk, moderate risk, or problem gambling). The CPGI has been found to be reliable (Cronbach's $\alpha = .84$, test retest reliability = .78) (Ferris and Wynne 2001).

Following conventions, lay gambler participants were classified into gambling subtypes according to their PGSI scores (0–2 = non-problem/low risk gambler; 3–7 = moderate risk gambler; ≥ 8 = problem gambler), with five participants meeting criteria for each subtype (Ferris and Wynne 2001).

Procedure

The study combined the MM approach to risk perception evaluation (Morgan et al. 2002), with data collection and interpretation based in GT (Strauss and Corbin 1994, 1998).

Traditionally, the MM methodology has been applied to hazard evaluation on the assumption that: users are entirely motivated by safety; users hold similar MM evaluating risk; and that risk factors follow predictable, consistent physical laws (Morgan et al. 2002). Gambling differs from hazards typically evaluated using the MM approach (e.g., radon gas, nuclear contamination, physical illness) in several important ways (Bostrom et al. 1992). Gamblers may hold additional variable motivations to notions of safety, for example, winning money (Binde 2009). Gamblers fall into clearly identifiable subgroups of recreational and disordered users, with systematic differences in cognitive functioning, and consequently, MM (Raylu and Oei 2002). Similarly, evidence suggests that gambler cognition varies systematically according to: preferred game type (Blaszczynski and Nower 2002); experience (Hodgins 2001); and other individual differences (Johansson et al. 2009; Raylu and Oei 2002).

Strategies were employed to control for the above factors. Participants were selectively recruited to reflect a broad range of backgrounds (e.g., gender, age, socio-economic status, length of gambling career) and exposure to problems with gambling (i.e., low risk, moderate risk, or problem gambling).

The study followed the step-by-step MM procedure outlined by Morgan et al. (2002), following on from the study by Spurrier et al. (Submitted). Lay gamblers completed interviews and questionnaires to: (1) identify the content of lay risk perception, (2) compare lay concepts against an expert map (outlined in Spurrier et al., Submitted), and (3) identify systematic gaps or errors in lay MM of gambling held by recreational versus disordered gamblers, compared to the comprehensive expert map. The University of Sydney Human Research Ethics Committee approved the conduct of the study.

Table 1 Lay gambler descriptive and demographic information

Pseudonym	Age	Sex	Identified ethnicity	Relationship status	Gambling experience	Gambling treatment	PGSI score	Gambling status
Tim	54	M	Anglo-Australian	Single	Horse racing, EGMs, keno; >5 years experience	Hypnotherapy, cognitive therapy, counselling	20	Problem
Marcel	19	M	Anglo-Australian	Never Married	EGMs		3	Moderate
Simon	19	M	Lebanese-Australian	Never Married	EGMs		2	Low risk
Colin	19	M	Italian-Australian	Never Married	EGMs		3	Moderate
Lewis	23	M	Anglo-Australian	Living with Partner	EGMs		12	Problem
Roger	20	M	Ukrainian-Australian	Never Married	EGMs, lottery		2	Low risk
Gene	59	M	Anglo-Australian	Never Married	EGMs, keno; >5 years experience	Cognitive therapy	24	Problem
Martin	19	M	Anglo-Australian	Never Married	Blackjack, EGMs		13	Problem
Joslyn	19	F	Anglo-Australian	Never Married	EGMs		0	Low risk
Steven	47	M	Anglo-Australian	Divorced	EGMs, horse-racing; >5 years experience	Cognitive behavioural therapy	14	Problem
Sarah	25	F	Lebanese-Australian	Engaged	EGMs, poker; >5 years experience		1	Low risk
Wendy	19	F	Chinese	Never Married	EGMs, pachinko, mahjong >5 years experience		4	Moderate
Claude	19	M	Anglo-Australian	Never Married	Poker, EGMs		6	Moderate
Susan	27	F	Korean	Never Married	EGMs		2	Low risk
Victoria	22	F	European-Australian	Never Married	EGMs		6	Moderate

Data Analysis

NVivo qualitative data analysis software was used to apply open, axial and selective coding analyses (QSR International, Version 9; Richards 2005; Strauss and Corbin 1994, 1998). Coded concepts were arranged chronologically to enable processes to emerge, after which data was subject to open coding. As the interviews progressed, recurrent themes were explored in subsequent interviews to enable theoretical sampling. Conceptual relationships were assembled through a process of axial coding whereby initial categories were linked to subcategories along the lines of their properties and dimensions. Finally, selective coding integrated and refined final categories, in order to provide a detailed, complete explanation of situated gambling risk perception. Two additional participants confirmed that theoretical saturation was achieved.

Controlling for Bias

Several strategies were employed to reduce potential researcher bias based on Chiovitti and Piran's (2003) recommendations. Interview paradigms were initially based on open questions. The author kept notes during interview, transcription, and analysis, to detail emergent concepts and identify potential personal bias. At the same time, participants' own language was used where possible to label and describe concepts. Following initial coding, two randomly selected interviews were blind-coded by a co-author, and used to refine coding and theory development. Finally, within-interview member checking tested interviewer interpretation of participant data.

Results

Overview of Lay Gambler Perspectives on Risk Perception

Gamblers' accounts of risk perception, decision-making and behaviour generally supported 'vulnerability' and 'protection' factors identified as relevant within the expert map outlined in Spurrier et al. (Submitted). Table 2 outlines each participant's vulnerability and protection factors based on interview data.

The majority of non-problem/low risk gamblers consistently indicated either absence of vulnerability factors, or presence of protection factors, along with few mediating/moderating factors. Reciprocally, the majority of problem gamblers described vulnerability factors relevant all risk perception and many mediating/moderating factors. Moderate risk gambler presentations were more varied than non-problem/low risk or problem gamblers, presenting with a mix of vulnerability and protection factors relevant to both risk perception and mediating/moderating factors.

In approximately nine of fifteen cases, vulnerability or protection risk perception factors consistently correlated with each other, and matched predicted subgroup membership. That is, protective risk beliefs, evaluation, strategic planning and non-problem/low risk gambling correlated with each other; with equivalent correlations between risk perception vulnerability, and moderate/problem gambler status. In all cases, at least one vulnerability or protection factor related to expected group membership. That is, moderate risk and problem gamblers held at least one identifiable vulnerability factor, while non-problem/low risk gamblers held at least one protection factor. In describing narratives about gambling, all gamblers were able to reflect on the causal influences between risk perceptions, the role

Table 2 Lay gambler descriptive and demographic information

Pseudonym	Estimation and expectancy	Meaning and motivation	Strategic planning	Reinforcement, learning and exposure	Decisional context and available choice	Implicit versus explicit cognition	Ambivalence and manipulation of risk data	Innate and developmental individual differences
<i>Non-problem and low risk gamblers</i>								
Roger	Accurate or cautious risk estimation	High value attributed to risk management Low emphasis or negative attributions towards gambling	Consistent, high risk management emphasis		Availability of internal or external triggers			
Joslyn	Accurate or cautious risk estimation	Low emphasis or negative attributions towards gambling	Consistent, high risk management emphasis		Availability of internal or external triggers			
Simon	Accurate or cautious risk estimation ^b	High value attributed to risk management Low emphasis or negative attributions towards gambling	Consistent, high risk management emphasis					
Susan	Accurate or cautious risk estimation	High value attributed to risk management Low emphasis or negative attributions towards gambling	Consistent, high risk management emphasis					

Table 2 continued

Pseudonym	Estimation and expectancy	Meaning and motivation	Strategic planning	Reinforcement, learning and exposure	Decisional context and available choice	Implicit versus explicit cognition	Ambivalence and manipulation of risk data	Innate and developmental individual differences
Sarah	Inaccurate risk estimation	High value attributed to risk management Competing gambling-inconsistent goals High value attributed to risky gambling goals	Consistent, high risk management emphasis	Significant exposure to reinforcement schedules		Implicit reasoning problems		
<i>Moderate risk gamblers</i>								
Marcel	Inaccurate risk estimation	High value attributed to risky gambling goals Presence of intense urges to gamble	Insufficient risk management emphasis		Availability of internal or external triggers	Hypersensitivity to gambling cues		
Colin	Accurate or cautious risk estimation	High value attributed to risky gambling goals Difficulty resisting impulse to gamble	Consistent, high risk management emphasis	Exposure to high value representations of gambling	Availability of internal or external triggers			Individual differences amplifying vulnerability factors
Victoria	Inaccurate risk estimation	High value attributed to risky gambling goals Difficulty resisting impulse to gamble	Consistent, high risk management emphasis		Availability of internal or external triggers			

Table 2 continued

Pseudonym	Estimation and expectancy	Meaning and motivation	Strategic planning	Reinforcement, learning and exposure	Decisional context and available choice	Implicit versus explicit cognition	Ambivalence and manipulation of risk data	Innate and developmental individual differences
Wendy	Inaccurate risk estimation	High value attributed to risky gambling goals	Insufficient risk management emphasis	Significant exposure to reinforcement schedules Exposure to high value representations of gambling	Availability of internal or external triggers	Hypersensitivity to gambling cues		Individual differences amplifying vulnerability factors
Claude	Inaccurate risk estimation	High value attributed to risky gambling goals	Insufficient risk management emphasis	Exposure to high value representations of gambling	Availability of internal or external triggers	Hypersensitivity to gambling cues		Individual differences amplifying vulnerability factors
<i>Problem gamblers</i>								
Tim	Accurate or cautious risk estimation ^a	High value attributed to risky gambling goals ^a Presence of intense urges to gamble	Consistent, high risk management emphasis ^a	Exposure to meaningful negative consequences Significant exposure to reinforcement schedules	Availability of internal or external triggers Presence of risky mental states or significant stressors	Implicit reasoning problems Increasing automaticity of gambling with experience	Perceptual or attentional distortion ^a	Individual differences amplifying vulnerability factors

Table 2 continued

Pseudonym	Estimation and expectancy	Meaning and motivation	Strategic planning	Reinforcement, learning and exposure	Decisional context and available choice	Implicit versus explicit cognition	Ambivalence and manipulation of risk data	Innate and developmental individual differences
Steven	Accurate or cautious risk estimation ^a	High value attributed to risk management ^a Presence of intense urges to gamble	Consistent, high risk management emphasis ^a	Exposure to meaningful negative consequences Significant exposure to reinforcement schedules	Availability of internal or external triggers Presence of risky mental states or significant stressors	Increasing automaticity of gambling with experience	Perceptual or attentional distortion ^a	Individual differences amplifying vulnerability factors
Gene	Accurate or cautious risk estimation ^a	High value attributed to risk management ^a High value attributed to risky gambling goals Presence of intense urges to gamble	Consistent, high risk management emphasis ^a	Exposure to meaningful negative consequences Significant exposure to reinforcement schedules	Availability of internal or external triggers Presence of risky mental states or significant stressors	Increasing automaticity of gambling with experience		Individual differences amplifying vulnerability factors
Martin	Inaccurate risk estimation	Low emphasis or value attributed to risk management High value attributed to risky gambling goals Difficulty resisting impulse to gamble Presence of intense urges to gamble	Insufficient risk management emphasis	Exposure to high value representations of gambling	Availability of internal or external triggers			Individual differences amplifying vulnerability factors

Table 2 continued

Pseudonym	Estimation and expectancy	Meaning and motivation	Strategic planning	Reinforcement, learning and exposure	Decisional context and available choice	Implicit versus explicit cognition	Ambivalence and manipulation of risk data	Innate and developmental individual differences
Lewis	Accurate or cautious risk estimation	High value attributed to risky gambling goals Difficulty resisting impulse to gamble Presence of intense urges to gamble Increasing will to manipulate risk perception	Insufficient risk management emphasis	Exposure to high value representations of gambling	Availability of internal or external triggers Presence of risky mental states or significant stressors	Increasing automaticity of gambling with experience	Perceptual or attentional distortion	Individual differences amplifying vulnerability factors

^a All three treatment experienced gamblers noted a significant shift in risk beliefs and distortions over the course of treatment from initially highly inaccurate risk perception.

^b Bold text denotes protection factors while regular text denotes vulnerability factors.

of risk perceptions in decisions, the significance of mediating/moderating factors to risk perception, and the manner in which contradictory vulnerability and protection factors overrode each other.

Gamblers varied considerably both in idiosyncratic descriptions of expert concepts, and the vulnerability and protection factors described, even among members of the same clinical subgroup. Instead, gamblers across subgroups described one or more, but never all, possible vulnerability or protection factors. A personalised 'profile' approach, incorporating a limited number of personally relevant factors is therefore likely to be more appropriate than a general model, with vulnerability and protection factors applicable to all gamblers, or particular subgroups, contrary to common models in the literature.

Non-problem/Low Problem Gamblers

Risk Perception

Four of five non-problem/low risk gamblers described risk perception factors with consistent, protective or benign influence on decision making: high expectations of negative or low expectations of positive outcomes compared to other gambler groups. However, a majority of individuals did not present detailed views about possible outcomes, instead conflating expectations into a generally pessimistic attitude towards likely outcomes that reciprocally influenced meanings, evaluations and strategic planning. For example:

I didn't really think that much about it. I just, I'm not a big fan of gambling... In the long-term, if you look at all the money you put in, you probably wouldn't have won it back... It's just a chance thing. That's why I think I don't put a lot of money on it, because there is no kind of logical way you could win. Joslyn (19, F)

The very reason I don't play them very much is because I don't think you can really win on them. Simon, (19, M)

In the majority of cases, gamblers causal beliefs, though benign or even protective, were inaccurate or vague. For example, Roger (20, M) described vague, erroneous beliefs about gaming machine return-to-player percentage underlying pessimistic expectations and low expenditure (Harrigan et al. 2011):

The percentage back is really small. It's, like, under thirty percent or something, around thirty percent... It's ridiculous - twenty percent over a period... Roger (20, M)

Nevertheless, compared to other gamblers, non-problem/low risk gamblers more frequently acknowledged subjectivity or fallibility of personal knowledge, and more clearly differentiated hopes as something distinct from expectations. For example:

I don't believe in luck - it's more like hope because it doesn't seem to have a pattern. Susan (27, F)

Four of five non-problem/low risk gamblers stated that, as a consequence of expectations, motivation behind decision making emphasised risk management (e.g., limiting losses) over other non-monetary but positive motives (e.g., fun and socialising), based on consistent, pre-planned strategies that limit expenditure:

When I'm walking into the pokies room, I just tell myself, like, 'this is the limit'. Whatever it is, I say, 'twenty bucks is the max you're going to put in'. Obviously I'm

thinking about getting more beers for later. I don't think about, I know a lot of other gamblers do, I don't really think about gambling to win. I just think about, 'alright, we're just having some fun on the pokies', I'm not thinking about trying to, uh, obviously you'd like to win, but it's just for a bit of fun - something to do when you're in the pub. I've probably gone over a little bit, but it would probably only be like five or ten bucks. That'd be quite rare as well. Roger (20, M)

Overall, non-problem/low risk gamblers presented more similarly to each other than did members of other subgroups. Only one individual, Sarah (25, *F*), described risk perceptions functionally different than those so far described. Unlike other non-problem/low risk gamblers, Sarah (25, *F*) described an optimistic overall view of gambling, high expectation of personal control, skill, and winning, low expectation of negative consequences, with high personal importance and arousal attached to winning money and emotional outcomes, and strong emphasis on strategies aimed at winning. However, Sarah (25, *F*) also described strict, sustainable spending limits that overrode all other play strategies when limits were reached.

Mediating and Moderating Factors

A majority of non-problem/low risk gamblers were relatively less affected than other gamblers by mediating factors (that changed the influence of risk perception on decision making), or moderating factors (that partitioned risk perception variables according to their influence on decision making) (Baron and Kenny 1986). Non-problem/low risk gamblers took greater personal responsibility for losses, with only two of five non-problem/low risk gamblers stating that occasional rule breaking resulted in larger than planned losses, due to alcohol consumption, boredom, peer influence or other factors. Again Sarah (25, *F*), unlike other non-problem/low risk gamblers, described greater influence on risk perception and decision making by mediating/moderating factors, including: evidence of greater exposure to reinforcement, memory biased for positive outcomes, and mood states that triggered initiation of gambling.

Moderate Risk Gamblers

Risk Perception

Moderate compared to non-problem/low risk gamblers described risk perceptions implying greater vulnerability to harm, though vulnerability factors appeared less consistently correlated than among problem gamblers. Four of five moderate risk gamblers admitted to similar assessments of the likelihood of negative outcomes (e.g., losing money), but also that they rarely reflected on this information when making decisions. Overall, moderate risk gamblers described more optimistic expectations, along with causal beliefs justifying riskier win-directed gambling—used in part to justify lack of reflection on negative contingencies.

Moderate and non-problem/low risk gamblers attributed similar positive qualities and goals when justifying motivation to gamble. However, moderate risk gamblers described experiences with greater emotional intensity, referring frequently for example, to the “thrill of winning” and the excitement, concentration and focus they felt while gambling (Colin, 19, *M*). Similarly, descriptions of mental rehearsal, fantasy or hope were more

positive and emotional in tone, demonstrating less reflection on the mechanics determining likely outcomes:

I think the risk of it is fun as well. It's not just about making money. It's about surprise, that element of surprise, or that element of 'it's a possibility'. Victoria (22, F)

Moderate risk gamblers also reported prioritising play strategies associated with different motivational goals than non-problem/low risk gamblers, often emphasising shorter term, specific, more immediate emotional or monetary goals over long term risk management. Like non-problem/low risk gamblers, a majority of moderate risk gamblers used behavioural rules to limit spending (e.g., playing only when in the company of peers), though often setting higher monetary limits (absolute, and as proportion of income), based on more complex, less consistent rules. For example, initially Wendy (19, F) described her strategy to limit spending as:

Tonight I only want to spend \$200, and not spend more. You never take a card with you. Otherwise you're going to lose more. Wendy (19, F)

Although, later in her interview, she reflected on a more complex method for reaching a higher limit, based on her potential pattern of loss:

The first time I would always take out small amounts of money, like fifties, but after that up to two hundred. If I still lose I will take the money up to five hundred. If I still lose, but not all of the five hundred, maybe four hundred, I will stop for the night. I will think 'tonight is no good'. Nobody wins all their money back all the time, so if you win once at one place, you try a second place to see if you have good luck, but if not, then I change to another machine. Wendy (19, F)

Mediating and Moderating Factors

Overall, moderate risk gamblers described less consistent, riskier decision making, both in risk perception or interpretation, and in the satisficing of goals or strategies. All moderate risk gamblers reported that decision-making may fluctuate with exposure to mental cues (alcohol intoxication, feelings of loneliness, confidence and boredom), and external cues (proximity to venues or peers, reaching preset spending limits, particular in-game events). Three of five moderate risk gamblers reported difficulty resisting the urge to gamble, even when mindful of likely negative outcomes. Common cues (alcohol, boredom, reaching spending limits) and implicit urges were reported to linger longer and be more influential on the decision making among moderate compared to non-problem/low risk gamblers, leading to spontaneous, often overwhelming urges to gamble, and prioritisation of riskier strategies (e.g., increasing bet sizes, ignoring preset spending limits, borrowing money):

Alcohol would be my main influence, big time, especially when you're out and you're spending money. You're thinking, 'well, this is a good idea', at the time, 'I might be able to make some money'. You also don't really have a bigger picture of how much you're actually losing, because you're under the influence of alcohol, and you're also enjoying yourself and having fun at the same time. Victoria (22, F)

Three of five moderate risk gamblers described historical factors associated with increased risk of vulnerability to either harmful risk perceptions, or inconsistent decision making, such as: an early history of gambling, substantial early career wins, and normalization or high valuation of gambling by close family members (Johansson et al. 2009; Raylu and Oei 2002). Although, only one gambler reported gambling for an extended or prolonged period—in this case, more than 2 years.

Problem Gamblers

Risk Perception

All individuals meeting criteria for problem gambling described risk perception and mediating/moderating vulnerability factors. Three of five individuals (*Tim, 54, M; Gene, 59, M; Steven, 47, M*) had engaged in cognitive behavioural therapy for gambling, leading to recovery from symptoms. Treatment experienced individuals demonstrated similarities distinguishing them from other problem gamblers: personally significant problems leading to treatment seeking (e.g., suicidality, self-harm, relationship breakdown, large financial debts); beliefs, prior to treatment, that were vague or erroneous, supporting overestimation of positive outcomes, underestimation of negative outcomes, and overall excessive optimism; and, with treatment, significantly reduced positive, and increased negative expectations, decreased explicit valuation of gambling, and increased volitional control despite residual urges:

Until [my therapist] explained it all, it was because everybody else was making a noise. It was the expectation of winning, thinking, ‘oh well, everything’s going off’, not knowing how they’re programmed, and how they work, and randomness, and probability. So it’s strange, I could walk into a pub, or a club, or sit at a poker machine by myself and just play away merrily. *Tim (54, M)*

Treatment inexperienced problem gamblers (*Martin, 19, M; Lewis, 23, M*) were comparatively younger, and less experienced than other group members. Similar to treated gamblers, Martin described erroneous concepts of causality (overestimation of positive, underestimation of negative outcomes) related to consequent high value attributed to gambling, and risky strategising. However, Lewis, unlike other problem, and many moderate gamblers, endorsed low expectation of winning or positive outcomes, and high expectation of losing or negative outcomes.

Regardless of background and beliefs, all problem gambling group members reported gambling to regulate emotions (stimulation, excitement, boredom relief) and to win money, describing more intense motivation to play than other participants. Consequently, all problem gamblers described using strategies aimed primarily at emotion regulation and winning. Although, treatment experienced gamblers noted that they currently prioritised risk management strategies developed during treatment. Only one recovered problem gambler (*Gene, 59, M*) described attempting to use spending limits to reduce risk prior to treatment. All treated gamblers were currently abstinent or gambling at a low level, sustainable at their current income:

The attraction’s still there. It’s something that I’ve had there for a long time in my life. I don’t take drugs or anything like that. I do smoke cigarettes. I don’t find myself wanting to go and get that extra fifty and go back so much, if you understand what I mean. The old [Gene] used to think of ways of going and getting some more money

and returning straight away. I tend to go with what I've got and leave it at that. Gene (59, M)

Mediating and Moderating Factors

Compared to low and moderate risk gamblers, problem gambling group members described greater intensity, number and influence of vulnerability factors associated with risk perception mediation/moderation. However, the relevance of particular factors varied considerably among individuals. Overall, problem gamblers described similar types of contextual influences as moderate risk gamblers (e.g., boredom, loneliness, alcohol, low mood, game events, proximity of venues and peers) though with a greater likelihood and intensity of arousing urges to gamble, and therefore with more powerful influence over gambling decisions:

I do a lot of designated driving for my mates. If I'm there as well I might put on \$10, \$20, just because I'm not drinking so I can afford it. I don't sort of think in my head, 'I don't need to put it in, I can just save it', I say, 'I've got the money on me I may as well spend it'. It sort of lures you in a little bit. It's the way, this is the way I always thought of it, because I always think of this when I'm at home when I'm bored. Like, the way the machines are set up to look like they're features, like a fun gaming opportunity. It's very sneaky. Martin (19, M)

When you drink it's the worst. Alcohol just destroys your mind, you just, like, you lose all your inhibitions. You're like, 'oh, what's another \$20?' Martin (19, M)

All group members noted changes in gambling cognition and behaviour over time, including: increasing exposure to reinforcement and negative consequences, more powerful urges to play often competing with conscious motivation, and greater mood, appraisal, and volitional fluctuation in response to contextual cues (e.g., intense feelings of regret, shame, or suicidality after losing money). Group members described higher rates of background risk factors (Johansson et al. 2009), often representative of more significant life problems predisposing individuals to vulnerable risk perceptions (e.g., substantial mental illness or trauma). Three of five group members also acknowledged that deception or denial of problems had had a significant influence over risk perceptions (e.g., amplifying positive, minimizing negative expectations), and decision-making:

I liked the encouraging aspect of the 'random' part. I'm not a great fan of the 'probability' part. So, I'll sit there and accept the fact that I randomly I can walk into a machine, put a dollar in, and just hit one go for one credit, and the big jackpot would come up. The probability of it, being so remote, doesn't occur to me, because I see the randomness of it, so as far as you're concerned, I can accidentally trip over and just press a button that's got two coins on it. So, I try to associate, or disassociate I suppose, the probability from the randomness. Tim (54, M)

Problem gambler Lewis presented a coherent, detailed narrative outlining his risk perceptions and their relationship with problematic gambling, in a similar way to many of the treated gamblers. Lewis reported that he had mostly negative memories and expectations of gambling. However, if enough time passed since his last gambling session, regret and other attributions about losses would dissipate, leaving him vulnerable to particular mental (boredom, being alone, perception of the close proximity of venues) and environmental cues (seeing gambling images), triggering positive perceptions and fantasies,

increasing motivation to gamble. Lewis noted that he would then attempt to rationalise gambling, minimising negative, and amplifying positive expectations, thereby further increasing his motivation, reducing volitional control, often leading to harmful gambling sessions:

That idea of, “maybe you could win” comes back in. And the negative feeling, maybe I push it down subconsciously, deliberately. I’m not sure. But those negative feelings sort of dissipate... I usually try and rationalise, ‘it would be good to win this money to do this’. I think I use that, more as an excuse too. But I think deep down, it’s the idea of winning really big that’s exciting - getting the actual jackpot or whatever... The temptation to keep playing and hopefully win just sort of wins in the end. Lewis (23, M)

Discussion

The present study sought to obtain preliminary data on how gamblers perceive risk and the role of risk perception in decision making. The aim was to build upon and extend an earlier study applying MM and GT mapping out how experts evaluated these factors. Although as a pilot study no definitive conclusions can be drawn given the diverse composition of the sample, the findings provide an important conceptual basis for understanding risk perception and the development of disordered gambling.

Positive Versus Negative Risk Perceptions

Perceptions of ‘positive’ and ‘negative’ consequences appear to convey distinct influence on decision making and behaviour. Detailed, consistent, heightened expectation of negative outcomes (e.g., losing money), and consistent, low erudition, expectation, and emphasis on positive outcomes (e.g., excitement, peer interaction), can be construed as contributing independently to fewer gambling problems, while reciprocal, equivalent expectations contributed to problematic gambling. Strength of convictions was associated with level of problems, or lack thereof. A majority of gamblers outlined coherent narratives outlining content and reciprocal causal influence between gambling risk perceptions, mediating/moderating factors, decision-making, behaviour, and consequences.

Mental models and GT analysis identified important between individual, and between group differences. Equivalent with the findings of this study, a number of drug and alcohol studies support the independent influence of positive and negative outcome expectancies and preferences in riskier behaviour and substance dependence, and in the reciprocal influence of substance use experience on risk perception (Aarons et al. 2001; Leigh 1999; Smith et al. 1995). Gambling risk perception research has been limited to date, though is also broadly consistent with the current findings, and findings in related disciplines (Derevensky et al. 2010; Inglin and Gmel 2011; Gillespie et al. 2007).

However, the current findings also suggest gamblers attribute meaning to risk perception in individually and contextually varied ways, incompatible with normative views of rationality (Delfabbro 2004; Delfabbro and Winefield 1999). Gamblers across groups described varied interpretations of behaviours, events, outcomes, causation, thought processes and content-relating interpretations to context-dependent, personally meaningful, short or long term goals. For example, Victoria (22, *F*, moderate risk gambler) described risk under uncertainty as exciting and positively motivating, while another gambler, Tim

(54, *M, problem gambler*), ashamed of earlier life events, described gambling losses and problems as a means of deserved, self-inflicted punishment. Nevertheless, many gamblers noted risk and loss as important disincentives justifying careful spending limits (e.g., *Joslyn, 19, F, low risk gambler*). Therefore, even 'risk' itself, or loss of money, was not seen universally as an inherently 'negative' outcome. However, in the few gambling studies investigating outcome expectancy (Wong and Tsang 2012), outcomes were typically pre-categorised, according to normative assumptions about motivational value, rather than reflecting idiosyncratic interpretation (Mischel 2004; Moodie 2007). Here, findings suggest that difficulties in predicting real world gambling behaviour according to current gambling decision making theories (Fortune and Goodie 2011) may be due to unrealistic reduction, or generalisation, or that it is incorrect to assume all disordered gamblers adhere to a common set of irrational, biased or erroneous risk cognitions (Delfabbro 2004; Rachlin 1990).

Gamblers in the current study reported multiple, inconsistent perceptions and goals—considered simultaneously—satisficing perceived negatives (e.g., loss, financial difficulties, interpersonal conflict, guilt and shame) and perceived positives (e.g., excitement, hope, stimulation, peer approval), to navigate multifaceted, subjective goals and scenarios. However, while research agrees gamblers may have multiple motivations for gambling (Binde 2009), the processes by which gamblers satisfice or negotiate multiple perceptions has been largely neglected in the MM and gambling literature (Breakwell 2007). In contrast, here, gamblers presented coherent narratives to explain gambling behaviour under competing constraints and conditions, or else provided data that compiled into plausible formulations, even in the case of harmful or inconsistent choices, or decision making confounded by perceptual suppression or bias. For, example, non-problem/low risk gamblers tended to explain limited gambling according to conscious prioritisation of risk management over entertainment, social, winning or other goals, with the equivalent reverse situation true for more disordered gamblers.

Idiosyncratic Gambler Profiling

Participants' risk perception/decision making profiles were complex and idiosyncratic, with differences, even within groups, in: risk beliefs, meanings and strategizing; predisposing, experiential, or contextual factors influencing the use of risk data; and patterns of dominance among risk perception and mediating/moderating factors. Many moderate risk, and some non-problem/low risk gamblers described milder problems, and less severe vulnerabilities, while more problematic gamblers described more harmful patterns of decision making according to a broader range of more powerfully influential vulnerability factors.

Individuals' motivations and behaviours also varied across contexts, and over the course of gambling careers. For example, gamblers explained decision making variation based on boredom, hope, guilt, uncontrollable urges, or alcohol consumption (e.g., *Lewis, 23, M, problem gambler; Tim, 54, M, problem gambler*), while treatment experienced gamblers reported shifts in estimation and consequent motivation, with downward spiral into problem gambling, and with recovery.

Findings suggest different predisposing and experiential factors lead individuals to make different decisions in different contexts—over time, or if gambling problems become more severe, problematic decision making processes may multiply and merge, compounding difficulties and making it difficult to tease apart cognitive processes responsible for problematic gambling. Current findings are consistent with research showing

substantial exposure to reinforcement or problems and harmful decision making processes may interact, exacerbating and compounding problematic decision making over time, in turn leading to more comprehensive, intense problematic cognitions (Holtgraves 2009). Meanwhile, less severe gambling problems result from fewer, less intense, more diverse risk perception vulnerabilities.

Individually varied and context dependent decision making observed here supports research highlighting, both, multiple pathways in and out of problem gambling (LaPlante et al. 2008; Milosevic and Ledgerwood 2010), as well as probable decision making differences among disordered gamblers (Grant et al. 2010; Holtgraves 2009). The current findings suggest that these two research areas may potentially be usefully linked in an integrative understanding of gambling disorder: adding valuable decision making explanation to subtyping models (Blaszczynski and Nower 2002), and helping to overcome the theoretical limitations of biopsychological theories of gambling (e.g., low level gambling problems without neurophysiological biases, or lack of gambling problems with biases) (Moscrop 2011).

Limitations and Future Directions

Despite following evidence-based methodological principles (Chiovitti and Piran 2003; Morgan et al. 2002; Strauss and Corbin 1998), it is difficult to generalise conclusions from this study, due to inevitable bias in participant and researcher viewpoints. Sampling, for example, was likely biased towards younger, university-educated, recreational gamblers, and more gambling experienced, treatment experienced, older, male problem gamblers. Analyses may also potentially over-explain uncertainty in the data (Burgess et al. 2013), despite analysis following an evidence based theory of gambling risk perception (outlined in detail in the previous study by Spurrier et al. Submitted) (Morgan et al. 2002). Gambler explanations throughout the study related to decision-making relationships, without control for combinatory effects among all relevant variables. Without psychometrically validated, quantitative measurement, it is difficult to reasonably infer which variables influence each another, or decisions, particularly when variables reportedly played different roles for different gamblers. Future research is therefore clearly needed to validate and build upon the preliminary factors outlined here. Specifically, larger samples and mixed qualitative–quantitative data collection methods should be employed to further expand and test the findings of this study.

Conclusion

This project represents early, exploratory research, limited by the available qualitative methodology. The current study offers some preliminary data that suggests that the development of disordered gambling may be heavily influenced by relative underestimation of risk and overvaluation of gambling, based on explicit and implicit analysis, and deliberate, innate, contextual, and learned processing evaluations and biases. Theoretical models or corrective interventions addressing estimation, expectation and evaluation of gambling may be beneficial, though should be mindful of factors impinging on gamblers' capacities to accurately process risk, and explicitly control behaviour.

Conflict of interest The authors declare that they have no conflict of interest.

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APPENDIX D: 48-item Gambling Risk Decisions Questionnaire

Gambling Risk Decisions Questionnaire

Rate the **LIKELIHOOD / PROBABILITY** of the following potential **OUTCOMES OF A GAMBLING SESSION...**

Please choose the appropriate response for each item:

	Impossible	Unlikely to happen	Average	Very Likely to happen	Certain
1. Relationship difficulties, losing respect or approval from others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
2. Financial, work, or legal problems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
3. Feeling guilty, shame, or bad about who I am	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
4. Stress, depression, anxiety, or other bad feelings	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

How **IMMEDIATE OR LONG LASTING** are the **EFFECTS** of each potential outcome...

Please choose the appropriate response for each item:

	No impact	Immediate impact only	Short term impact	Long term impact	Permanent
5. Feeling excitement, feeling a 'rush'					
6. Reducing boredom	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
7. Gaining respect or approval from others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
8. Feeling powerful, proud, or confident	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Rate how TRUE / FALSE each of the following statements about gambling is.

Please choose the appropriate response for each item:

	Completely UNTRUE				Completely TRUE
9. Gambling has predictable outcomes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
10. A gambler can win over the long term	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
11. I can predict game outcomes when I am tuned in or observant	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
12. I can control the outcome of games	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
13. I am luckier than most people	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
14. You usually need to invest a certain amount before you win	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
15. Losing profit from gambling is not really losing money	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
16. If you lose, you are more likely to win next time	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Nil				Very strong
17. Right at this moment, how strong is your urge to gamble	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
18. Right at this moment, how strong is your intention to gamble	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
	Very easy				Very difficult
19. How difficult is it to follow your own rules or plans during gambling sessions?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
20. How difficult is it to ignore or dismiss thoughts about gambling?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
21. How difficult is it to resist the urge to gamble?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

- | | | | | | |
|---|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| | Very
comfortable | | | | Very
uncomfortable |
| 22. How uncomfortable do you find competing goals during gambling sessions? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Consider the following SITUATIONS and STATES OF MIND (items 23-30).

Please choose the appropriate response for each item:

- | | | | | | |
|--|---|-----------------------|-----------------------|-----------------------|--------------------------------------|
| | Unlikely to
THINK
about
gambling | | | | Likely to
THINK about
gambling |
| 23. you're alone at home | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 24. you see an advertisement, or sign for gambling | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 25. you had an argument with your partner, friend, or family member | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 26. you're at a casino, race track, or other gambling venue | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 27. you feel low or depressed | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 28. you're at a sporting event, or a venue where gambling may be available | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 29. you feel anxious, stressed, or on edge | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 30. you had a recent, large gambling win | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

- | | | | | | |
|--|-----------------------|-----------------------|-----------------------|-----------------------|-------------------------|
| | No problem
at all | | | | Significant
problems |
| 31. Please estimate, how significant your gambling-related problems to be? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

32. In the PAST FORTNIGHT, approximately how much money (IN DOLLARS) did you spend on gambling?

\$_____

33. In the NEXT TWO WEEKS, how much money (IN DOLLARS) do you plan to spend on gambling?

\$_____

- | | Much less than average | Less than average | Average | More than average | Much more than average |
|---|------------------------|-----------------------|-----------------------|-----------------------|------------------------|
| 34. Compared to others, how high do you consider your spending on gambling? | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Consider what you are most likely to do in the following GAMBLING SCENARIOS:

You have been gambling for a while and...

- | | stop gambling | think carefully about what is going on | continue gambling, but play more carefully | continue gambling in the same way | continue gambling, but take more risks | allow myself to 'switch off', 'get in the zone', or play by instinct |
|--|-----------------------|--|--|-----------------------------------|--|--|
| 35. you have a big win | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 36. you have lost more than you planned to wager | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 37. you reach your designated spending limit | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 38. you reach your designated spending limit | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Approximately, how long would you spend gambling each time you gambled...

- | | <5 minutes | 5-30 minutes | ½-2 hours | 2-5 hours | 5+ hours |
|---------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 39. ...in the last 2 months | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 40. ...since you began gambling | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Approximately how often have you gambled...

- | | Less than monthly | Monthly | Weekly | Daily | More than daily |
|---------------------------------|-----------------------|-----------------------|-----------------------|-----------------------|-----------------------|
| 41. ...in the past 2 month | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |
| 42. ...since you began gambling | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> | <input type="radio"/> |

Demographics and experience (optional scales)

43. **Age**

Please write you answer here: _____ years old

44. **Gender Please choose only one of the following:**

Male

Female

45. **Have you ever been diagnosed with, or treated for a drug, alcohol, relationship, or mental health issue? (tick any that apply)**

Yes I was diagnosed with an issue

Yes I attended therapy or a support group

No, none of the above

46. **Have you ever wagered or spent money on any form of gambling? (e.g., horse racing, lotto, pokies, poker, etc.)**

Please choose **only one** of the following:

Yes

No

If you answered YES to question 51, answer questions 52 and 53...

47. **Do you remember an important or big win or loss early in your gambling?**

Please choose **only one** of the following:

Win

Lose

Neither a win nor loss

48. **At what age did you first start gambling with money?**

Please write you answer here: _____ years old

APPENDIX E: Gambling risk decisions questionnaire scoring protocol

Gambling Risk Decisions Questionnaire Scoring protocol

Risk decision content

Factors 1. Likelihood (negative outcomes)

Items 1 – 4

Likelihood (negative outcomes) assesses individuals' estimation of the likelihood of negative gambling outcomes. Higher scores denote higher expectation of events to occur.

Score each item 1-5 points, where 'impossible' = 1, 'certain' = 5

Likelihood (negative outcomes) score = Sum of items numbered 1 to 4

Factors 2. Immediacy (positive outcomes)

Items 5 – 8

Immediacy (positive outcomes) assesses individuals' perception of the immediate versus long term impact of potential positive outcomes. Higher scores denote expectation that outcomes will have longer lasting impacts. Lower scores denote expectation that outcomes will have only immediate or short term impacts.

Score each item 1-5, where 'no impact' = 1, 'permanent' = 5

Immediacy (positive outcomes) score = Sum of items numbered 5 to 8

Factor 3. Belief in luck

Items 9-16

Belief in luck assesses the extent to which individuals report confidence in the predictability of games and personal luck. Higher scores denote greater confidence in luck.

Score each item 1-5, where 'completely untrue' = 1, 'completely true' = 5

Belief in luck score = Sum items numbered 9 to 16

Risk decision processes

Factor 4. Motivation

Items 17-18

Motivation scale items measure the extent to which individuals are motivated to gamble. Higher scores denote greater motivation to gamble.

Score each item 1-5, where 'nil' = 1, 'very strong' = 5

Motivation score = Sum items numbered 17 and 18

Factor 5. Lack of control

Items 19-22

Lack of control scale items assess the difficulty and discomfort individuals experience in controlling gambling related urges or thoughts. Higher scores denote poorer control.

Score each item 1-5 points, where 'very easy' / 'very comfortable' = 1, 'very difficult' / 'very uncomfortable' = 5

Lack of control score = Sum items numbered 19 to 22

Factor 6 & 7. Cue sensitivity (emotional) & Cue sensitivity (venue)

Items 23-30

Cue scales assess the extent to which individuals are vulnerable to particular mental states and contextual cues. Higher emotional cue scores denote greater perceived sensitivity to negative emotional mental states. Higher venue cue scores denote greater perceived sensitivity to environmental cues associated with gambling venues and advertising.

Score each item 1-5 points, where 'Unlikely to think about gambling' = 1, 'likely to think about gambling' = 5

Emotional cues score = Sum of odd numbered items

Venue cues score = Sum of even numbered items

Factor 8. Self-monitoring deficit (problems)

Item 33*

Self-monitoring deficit (problems) assesses level of inaccuracy in individuals' self-evaluations of problems. Magnitude of score denotes the level of discrepancy between reported problems and perception of how problems compare to other gamblers. Zero denotes accurate perception of problems. Scores above zero denote higher problems compared to individuals' perception of problems. Scores below zero denote higher perceived problems compared to reported problems.

Self-monitoring accuracy (problems) = Z score (problems) – Z score (perception of problems)

Self-monitoring accuracy (problems) = A - B + 0.79

A = Estimate of gambling related problems ranging from 1 to 4 points.

Where, 'no problems', or never gambled = 1

'low risk gambling' = 2

'moderate risk gambling' = 3

'problem gambling' = 4

**N.B. Gambling related problems are not directly measured by the GRDQ. Instead, during development of the GRDQ participants' negative gambling consequences were estimated using the Problem Gambling Severity Index (PGSI; Ferris & Wynne, 2001). Normative data for the GRDQ therefore makes use of participant PGSI scores. Based on participants' PGSI scores and group membership, individuals should be allocated a score for "A" equivalent to their group membership score (as described above).*

E.g., If an individual's PGSI score was 14, this would represent 'problem gambling', such that A = 4 (PGSI; Ferris & Wynne, 2001)

B = perception of problems score = score for item 31, ranging from 1 to 5 points, from 'No problem at all' = 1, to 'Significant problems' = 5

Factor 9. Self-monitoring deficit (spending)

Self-monitoring accuracy (spending) = Z score (reported spending) – Z score (perception of spending)

Self-monitoring scores measure the accuracy of individuals' self-evaluations. Magnitude of score denotes the level of discrepancy between reported spending and perception of how spending compares to other gamblers. Zero denotes accurate perception of spending. Scores above zero denote higher actual spend compared to perception of relative spend. Scores below zero denote higher perceived spend compared to reported spend.

Self-monitoring accuracy (spending) = C - D + 1.58

Where, C = mean of scores for items 32 and 33, i.e. =
$$\frac{\text{item 32} + \text{item 33}}{2}$$

= (number of dollars spent on gambling over past two weeks, estimated in Australian dollars)

+ (expected number of dollars spend on gambling in next two weeks, estimated in Australian dollars) /2

Where, D = score for item 34, ranging from 1 to 5 points, from 'Much less than average' = 1, to 'Much more than average' = 5

Risk decision stability

Factor 10. Variance across contexts

Items 35-38

Variance across contexts measures variance in individuals' responses to different scenarios described in items 35 to 38. Higher scores denote greater reported variance across difference gambling scenarios.

Instability = s^2 = Variance of items 35 to 38 =
$$\frac{(\text{item 35} - X)^2 + (\text{item 36} - X)^2 + (\text{item 37} - X)^2 + (\text{item 38} - X)^2}{3}$$

Where, 'stop gambling' = 1

'think carefully...' = 2

'continue gambling but play more carefully' = 3

'continue gambling in the same way' = 4

'continue gambling, but take more risks' = 5

'allow myself to switch off...' = 6

Where, X = Mean of scores for items 35 to 38 =
$$\frac{\text{item 35} + \text{item 36} + \text{item 37} + \text{item 38}}{4}$$

Gambling behaviour

Factor 11. Gambling involvement (current)

Items 39 & 41

Gambling involvement (current) measures individuals' estimated frequency and length of gambling sessions over the past 2 months. Higher scores denote more gambling involvement through more frequent and/or longer gambling sessions.

Score each item 1-5 points, where 'less than monthly' / '<5 minutes' = 1, 'more than daily' / '5+ hours' = 5

Gambling involvement score =
$$\frac{\text{items 39} + \text{item 41}}{2}$$

Demographic and experiential background factors (optional scales)

Demographic / Individual differences

Background Factor 1: Gender

Item 44

Score 1 point for 'female',

Score 2 point for 'male'

A higher score denotes higher risk.

Background Factor 2: Mental health issues

Item 45

Score 1 point for each 'Yes', up to a maximum of 2 points.

Score 0 points for a no response.

A higher score denotes higher risk.

Gambling experience and exposure

Background Factor 3: Experience of early wins/losses

Item 47

Score 1 point for either a win or a loss

Score 0 points for neither a win nor a loss

A higher score denotes higher risk

Background factor 4. Gambling involvement (long term)

Items 40 & 42

Score each item 1-5 points, where 'less than monthly' / '<5 minutes' = 1, 'more than daily' / '5+ hours' = 5

Gambling involvement score = $\frac{\text{items 40} + \text{item 42}}{2}$

2

A higher score denote higher risk

Background Factor 5: Gambling career length

Item 43 & 48

Gambling career length = Item 43 (age in years) - Item 48 (years spent gambling)

A higher score denotes higher risk

References

Ferris, J., & Wynne, H. (2001). *The Canadian problem gambling index: Final report*. Ottawa: Canadian Centre on Substance Abuse.

APPENDIX F: Human ethics research approval

Ref: PB/PE

16 September 2014

Professor Alex Blaszczyński
School of Psychology
Brennan MacCallum Building – A18
The University of Sydney
Email: a.blaszczyński@usyd.edu.au

Dear Professor Blaszczyński

Thank you for your correspondence dated 15 February and 4 March 2010 addressing comments made to you by the Human Research Ethics Committee (HREC). After considering the additional information, the Executive Committee at its meeting held on **9 March 2010** approved your protocol entitled “**Mental models of risk in problem/pathological gambling**”.

Details of the approval are as follows:

Protocol No.:	12367
Approval Period:	March 2010 to March 2011
Authorised Personnel:	Professor Alex Blaszczyński Dr Paul Rhodes Mr Michael Spurrier

The HREC is a fully constituted Ethics Committee in accordance with the National Statement on Ethical Conduct in Research Involving Humans-March 2007 under Section 5.1.29.

The approval of this project is conditional upon your continuing compliance with the National Statement on Ethical Conduct in Research Involving Humans. We draw to your attention the requirement that a report on this research must be submitted every 12 months from the date of the approval or on completion of the project, whichever occurs first. Failure to submit reports will result in withdrawal of consent for the project to proceed. Your report will be due on **9 March 2011**.

Chief Investigator / Supervisor’s responsibilities to ensure that:

1. All serious and unexpected adverse events should be reported to the HREC within 72 hours for clinical trials/interventional research.
2. All unforeseen events that might affect continued ethical acceptability of the project should be reported to the HREC as soon as possible.
3. All changes to the protocol must be approved by the HREC before continuation of the research project.



4. All research participants are to be provided with a Participant Information Statement and Consent Form, unless otherwise agreed by the Committee. The following statement must appear on the bottom of the Participant Information Statement: *Any person with concerns or complaints about the conduct of a research study can contact the Deputy Manager, Human Ethics Administration, University of Sydney on +61 2 8627 8176 (Telephone); + 61 2 8627 8177 (Facsimile) or ro.humanethics@sydney.edu.au (Email).*
5. Copies of all signed Consent Forms must be retained and made available to the HREC on request.
6. It is your responsibility to provide a copy of this letter to any internal/external granting agencies if requested.
7. The HREC approval is valid for four (4) years from the Approval Period stated in this letter. Investigators are requested to submit a progress report annually.
8. A report and a copy of any published material should be provided at the completion of the Project.

Please do not hesitate to contact the Human Ethics Office should you require further information or clarification.

Yours sincerely

Associate Professor Philip Beale
Chair
Human Research Ethics Committee

Copy: Mr Michael Spurrier mikes@psych.usyd.edu.au

Approved Documents:

Cards for Participants
Advertising Flyer
Participant Information Statement (interview)
Participant Information Statement (questionnaire and interview)
Participant Information Statement (two questionnaires)
Advertising Flyer
Interview Questions
Letter of invitation to participate
Canadian Problem Gambling Index
Participant Consent Form
Handout



Mike Spuz <mickspurrier@gmail.com>

20121127 12367 Blaszczy nski Modification Approved

1 message

Human Ethics <ro.humanethics@sydney.edu.au>
To: Alex Blaszczy nski <alex.blaszczy nski@sydney.edu.au>
Cc: "mikes@psych.usyd.edu.au" <mikes@psych.usyd.edu.au>

Mon, Dec 3, 2012 at 10:50 AM

Dear Professor Blaszczy nski

Title: Mental models of risk in problem/pathological gambling

Protocol No: 12367

Approved Documents:

Advertisement – Version 2, 23rd November 2012

Participant Information Statement – Version 3, 23rd November 2012

Participant Consent Form – Version 2, 2nd November 2012

Questionnaire

Your request to modify the above application was considered by the Executive Committee of the Human Research Ethics Committee (HREC) at its meeting on **27 November 2012**. The modification has been approved as attached.

The Committee had no ethical objections to the modification/s and has approved the protocol to proceed.

Please do not hesitate to contact Research Integrity (Human Ethics) should you require further information or clarification.

Yours Sincerely

Human Research Ethics Committee

The University of Sydney

2 attachments

 **20121121 12367 Blaszczyynski Modification Deferred.msg**
602K

 **20121121 12367 Blaszczyynski Modification Response.pdf**
635K

APPENDIX G: Recruitment documentation

Do you gamble regularly?



A team of researchers from the School of Psychology are conducting research into people's perceptions about gambling. We are looking for approximately 130 participants with some experience of gambling to participate in our study. For more information and to participate, please contact:

Michael Spurrier Mobile: 0433 010 640 Email: mikes@psych.usyd.edu.au

Primary Researcher: Prof. Alex Blaszczynski

Phone: 02 9036 7227

Email: alex@psych.usyd.edu.au

Secondary Research Supervisor: Dr. Paul Rhodes

Phone: 02 9351 6708

Email: paul@psych.usyd.edu.au

Do you gamble regularly?

Michael Spurrier

Mobile: 0433 010 640

Email: mikes@psych.usyd.edu.au

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Do you gamble regularly?

Michael Spurrier

Mobile: 0433 010 640

Email: mikes@psych.usyd.edu.au



Are you interested in taking part in a brief survey about gambling cognition and behaviour? If so, follow the link below to an online version of the survey:

[<link to online questionnaire - to be generated upon approval of questionnaire>](#)

Alternatively, please contact me for further details to arrange receipt of the questionnaire via post or email. You can reach me at 02 90367263 and mstu1648@uni.sydney.edu.au

All participants will go into a draw to receive one of five grocery vouchers.

Please feel free to forward this email to anybody you may think may be interested in taking part in this study.

Experience with gambling may be useful, but is not essential. The survey is part of a project being conducted by a team of researchers from the Department of Psychology, University of Sydney. This project has Human Research Ethics Committee approval.

Yours Sincerely,
Michael Spurrier & Alex Blaszczynski

Study Name	Mental Models of Risk in Problem/Pathological Gambling
Abstract	This project examines the way that gamblers perceive and manage risk.
Description	<p>This study involves completing a single, brief questionnaire about your beliefs, experience, and behaviour related to gambling. No experience in gambling is necessary to complete this study. THIS STUDY MAY BE COMPLETED ONLINE: (1.) Select “[View Study Website]” below; (2.) Follow instructions at the end of the questionnaire to claim credit for your participation. ALTERNATIVELY, you may SIGN-UP/ATTEND one of the timeslots allocated below.</p>
Website	<p>[View Study Website] https://www.psych.usyd.edu.au/limesurvey187/index.php?sid=42644&newtest=Y&lang=en</p>
Prescreen Restrictions	No Restrictions - [View/Modify Restrictions]
Duration	60 minutes
Credits	1 Credits
Researcher	<p>Michael Spurrier Office: STUDENT, Ph.D, ph 65008 Email: mstu1648@uni.sydney.edu.au</p>
Participant Sign-Up Deadline	24 hours before the study is to occur
Study Status	<p>Not visible to participants (not approved) -- [Send a Request] to have this study approved Active study (does not appear on list of available studies -- must also be approved)</p>
Automatic Credit Granting	Credit will be automatically granted for timeslots where no action was taken, that are more than 48 hours old. Automatic credit grant is done once per day.
Human Res Ethics Com Approval Code	12367

APPENDIX G: Participant consent and information sheets



ABN 15 211 513 464

ALEX BLASZCZYNSKI
PROFESSOR IN CLINICAL PSYCHOLOGY

School of Psychology (A18)
Faculty of Science
The University of Sydney
NSW 2006 AUSTRALIA
Telephone: +61 2 9036 7227
Facsimile: +61 2 9351 7328
Email: alexb@psych.usyd.edu.au
Web: <http://www.usyd.edu.au/>

PARTICIPANT CONSENT FORM

I,[PRINT NAME], give consent to my participation in the research project

TITLE:

In giving my consent I acknowledge that:

1. The procedures required for the project and the time involved have been explained to me, and any questions I have about the project have been answered to my satisfaction.
2. I have read the Participant Information Statement and have been given the opportunity to discuss the information and my involvement in the project with the researcher/s.
3. I understand that I can withdraw from the study at any time, without affecting my relationship with the researcher(s) or the University of Sydney now or in the future.
4. I understand that my involvement is strictly confidential and no information about me will be used in any way that reveals my identity.
5. I understand that being in this study is completely voluntary – I am not under any obligation to consent.
6. I understand that I can stop the interview at any time if I do not wish to continue, the audio/video recording will be erased and the information provided will not be included in the study.
7. I consent to:

- i) Audio-taping YES NO
ii) Receiving Feedback YES NO

If you answered YES to the "Receiving Feedback Question (iii)", please provide your details i.e. mailing address, email address.

Feedback Option

Address: _____

Email: _____

Signed:

Name:

Date:



ABN 15 211 513 464

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7. I consent to:

- i) Audio-taping YES NO
- ii) Receiving Feedback YES NO

If you answered YES to the "Receiving Feedback Question (iii)", please provide your details i.e. mailing address, email address.

Feedback Option

Address: _____

Email: _____

Signed:

Name:

Date:



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Feedback Option

Address: _____

Email: _____

Signed:

Name:

Date:



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Mental models of risk in problem/pathological gambling

PARTICIPANT INFORMATION STATEMENT

(1) What is the study about?

You are invited to take part in a research study into mental models of risk in problem/pathological gambling. The object is to investigate the perceptions and beliefs regular gamblers hold about gambling and risk.

(2) Who is carrying out the study?

The study is being conducted by Prof. Alex Blaszczynski, Michael Spurrier and Dr. Paul Rhodes. This will form the basis for the degree of Master of Science at the University of Sydney for Michael Spurrier under the supervision of Prof. Alex Blaszczynski and Dr. Paul Rhodes.

(3) What does the study involve?

If you agree to participate in this study, you will be asked to complete a short questionnaire and interview (which will be audio recorded). These measures will involve answering a series of questions about your perceptions and experiences of gambling and risk.

The interview and questionnaire will be completed at the Psychology Clinic, University of Sydney, Camperdown campus. Alternatively interviews may be completed via Skype, with questionnaires and signed consent forms to be returned via the self-addressed envelope provided. Completion of interviews and questionnaires will occur at a mutually convenient time. If you would like to complete the interview via Skype please provide Michael Spurrier with a Skype address where he may contact you.

(4) How much time will the study take?

The study will take approximately 45 minutes.

(5) Can I withdraw from the study?

Participation in this study is entirely voluntary: you are not obliged to participate and - if you do participate - you can withdraw at any time. Whatever your decision, it will not affect your relationship with the research staff.

You may stop the interview at any time if you do not wish to continue, the audio recording will be erased and the information provided will not be included in the study.

Being in this study is completely voluntary and you are not under any obligation to consent to complete the questionnaire. Submitting a completed questionnaire is an indication of your consent to participate

in the study. You can withdraw any time prior to submitting your completed questionnaire. Once you have submitted your questionnaire/survey anonymously, your responses cannot be withdrawn.

(6) Will anyone else know the results?

All aspects of the study, including results, will be strictly confidential and only the researchers will have access to information on participants. A report of the study may be submitted for publication, but individual participants will not be identifiable in such a report.

(7) Will the study benefit me?

The aim of this study is to gather information that may guide development of effective communication to gamblers about the risks of gambling, as well as to provide a tool to be used in clinical assessment and treatment of Pathological Gambling.

Identifying differences in the beliefs of different gambler subgroups is likely to yield useful information about what specific beliefs are associated with the negative consequences experienced by Pathological Gamblers. This information will be useful for creating corrective communication that directly targets the erroneous beliefs held by problem gamblers. This is an area of research not previously examined and one that is likely to support the responsible use of gambling services. In addition, a questionnaire will be developed from the results of the study that may become a useful tool for the clinical assessment of gambling beliefs, and as a guide to treatment for Pathological Gamblers.

(8) Can I tell other people about the study?

You are welcome to discuss the study with other people.

(9) What if I require further information?

When you have read this information, Michael Spurrier will discuss it with you further and answer any questions you may have. If you would like to know more at any stage, please feel free to contact the investigators at the contact details listed below:

Prof. Alex Blaszczynski	(02) 9036 7227	alex@psych.usyd.edu.au
Dr. Paul Rhodes	(02) 9251 6708	paulr@psych.usyd.edu.au
Michael Spurrier	0433 010 640	mikes@psych.usyd.edu.au

(10) What if I have a complaint or concerns?

Any person with concerns or complaints about the conduct of a research study can contact the Deputy Manager, Human Ethics Administration, University of Sydney on +61 2 8627 8176 (Telephone); +61 2 8627 8177 (Facsimile) or ro.humanethics@sydney.edu.au (Email).

This information sheet is for you to keep

ALEX BLASZCZYNSKI
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You may stop the interview at any time if you do not wish to continue, the audio recording will be erased and the information provided will not be included in the study.

Being in this study is completely voluntary and you are not under any obligation to consent to complete the questionnaire. Submitting a completed questionnaire is an indication of your consent to participate in the study. You can withdraw any time prior to submitting your completed questionnaire. Once you have submitted your questionnaire/survey anonymously, your responses cannot be withdrawn.

(6) Will anyone else know the results?

All aspects of the study, including results, will be strictly confidential and only the researchers will have access to information on participants. A report of the study may be submitted for publication, but individual participants will not be identifiable in such a report.

(7) Will the study benefit me?

The aim of this study is to gather information that may guide development of effective communication to gamblers about the risks of gambling, as well as to provide a tool to be used in clinical assessment and treatment of Pathological Gambling.

Identifying differences in the beliefs of different gambler subgroups is likely to yield useful information about what specific beliefs are associated with the negative consequences experienced by Pathological Gamblers. This information will be useful for creating corrective communication that directly targets the erroneous beliefs held by problem gamblers. This is an area of research not previously examined and one that is likely to support the responsible use of gambling services. In addition, a questionnaire will be developed from the results of the study that may become a useful tool for the clinical assessment of gambling beliefs, and as a guide to treatment for Pathological Gamblers.

(8) Can I tell other people about the study?

You are welcome to discuss the study with other people.

(9) What if I require further information?

When you have read this information, Michael Spurrier will discuss it with you further and answer any questions you may have. If you would like to know more at any stage, please feel free to contact the investigators at the contact details listed below:

Prof. Alex Blaszczynski	(02) 9036 7227	alex@psych.usyd.edu.au
Dr. Paul Rhodes	(02) 9251 6708	paulr@psych.usyd.edu.au
Michael Spurrier	0433 010 640	mikes@psych.usyd.edu.au

(10) What if I have a complaint or concerns?

Any person with concerns or complaints about the conduct of a research study can contact the Deputy Manager, Human Ethics Administration, University of Sydney on +61 2 8627 8176 (Telephone); +61 2 8627 8177 (Facsimile) or ro.humanethics@sydney.edu.au (Email).

This information sheet is for you to keep

ALEX BLASZCZYNSKI
PROFESSOR IN CLINICAL PSYCHOLOGY

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Mental models of risk in problem/pathological gambling

PARTICIPANT INFORMATION STATEMENT

(1) What is the study about?

You are invited to take part in a research study into mental models of risk in problem/pathological gambling. The object is to investigate the perceptions and beliefs regular gamblers hold about gambling and risk.

(2) Who is carrying out the study?

The study is being conducted by Prof. Alex Blaszczynski, Michael Spurrier and Dr. Paul Rhodes. This will form the basis for the degree of Master of Science at the University of Sydney for Michael Spurrier under the supervision of Prof. Alex Blaszczynski and Dr. Paul Rhodes.

(3) What does the study involve?

If you agree to participate in this study, you will be asked to complete two short questionnaire. These measures will involve answering a series of questions about your perceptions and experiences of gambling and risk.

Questionnaires will be completed at the Psychology Clinic, University of Sydney, Camperdown campus. Upon completion questionnaires will be collected by Michael Spurrier. Alternatively, questionnaires and signed consent forms may be returned via the stamped self-addressed envelope provided.

(4) How much time will the study take?

The study will take approximately 30 minutes.

(5) Can I withdraw from the study?

Participation in this study is entirely voluntary: you are not obliged to participate and - if you do participate - you can withdraw at any time. Whatever your decision, it will not affect your relationship with the research staff.

You may stop the interview at any time if you do not wish to continue, the audio recording will be erased and the information provided will not be included in the study.

Being in this study is completely voluntary and you are not under any obligation to consent to complete the questionnaire. Submitting a completed questionnaire is an indication of your consent to participate in the study. You can withdraw any time prior to submitting your completed questionnaire. Once you have submitted your questionnaire/survey anonymously, your responses cannot be withdrawn.

(6) Will anyone else know the results?

All aspects of the study, including results, will be strictly confidential and only the researchers will have access to information on participants. A report of the study may be submitted for publication, but individual participants will not be identifiable in such a report.

(7) Will the study benefit me?

The aim of this study is to gather information that may guide development of effective communication to gamblers about the risks of gambling, as well as to provide a tool to be used in clinical assessment and treatment of Pathological Gambling.

Identifying differences in the beliefs of different gambler subgroups is likely to yield useful information about what specific beliefs are associated with the negative consequences experienced by Pathological Gamblers. This information will be useful for creating corrective communication that directly targets the erroneous beliefs held by problem gamblers. This is an area of research not previously examined and one that is likely to support the responsible use of gambling services. In addition, a questionnaire will be developed from the results of the study that may become a useful tool for the clinical assessment of gambling beliefs, and as a guide to treatment for Pathological Gamblers.

(8) Can I tell other people about the study?

There are no right or wrong answers to the questionnaires included in this study, however it is important that you do not discuss the content of the questionnaires with other people who may also participate in this study, as this may bias their responses to the questionnaire.

(9) What if I require further information?

When you have read this information, Michael Spurrier will discuss it with you further and answer any questions you may have. If you would like to know more at any stage, please feel free to contact the investigators at the contact details listed below:

Prof. Alex Blaszczynski	(02) 9036 7227	alex@psych.usyd.edu.au
Dr. Paul Rhodes	(02) 9251 6708	paulr@psych.usyd.edu.au
Michael Spurrier	0433 010 640	mikes@psych.usyd.edu.au

(10) What if I have a complaint or concerns?

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This information sheet is for you to keep



The University of Sydney

School of Psychology

Mental models of risk in problem/pathological gambling

Subject Debrief

Investigators:

Names of experimenters: Michael Spurrier

Phone: 9516 3945

Email: mspu1648@uni.sydney.edu.au

Name of primary supervisor: Prof. Alex Blaszczynski

Phone: 9036 7227

Email: alex.blaszczynski@uni.sydney.edu.au

Name of secondary supervisor: Dr. Paul Rhodes

Phone: 9351 6708

Email: p.rhodes@uni.sydney.edu.au

Gambling involves risk and the potential for significant negative impacts: Pathological gamblers suffer depression, substance abuse and attempted suicide; debts and relationship problems; and increased likelihood of criminal offence (Productivity Commission, 1999). Various studies have shown that 70% to 90% of adults gamble at sometime (Ladouceur, 1991; Productivity Commission, 1999) with 1% to 2% meeting current, and 0.1% and 5.1% lifetime, criteria for Pathological Gambling (Raylu & Oei, 2002).

Evidence suggests that beliefs play a significant role in the development and maintenance of Pathological Gambling: Pathological Gamblers exhibit erroneous, biased or incomplete beliefs about gambling that help maintain gambling despite continuous losses (Reid, 1986). A limitation of these studies is that they do not present a complete or cohesive model of beliefs and theories



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held by gamblers about gambling. Hence the context within which gambling-related judgments are made remains largely unexplained. This is significant because decisions that people make when faced with a 'hazard' depends in part on knowledge held of potential risks and harm (Breakwell 2007). Nisbett and Ross (1980), for example, demonstrated that decision-making processes people apply in rapidly changing real-world scenarios depend more on pre-existing or learned stored beliefs and theories than on formal rational judgment procedures.

The concept of 'Mental Models' has been applied to theoretical knowledge structures composed of, and integrating, beliefs and perceived risks (Breakwell, 2007). Mental Models include information that is propositional (e.g., gambling is harder to control after consuming alcohol), or holistic/schematic (e.g., understanding the principles of gambling and concepts of 'house-take'). Mental Models may be thought of as scripts describing various aspects and implications of a hazard, how it can be controlled, or factors impairing personal control. Mental Models need not be factually accurate to enable interaction with an individual's environment, follow a standardized format, remain constant over the long-term, or be bounded by the specifics of a hazard; instead they remain free to evolve in response to particular needs and experiences of an individual in evaluating hazards (Breakwell, 2007).

The growing appreciation for the role of Mental Models in decision-making in risk has led to research aimed at identifying and correcting components of Mental Models. Researchers have developed a methodology to assess a range of hazardous factors (e.g. radon gas or HIV exposure) (Morgan, Fischhoff, Bostrom & Atman, 2002) but to date Mental Models have not been



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applied to gambling-related risks. The approach seeks to identify for a particular hazard both accurate and inaccurate beliefs held by a target population, and has a demonstrated application in the development of risk communication interventions (Morgan, et al., 2002). Data derived from this approach can be used as a basis for developing risk communication material to correct misunderstandings enabling more responsible, decision-making. This is achieved by: investigating Mental Models and vocabulary of lay and expert populations regarding a risk; identifying differences between lay and expert Mental Models; and determining how to bridge gaps between these models using language comprehensible to the target population (e.g., by correcting cognitive errors and concepts, strengthening correct beliefs, and minimizing peripheral concepts). This is particularly relevant within the domain of gambling risk because relatively clearly defined subgroups of gamblers experience either minimal or significant problems due to gambling, and gamblers with more severe problems demonstrate a higher rate of cognitive errors and biases in general (Raylu & Oei, 2002; Ferris & Wynne, 2001). It is therefore likely that a number of critical differences between the Mental Models of these gambler subgroups may contribute significantly to the development and maintenance of gambling related problems and pathology.

Gambling is associated with a significant negative impact on functioning and quality of life for some gamblers (Blaszczynski & Nower, 2002). Identification of the differences in beliefs about risk for different types of gamblers is likely to yield useful insights for creating communication directed at correcting erroneous beliefs. This is an area of research not previously examined.



The University of Sydney School of Psychology

All aspects of the study including the results will be strictly confidential and only the investigators named above will have access to the information. You will not be identified in any publication arising from the study.

References

- Blaszczynski, A., & Nower, L. (2002). A pathways model of problem and pathological gambling. *Addiction, 97*, 487-499.
- Breakwell, G. M. (2007). *The psychology of risk*. Cambridge, England: Cambridge University Press.
- Morgan, M. G., Fischhoff, B., Bostrom, A., & Atman, C. J. (2002). *Risk communication: a mental models approach*. Cambridge, England: Cambridge University Press.
- Productivity-Commission (1999). *Inquiry report: Australia's gambling industries*. Canberra: Ausinfo.
- Raylu, N., & Oei, T. P. S. (2002). Pathological gambling: a comprehensive review. *Clinical Psychology Review, 22*, 1009-1061.

THANK YOU FOR YOUR PARTICIPATION

This information sheet is for you to keep.

Any persons with concerns or complaints about the conduct of a research study can contact the Manager of Ethics and Biosafety Administration, University of Sydney, on (02) 9351 4811.

APPENDIX H: Experimental materials

PROBLEM GAMBLING SEVERITY INDEX

Thinking about the last 12 months...

Please choose the appropriate response for each item:

	Never	Sometimes	Most of the time	Almost always
Have you bet more than you could really afford to lose?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Have you needed to gamble with larger amounts of money to get the same feeling of excitement?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When you gambled, did you go back another day to try to win back the money you lost?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Have you borrowed money or sold anything to get money to gamble?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Have you felt that you might have a problem with gambling?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Has gambling caused you any health problems, including stress and anxiety?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Have people criticized your betting or told you that you had a gambling problem, regardless of whether or not you thought it was true?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Has your gambling caused any financial problems for you or your household?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Have you felt guilty about the way you gamble or what happens when you gamble?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

The following questionnaire will involve answering a series of questions about your perceptions and experiences of gambling.

PARTICIPANT INFORMATION STATEMENT:

THE FOLLOWING BRIEF QUESTIONNAIRE INVESTIGATES GAMBLING RELATED RISK PERCEPTION AND BEHAVIOUR.

THE STUDY WILL TAKE APPROXIMATELY 10-20 MINUTES TO COMPLETE.
UPON COMPLETION, PARTICIPANTS MAY ENTER A DRAW TO RECEIVE SHOPPING VOUCHERS.

There are no right or wrong answers to the following questions.

Participation in this study is entirely voluntary: you are not obliged to participate and - if you do participate - you can withdraw at any time. Whatever your decision, it will not affect your relationship with the research staff. Being in this study is completely voluntary and you are not under any obligation to consent to complete the questionnaire. Submitting a completed questionnaire is an indication of your consent to participate in the study. You can withdraw any time prior to submitting your completed questionnaire. Completed questionnaires will be collected by Michael Spurrier and stored under lock and key.

All aspects of the study, including results, will be strictly confidential. Only the researchers will have access to information about participants. Participant contact details will be stored separately from questionnaire data. A report of the study may be submitted for publication, but individual participants will not be identifiable in such a report. The aim of this study is to gather information that may improve assessment and treatment of problem gambling. If you would like to know more at any stage, please feel free to contact the investigators at the contact details listed below:

Michael Spurrier: 0433 010 640; mshpu1648@uni.sydney.edu.au
Prof. Alex Blaszczyński: (02) 9036 7227; alex.blaszczyński@sydney.edu.au
Dr. Paul Rhodes: (02) 9251 6708; p.rhodes@sydney.edu.au

This questionnaire will form part of the degree of Doctor of Philosophy at the University of Sydney for Michael Spurrier under the supervision of Prof. Alex Blaszczyński and Dr. Paul Rhodes. Any person with concerns or complaints about the conduct of a research study can contact the Deputy Manager, Human Ethics Administration, University of Sydney on +61 2 8627 8176 (Telephone); +61 2 8627 8177 (Facsimile) or ro.humanethics@sydney.edu.au (Email).

Please note:

- You can withdraw from the study at any time prior to completion of the questionnaire without affecting my relationship with the researchers or the University of Sydney. The questionnaire will be destroyed, and the information provided will not be included in the study
- Involvement is strictly confidential and no information about you will be used in any way that reveals my identity
- This study is completely voluntary – you are not under any obligation to consent
- Submission of a completed consent form along with your questionnaire indicates consent to be included in this study

Gambling Risk Perception Questionnaire

[1] Age

Please write your answer here: _____ years old

[2] Gender Please choose **only one** of the following:

- Male
- Female

[3] What country do you live in? Please write your answer here: _____

[4] Ethnic background Please choose **only one** of the following:

- Australian
- New Zealander/Pacific Islander
- Asian
- North American
- South American
- European
- Middle Eastern
- African
- Other

[5] Highest level of education Please choose **only one** of the following:

- Primary / Elementary School
- Secondary School
- TAFE / technical college
- Tertiary - Undergraduate
- Tertiary - Postgraduate

[6] Current job status Please choose **only one** of the following:

- Unemployed
- Casual or part-time employment
- Full-time employment

[7] Have you ever been diagnosed with one of the following conditions? (OPTIONAL)

Please choose **all** that apply:

- Gambling difficulties
- Anxiety
- Depression
- Childhood behavioural disorder (e.g., ADHD)
- Post-Traumatic Stress Disorder
- Relationship difficulties
- Life stresses
- Drug or alcohol issues
- Mania, Psychosis, or Bipolar Disorder

[8]Have you attended a related support group or treatment program? (OPTIONAL)

Please choose **all** that apply:

- Gambling difficulties
- Anxiety
- Depression
- Childhood behavioural disorder (e.g., ADHD)
- Post-traumatic Stress Disorder
- Relationship difficulties
- Life stresses
- Drug or alcohol issues
- Mania, psychosis, or bipolar disorder

Gambling Experience

The following questions address your gambling experiences and involvement.

[9]Have you ever wagered or spent money on any form of gambling?

(e.g., horse racing, lotto, pokies, poker, etc.)

Please choose **only one** of the following:

- Yes
 No

If you answered YES to question 9, please go to question 10, otherwise go to question 25

[10]Since you first gambled, which of the following best describes your pattern of gambling?

Please choose **only one** of the following:

- Increased
 Decreased
 Remained fairly consistent
 Came in clusters
 Binge episodes
 Fluctuated in intensity
 Limited to a few individual events, e.g., work sweepstakes
 I have not gambled

[11]At what age did you first start gambling with money?

Please write your answer here: _____years

[12]Do you remember an important or big win or loss early in your gambling?

Please choose **only one** of the following:

- Win
 Lose
 Neither a win nor loss

[13]Right at this moment, how strong is your...

	Nil				Very strong
...urge to gamble	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...intention to gamble	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

[14]Approximately how often have you gambled...

	Less than monthly	Monthly	Weekly	Daily	More than daily
...Since you began gambling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...In the past 2 months	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

[15] Approximately, how long would you spend gambling each time you gambled...

	<5 minutes	5-30 minutes	1/2-2 hours	2-5 hours	5+ hours
...Since you began gambling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
...In the last 2 months	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

[16] In the PAST FORTNIGHT, approximately how much money did you spend on gambling?

\$ _____

[17] In the NEXT TWO WEEKS, how much money do you plan to spend on gambling?

\$ _____

[18] Have you ever tried to completely stop gambling?

- Yes
 No

If you answered YES to question 18, please go to question 19, otherwise go to question 21

[19] Which of the following best describes your attempts to stop gambling?

Please choose **only one** of the following:

- Stopped gambling, did not start again
 Mostly stopped gambling
 Periods of abstinence, followed by episodes or periods of heavy gambling
 Did not stop gambling

[20] What motivated you to attempt to stop gambling?

Please choose **all** that apply:

- I recognized my gambling was becoming a problem
 People around me were pressuring me to stop
 I experienced financial problems
 I no longer had access to money
 I lost interest in gambling, or became interested in other things
 It was recommended by a therapist, counselor or support group member
 Other

[21] Since you began gambling, roughly what proportion of your gambling has involved the following? PROVIDE PERCENTAGES THAT ADD UP TO 100%

e.g., 30% Internet poker, 70% Slot machines / Pokies

Please write your answer(s) here:

- Poker
- Internet Poker
- Other internet gambling
- Slot machines / Pokies
- Other electronic devices (keno, blackjack, quickdraw)
- Horse, dog, other racing
- Sports betting
- Lottery, lotto
- Casino / Table games (blackjack, baccarat, Caribbean stud)
- Other

[22] At present, what is your MAIN form of gambling?

Please choose **only one** of the following:

- Poker
- Internet poker
- Other internet gambling
- Slot machines / Pokies
- Other electronic devices (keno, blackjack, quickdraw)
- Horse, dog, other racing
- Sports betting
- Lottery, lotto
- Casino / Table games (blackjack, baccarat, Caribbean stud)
- Other

[23] To what extent do you use the following rules when gambling to protect yourself against bad outcomes? *

Please choose the appropriate response for each item:

	Not at all			All the time	
Leaving credit cards at home	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Setting an overall spending limit for each gambling session	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Setting bet limits, e.g., making small bets	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Thinking strategies, e.g., reminding myself I can't win	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Self-exclusion from venues	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Avoiding particular places, e.g., clubs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Avoiding particular triggers, e.g., drinking alcohol	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other rules	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

THE FOLLOWING NINE ITEMS MAKE UP THE PGSI

[24]Thinking about the last 12 months...

Please choose the appropriate response for each item:

	Never	Sometimes	Most of the time	Almost always
Have you bet more than you could really afford to lose?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Have you needed to gamble with larger amounts of money to get the same feeling of excitement?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
When you gambled, did you go back another day to try to win back the money you lost?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Have you borrowed money or sold anything to get money to gamble?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Have you felt that you might have a problem with gambling?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Has gambling caused you any health problems, including stress and anxiety?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Have people criticized your betting or told you that you had a gambling problem, regardless of whether or not you thought it was true?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Has your gambling caused any financial problems for you or your household?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Have you felt guilty about the way you gamble or what happens when you gamble?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Outcome expectations

This section asks questions about your expectations and motivations for gambling.

[25]Rate the LIKELIHOOD / PROBABILITY of the following potential OUTCOMES OF A GAMBLING SESSION...

Please choose the appropriate response for each item:

	Impossible	Unlikely to happen	Average	Very Likely to happen	Certain
Having fun, socializing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Winning money	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Losing money	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feeling excitement, feeling a 'rush'	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Switching off, escaping, avoiding stress or bad feelings	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Relationship difficulties, losing respect or approval from others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reducing boredom	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feeling powerful, proud, or confident	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Losing control	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Gaining respect or approval from others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Financial, work, or legal problems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feeling guilt, shame, or bad about who I am	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Stress, depression, anxiety, or other bad feelings	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

[26]How much does each potential outcome INFLUENCE YOUR CURRENT GAMBLING CHOICES...

Please choose the appropriate response for each item:

	Highly undesirable, unwanted		Neutral, not motivating either way		Very important, desirable, significant to me
Having fun, socializing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Winning money	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Losing money	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feeling excitement, feeling a 'rush'	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Switching off, escaping, avoiding stress or bad feelings	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Relationship difficulties, losing respect or approval from others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reducing boredom	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feeling powerful, proud, or confident	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Losing control	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Gaining respect or approval from others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Financial, work, or legal problems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feeling guilt, shame, or bad about who I am	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Stress, depression, anxiety, or other bad feelings	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

[27] Is this MORE, LESS or THE SAME INFLUENCE compared to when you started gambling?

Please choose the appropriate response for each item:

	Much less motivating/ important		About the same		Much more motivating/ important
Having fun, socializing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Winning money	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Losing money	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feeling excitement, feeling a 'rush'	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Switching off, escaping, avoiding stress or bad feelings	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Relationship difficulties, losing respect or approval from others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reducing boredom	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feeling powerful, proud, or confident	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Losing control	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Gaining respect or approval from others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Financial, work, or legal problems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feeling guilt, shame, or bad about who I am	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Stress, depression, anxiety, or other bad feelings	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

[28]How IMMEDIATE OR LONG LASTING are the EFFECTS of each potential outcome...

Please choose the appropriate response for each item:

	No impact	Immediate impact only	Short term impact	Long term impact	Permanent
Having fun, socializing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Winning money	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Losing money	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feeling excitement, feeling a 'rush'	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Switching off, escaping, avoiding stress or bad feelings	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Relationship difficulties, losing respect or approval from others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reducing boredom	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feeling powerful, proud, or confident	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Losing control	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Gaining respect or approval from others	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Financial, work, or legal problems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Feeling guilt, shame, or bad about who I am	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Stress, depression, anxiety, or other bad feelings	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Gambling beliefs

The following section investigates your beliefs and attitudes towards gambling.

[29]Rate how TRUE / FALSE each of the following statements about gambling is.

Please choose the appropriate response for each item:

	Completely UNTRUE			Completely TRUE	
gambling has predictable outcomes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
a gambler can win over the long term	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
correct strategies will make someone win	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I know the correct strategies to win	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I can predict game outcomes when I am tuned in or observant	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I can control the outcome of games	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am a skilled gambler	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
most gambling is designed so that the punter loses	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I win more than I lose	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I lose more than I win	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I am luckier than most people	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you usually need to invest a certain amount before you win	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
losing profit from gambling is not really losing money	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I look for patterns among gambling outcomes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I apply different strategies depending on my instincts, or my gut feeling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
my strategies for winning have changed a lot since I began gambling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I follow rules or strategies to win	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I follow rules or set limits to avoid losing too much	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I follow my instincts and gut feelings to make gambling decisions	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
if you lose, you are more likely to win next time	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**[30] What proportion of what you know about gambling comes from the following sources?
 PROVIDE PERCENTAGES ADDING UP TO 100%**

	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%
Family, friends or colleagues who gamble	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Family, friends or colleagues who don't gamble	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Government, non-profit organizations	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Counselors, psychologists, support group members	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Advertisements, the gambling industry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Gambling experience	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Other	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

[31]How often do you have thoughts about gambling without any prompting?

Please choose **only one** of the following:

- Never
- Several times a year
- once a week
- daily
- Several times a day

Gambling situations

The following section investigates your experiences in different situations and states of mind.

[32] Consider the following SITUATIONS and STATES OF MIND.

Please choose the appropriate response for each item:

	Unlikely to THINK about gambling			Likely to THINK about gambling	
you see an advertisement, or sign for gambling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you're socializing with friends	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you're at a casino, race track, or other gambling venue	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you're at a sporting event, or a venue where gambling may be available	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you're alone at home	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you're drinking alcohol or using drugs (if applicable)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you had an argument with your partner, friend, or family member	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you had a recent, large gambling loss	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you had a recent, large gambling win	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you feel low or depressed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you feel anxious, stressed, or on edge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you feel bored	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you feel excited	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you feel content and happy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

[33] Consider the following SITUATIONS and STATES OF MIND.

Please choose the appropriate response for each item:

	Unlikely to FEEL THE URGE to gamble			Likely to FEEL THE URGE to gamble	
you see an advertisement, or sign for gambling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you're socializing with friends	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you're at a casino, race track, or other gambling venue	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you're at a sporting event, or a venue where gambling may be available	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you're alone at home	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you're drinking alcohol or using drugs (if applicable)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you had an argument with your partner, friend, or family member	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you had a recent, large gambling loss	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you had a recent, large gambling win	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you feel low or depressed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you feel anxious, stressed, or on edge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you feel bored	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you feel excited	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you feel content and happy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

[34] Consider the following SITUATIONS and STATES OF MIND.

Please choose the appropriate response for each item:

	Unlikely to TRIGGER ME TO GAMBLE			Likely to TRIGGER ME TO GAMBLE	
you see an advertisement, or sign for gambling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you're socializing with friends	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you're at a casino, race track, or other gambling venue	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you're at a sporting event, or a venue where gambling may be available	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you're alone at home	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you're drinking alcohol or using drugs (if applicable)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you had an argument with your partner, friend, or family member	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you had a recent, large gambling loss	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you had a recent, large gambling win	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you feel low or depressed	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you feel anxious, stressed, or on edge	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you feel bored	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you feel excited	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you feel content and happy	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

[35] Consider what you are most likely to do in the following GAMBLING SCENARIOS:

You have been gambling for a while and...

	stop gambling	think carefully about what is going on	continue gambling, but play more carefully	continue gambling in the same way	continue gambling, but take more risks	allow myself to 'switch off', 'get in the zone', or play by instinct
you have a big win	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you have lost more than you planned to wager	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you reach your designated spending limit	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
you are breaking even	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

[36] How carefully do you think about each step or stage during each gambling session?

Not at all Very much

[37] How much time each week do you think or fantasize about good gambling outcomes?

Never All the time

[38] How much of your spare time do you spend gambling?

[39] Which of the following are more important to you when gambling?

Believing you can win Hoping you can win

[40] Which of the following are more important to you when gambling? *

Switching off, escaping Feeling excitement, or the 'rush'

[41]How often do you...

	Never				Very often
Think about negative effects of gambling on your life?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Have competing urges or goals related to gambling?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Focus on the good things about gambling?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Focus on the bad aspects of gambling?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Try to forget about the good aspects of gambling?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Try to forget about the bad aspects of gambling?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

[42]How difficult is it to...

	Very easy				Very difficult
follow your own rules or plans during gambling sessions?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
ignore or dismiss thoughts about gambling?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
resist the urge to gamble?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

[43] How uncomfortable do you find conflict between goals related to gambling?

Very comfortable					Very uncomfortable
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

[44] Please estimate, how significant your gambling-related problems to be?

No problem at all					Significant problems
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

[45] Compared to others, how high do you consider your spending on gambling?

Much less than average	Less than average	Average	More than average	Much more than average
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

[46]Rate how true each of the following statements are:

If I WIN at gambling, it is due to...

	Completely Untrue			Very true	
the laws of probability	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
the house advantage, or book-keeper's profit margin	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
my luck	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
my skill at gambling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
knowing/following the right strategy or set of rules	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
factors not related to myself	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
factors related to myself	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

[47]Rate how TRUE / FALSE each of the following statements are:

If I LOSE at gambling, it is due to...

	Completely Untrue			Very true	
the laws of probability	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
the house advantage, or book-keeper's profit margin	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
my luck	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
my skill at gambling	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
knowing/following the right strategy or set of rules	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
factors not related to myself	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
factors related to myself	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

[48]Roughly how many times have you used illicit drugs in the last month?

Please write your answer here: _____

[49]Roughly how much alcohol do you drink on average in a typical week? (standard drinks)

Please write your answer here: _____

[50]Have you ever been charged with a criminal offence?

Please choose **only one** of the following:

- Yes
- No

[51]What is your annual income?

Please choose **only one** of the following:

- Disability pension/government allowance
- up to \$20,000
- \$20,001-\$40,000
- \$40,001-\$70,000
- \$70,001+

Thank you for participating.