Structural Characteristics in Gambling

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Dissertation for the degree philosophiae doctor (PhD)

at the University of Bergen

2012

Contents

Acknowledgements

I would like to extend my sincere gratitude to the following people, without whom this thesis would have never seen the light of day:

All the participants who volunteered to spend hours of their valuable time in the lab. You are the heart and soul of science.

Professor Jon Christian Laberg and Professor Ståle Pallesen, your combined guidance has been an invaluable source of inspiration and motivation for me. You were always there to help when I was lost, and you trusted me enough to give a great sense of freedom while working on the project.

Dr. Geir Scott Brunborg for sharing an office with me for the main part of the project period. You patiently listened while I tried to explain my ideas, and generously shared your own, better ones. Importantly, you also have a great taste in music.

Dr. Helge Molde and Dr. Helga Myrseth, when I began my work, you were the veteran PhD candidates who lead the way. You have been great discussion partners, rollercoaster riders and wordfeud competitors.

Dr. Mark Price and Dr. Elisabeth Norman, you were kind enough to let me help in your projects and let me travel with you to my first international academic conferences. Without you two, I would not have been doing what I do today.

Dr. Bjørn Sætrevik and Dr. Daniel Hanss for being great office neighbours and colleagues, for pointing me towards executive pinstripe hoodies, and for letting me win in FIFA.

All the members of the new addiction research group at UiB, I am truly looking forward to collaborating with you on the many projects we are planning.

The Norwegian Research Council for funding the project.

Arne Magnus Morken, for being the best administrator this project could possibly have. You always say no first, but usually end up saying yes.

To my parents, family and friends, for being who you are and accepting me for who I am.

And finally, Cilje, Tarje and Even. You are the ones who provide sunshine on cloudy days. Thank you.

Scientific environment

The dissertational work presented here was completed at the Department of Psychosocial Science, Faculty of Psychology, University of Bergen. The research education was provided by the Graduate School of Clinical and Developmental Psychology, and I was a member of the Bergen Group for Treatment Research.

List of papers

Mentzoni, R. A., Laberg, J. C., Brunborg, G. S., Molde, H., & Griffiths, M. D. (In press). Effects of sequential win occurrence on subsequent gambling behaviour and urges. *Gambling Research*.

Mentzoni, R. A., Laberg, J. C., Brunborg, G. S., Molde, H., & Pallesen, S. (Submitted). Tempo in electronic gaming machines affects behavior among at-risk gamblers.

Mentzoni, R. A., Laberg, J. C., Brunborg, G. S., Molde, H., & Pallesen, S. (Submitted). Type of Musical Soundtrack Affects Behavior in Gambling.

Summary

Although structural characteristics may be important moderators of behaviour and cognition in gambling, empirical investigations of such characteristics are still needed. Through three laboratory based studies, this thesis presents original research on the effects of structural characteristics in gambling.

The main aim of study one was to investigate how within-session events affect subsequent gambling behaviour and gambling urges. Specifically, the aim was to investigate whether making a relatively large win early in a session involving a computer-simulated gambling situation would lead to prolonged gambling and elevated gambling urges, compared with making an identical win late in the gambling session.

The main aim of study two was to generate more knowledge about speed as a structural characteristic in gambling by comparing the effects of three different bet-to-outcome intervals on gamblers bet sizes, game evaluations and the illusion of control while gambling on a computer-simulated slot machine.

The main aim of study three was to corroborate and elaborate on the existing findings concerning gambling and music by investigating if the tempo of a musical soundtrack in a gambling situation would influence the number of bets placed, speed of placing bets and evaluation of the game.

In order to achieve these aims, three laboratory based experiments were conducted in which non-pathological participants took part in a computer simulated gambling simulation.

In Study 1, no effect of the sequential occurrence of the big win on subsequent gambling behaviour and cognitions was found. In Study 2, at-risk gamblers had a higher average bet size in the fastest version of the gambling situation, compared to no-problem gamblers. No effect was found on game

evaluations or illusion of control. In Study 3, participants listening to slow music placed more bets than did participants listening to fast music, whereas participants listening to fast music placed bets quicker than did participants listening to slow music.

The results from these studies add to existing knowledge by building on previous findings and they help generate proposals for future investigations. The findings may also prove useful for clinical practice if incorporated into psychoeducational approaches.

1. Introduction

This thesis will present original research on the effects of structural characteristics in gambling. Results from three laboratory-based empirical investigations will be described and discussed. In these experiments, win occurrence, game tempo and musical tempo are manipulated in order to study their effects on gambling behaviour and cognitions in non-pathological samples.

1.1 Definitions and Prevalence

1.1.1 Definitions

According to Dickerson and O'Connor (2006), no consensus exists on a formal definition of gambling, but most attempts centre on gambling involving risking something of value (such as money) on the uncertain outcome of an event (Ladouceur & Walker, 1998). According to Griffiths (1995), gambling can be distinguished from ordinary risk-taking by four additional factors. First, gambling involves the re-allocation of wealth, usually without the introduction of productive work. Second, winners gain at the expense of losers. Third, the outcome is at least partly determined by chance. Finally, losses can be avoided by not taking part in the gamble. These definitions include typical gambling activities such as casino gambling (e.g. roulette, poker, slot machines), sports betting and lotteries, but also behaviour that might not be regarded as gambling by laymen, for instance stock market trading.

Gambling activities can be categorised along several dimensions. One commonly drawn distinction is between games that are mainly or entirely based on chance and games that are skill-based to a certain extent. Lotteries, scratch cards and slot machines are examples of the first category, whereas poker is an example of the latter. Sports betting is often characterised as a skill-based form of gambling, but several studies question this by demonstrating that

'experts' in sports betting fail to outperform a chance level of cash return (Andersson, Edman, & Ekman, 2005; Cantinotti, Ladouceur, & Jacques, 2004; Steinkopf et al., 2011).

Although most people engage in gambling as a recreational activity (Williams, Volberg, & Stevens, 2012), some people develop problems that can be linked to this behaviour. Pathological gambling (PG) was recognised as a behavioural disorder in the third edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-III; American Psychiatric Association, 1980). The latest edition, DSM-IV-TR, defines PG as an impulse control disorder, characterised by "persistent and recurrent maladaptive gambling behaviour that disrupts personal, family, or vocational pursuits" (American Psychiatric Association, 2000, p. 671). The diagnostic criteria, five of which must be fulfilled, are as follows:

A. Persistent and recurrent maladaptive gambling behaviour as indicated by five (or more) of the following:

1. Is preoccupied with gambling (e.g. preoccupied with reliving past gambling experiences, handicapping or planning the next venture, or thinking of ways to get money with which to gamble)

2. Needs to gamble with increasing amounts of money in order to achieve the desired excitement

3. Has repeated unsuccessful efforts to control, cut back, or stop gambling

4. Is restless when attempting to cut down or stop gambling

5. Gambles as a way of escaping from problems or of relieving a dysphoric mood (e.g. feelings of helplessness, guilt, anxiety, depression)

6. After losing money on gambling, often returns another day to get even ('chasing' one's losses)

7. Lies to family members, a therapist, or others to conceal the extent of involvement with gambling

8. Has committed illegal acts such as forgery, fraud, theft or embezzlement to finance gambling

9. Has jeopardized or lost a significant relationship, job, or educational or career opportunity because of gambling

10. Relies on others to provide money to relieve a desperate financial situation caused by gambling

B. The gambling behaviour is not better accounted for by a Manic Episode.

Although definitions vary in the research literature, the term 'problem gambling' (PrG) is commonly used to describe a subclinical behavioural pattern where some gambling problems are displayed, but where the diagnostic criteria are only partially fulfilled (e.g. satisfying 3 to 4 of the DSM-IV criteria Petry, 2004). Other terms that have been used to describe this type of gambling are 'at-risk gambling', 'in-transition gambling' and 'disordered gambling' (Petry, 2004).

1.1.2 Prevalence of Recreational Gambling

Estimates of gambling prevalence have shown that the vast majority of the adult population will engage in some sort of gambling activity at least occasionally during their lifetime. For instance, one meta-analysis reported that as many as 94.7% of the population of North America had ever gambled (Shaffer, Hall, & Vander Bilt, 1999). In Great Britain, one nationally representative survey reported that 73% of the adult population had participated in some form of gambling during the past year (Wardle et al., 2011). The most popular type of gambling in the latter study was the National Lottery Draw, for which 59% of the adult population had bought tickets. After the National Lottery Draw, the most popular types of gambling were other

lotteries (25%), scratch cards (24%), horse race betting (16%), slot machines (13%) and private betting (11%).

1.1.3 Prevalence of Problem and Pathological Gambling

The estimated level of PrG and PG in the population varies greatly across studies. This is at least partly due to different operational definitions of what constitutes PG and PrG. The most commonly used instrument for measuring gambling problems is the South Oaks Gambling Screen - Revised (SOGS-R; Lesieur & Blume, 1987, 1993). Examples of other instruments are the Canadian Problem Gambling Index (CPGI; Ferris & Wynne, 2001), and instruments based on the DSM-IV criteria, such as the National Opinion Research Center DSM-IV Screen for Gambling Problems (NODS; National Opinion Research Center, 1999).

SOGS-R consists of 20 statements about gambling, such as 'When you gamble, how often do you go back another day to win back money you have lost'. Originally designed to screen for PG in clinical populations, SOGS-R is scored by summing the number of endorsed items. A score of 5 or more is usually taken to indicate probable PG, whereas a score of 1 to 4 indicates some problems with gambling. In research settings, scores of 3 or 4 are often labelled PrG. SOGS has often been criticised for overestimating the prevalence of PG compared with DSM-based criteria or clinical interviews (Ladouceur et al., 2000; Stinchfield, 2002; Thompson, Walker, Milton, & Djukic, 2005).

CPGI was developed to account for more of the social and contextual factors of gambling. It includes 31 items, 9 of which count towards problem gambling. Each of these items are scored from 0 (never) to 3 (always), yielding a sum score ranging from 0 to 27. A score of 8 or more indicates severe problem gambling, whereas a score of 3 to 7 indicates moderate risk gambling.

NODS consists of 17 items that match the DSM-IV criteria for PG. Some criteria are measured by two items, others by one, resulting in scores ranging

from 0 to 10. According to the DSM-IV guidelines, a score of 5 or more is considered to indicate PG. PrG is indicated by a score of 3 or 4.

Table 1 lists the range and weighted means of PrG, PG and excessive gambling (the sum of PrG + PG) from a systematic review of prevalence studies involving SOGS, CPGI or DSM-based criteria (Stucki & Rihs-Middel, 2007).

	Problem gambling		Pathological gambling		Excessive gambling	
	Range (%)	Mean (%)	Range (%)	Mean (%)	Range (%)	Mean (%)
SOGS	0.4–3.6	1.2 (1.6)	0.2–3.5	1.8 (1.2)	0.6–6.4	3.0 (2.7)
CPGI	1.0–4.7	2.4 (2.5)	0.5–1.4	0.8 (0.9)	1.7–5.9	3.3 (3.4)
DSM	0.5–4.0	1.9 (1.8)	0.15–2.1	1.2 (1.1)	0.6–5.8	3.1 (2.9)

Table 1. Range and weighted means of PrG, PG and excessive gambling as measured by SOGS, CPGI and DSM-based criteria (Stucki & Rihs-Middel, 2007)

Estimates of PG range from 0.15% to 3.5%, whereas estimates of PrG range from 0.4% to 4.7%.Several studies have indicated that young age (Johansson, Grant, Kim, Odlaug, & Gotestam, 2009; Ladouceur, Boudreault, Jacques, & Vitaro, 1999; Volberg, Abbott, Rönnberg, & Munck, 2001), male gender (Johansson, et al., 2009; Ladouceur, et al., 1999; Molde, Pallesen, Bartone, Hystad, & Johnsen, 2009; Volberg, et al., 2001) and low socioeconomic status (Feigelman, Kleinman, Lesieur, Millman, & Lesser, 1995; Hall et al., 2000; Johansson, et al., 2009; Volberg, et al., 2001) are particular risk factors for PG. Stucki and Rihs-Middel (2007) raised four main objections to existing prevalence studies. Firstly, varying time frames have been used, where gambling behaviour has been reported for the past year, past

six months or past month. Secondly, many studies have not been made publicly available, and one meta-analysis (Shaffer & Hall, 2001) arrived at two-thirds of the studies included through personal contact alone. Thirdly, a selection bias seems to be present in some studies. For example, studies using telephone interviews are more likely to reach women, since they are more frequently at home, and in Canada the majority of people with PG did not have a telephone. Finally, sampling bias has been present because people in institutions such as prisons or hospitals were not included. Certain ethnic or cultural groups have also been undersampled due to communication difficulties. Concerns have also been raised about low response rates among people with PG.

1.1.4 Gambling in Norway

Norway experienced a steep increase in gambling in the early 2000s, with an increase in turnover from NOK 22 billion in 2001 to NOK 42 billion in 2005 which was largely attributed to the use of slot machines (Øren & Leistad, 2010). During this period, slot machines were easily available and could typically be found in supermarkets, kiosks, pubs and shopping centres. The increase in turnover led policymakers to introduce stricter regulations for such machines, and, with effect from 1 July 2006, bill acceptors were no longer allowed. Subsequently, traditional slot machines were banned entirely and replaced by new, strongly regulated machines operated by the state-owned gambling company Norsk Tipping. These new machines were characterised by, for instance, limitations on stake size and maximum wins, the game tempo and maximum loss per month. Furthermore, restrictions on the location of the machines were introduced, and the new machines were only available in kiosks. However, since Norsk Tipping was not ready to provide the new machines immediately after the removal of traditional slot machines, no slot machines were available during the period from 1 July 2007 to autumn 2008.

As with slot machines, sports betting is monopolised in Norway, with Norsk Tipping as the sole provider. Norsk Tipping also runs the national

lottery. Rikstoto operates horse race betting. Scratch cards and bingo games are run by a number of different organisations. Casino games such as roulette and poker are currently not available from any of the licensed operators in Norway. However, casino games, sports betting and electronic slot machines can be easily accessed online from offshore operators and, although such operators are not legally licensed to provide gambling to the Norwegian public, there are no legal restrictions on consumers' use of such sites. Consequently, gambling on games run by the nationally licensed operators (Norsk Tipping and Rikstoto) can be easily monitored, whereas information on online gambling largely relies on self-reported data from gamblers.

As regards the prevalence of recreational and problem gambling in Norway, one nationwide survey ($N = 3482$) reported that 67.9% had gambled during the past year, and that 0.7% were problem gamblers, defined as a NODS score of 3 or more. For problem gamblers, slot machines and internet gambling were the most frequently played games, whereas lotteries were the most frequently played game for recreational gamblers (Bakken, Götestam, Gråwe, Wenzel, & Øren, 2009).

1.2 Theoretical Models of Pathological Gambling

This section will present three of the central existing models of pathological gambling. The first, Blaszczynski and Nower's pathway model (2002) deals with gambling specifically, whereas the latter two, the components model of addiction and the syndrome model of addiction (Griffiths, 2005; Shaffer et al., 2004), concern addiction in general. The place of structural mechanisms within each of the models will be described.

1.2.1 Pathway Model of Pathological Gambling

Blaszczynski and Nower's pathway model (2002) posits that pathological gambling can develop along three distinct pathways, resulting in three subgroups of pathological gamblers. According to the model, behaviourally

conditioned gamblers develop problem or pathological gambling through the effects of conditioning, cognitive illusions and irrational beliefs, without suffering from any pre-existing pathology. The authors suggest that this group is characterised by the least severe gambling problems, and that they will naturally fluctuate between pathological and problem gambling.

The second subgroup consists of emotionally vulnerable gamblers. In addition to conditioning processes, cognitive illusions and irrational beliefs, this group is characterised by premorbid anxiety or depression along with a history of 'poor coping and problem-solving skills, and negative family background experiences, developmental variables and life events' (p. 97). This group could be particularly motivated to gamble in order to escape negative psychological states or in order to achieve arousal.

Finally, the third subgroup consists of 'highly disturbed individuals with substantial psychosocial interference from gambling' (p.97). This group shares the characteristics that define behaviourally conditioned gamblers and emotionally vulnerable gamblers, but they also display antisocial and impulsive traits. See Figure 1 for a schematic illustration of the different pathways.

Although not explicitly discussed by Blaszczynski and Nower (2002), structural mechanisms in gambling are likely to play a crucial part in the 'classical and operant conditioning' phase, which is shared by all three pathways. More specifically, structural mechanisms may modulate the degree of arousal/excitement and disadvantageous cognitive schemas in gamblers during this phase.

ECOLOGICAL FACTORS
➢ Increased availability
➢ Increased accessibility

Pathway 3

Pathway 1

Pathway 2

EMOTIONAL VULNERABILITY
Childhood disturbance
Personality
➢ Risk taking
➢ Boredom proneness
Mood disturbance
➢ Depression
➢ Anxiety
Poor coping/problem-solving
➢ Life stresses
➢ Substance use

BIOLOGICAL VULNERABILITY
Biochemical
➢ Serotonergic
➢ Noradrenergic
➢ Dopaminergic

Cortical
➢ EEG differentials

CLASSICAL AND OPERANT CONDITIONING
Arousal/excitement
➢ Subjective excitement
➢ Psysiological arousal
Cognitive schemas
➢ Irrational beliefs
➢ Illusion of control
➢ Biased evaluation
➢ Gambler's fallacy

IMPULSIVIST TRAITS
Neuropsychological
➢ ADHD
➢ Impulsivity
Anti-social behaviour
Substance abuse

HABITUATION
➢ Pattern of habitual gambling established

CHASING
➢ Chasing wins, losses
➢ Losing more than expected

PROBLEM AND PATHOLOGICAL GAMBLING

Figure 1. Integrated pathway model of problem gambling (Blaszczynski & Nower, 2002; Reprinted with permission from John Wiley and Sons).

1.2.2 A 'Components' Model of Addiction

The components model of addiction (Griffiths, 2005) states that all addictions are characterised by six core components: salience, mood modification, tolerance, withdrawal, conflict and relapse. In relation to gambling, salience refers to the experience that gambling becomes a very important activity in a person's life, leading to a preoccupation with the activity and dominating his or her thought processes. Salience might become most

pronounced when a person is deprived of the opportunity to gamble, giving rise to frustration and urges to engage in the activity.

Mood modification refers to the experience of being able to escape unpleasant affective states, or achieve pleasant states, by engaging in gambling. Different types of gambling have been suggested to be suited to different forms of mood modification. That is, whereas slot machines might be suitable as an activity that can alleviate unpleasant states (escape), horse race betting might be better suited to achieving pleasant physical and/or psychological arousal. However, it also seems that the same activity can be used to achieve both escape and arousal, at different points in time (Griffiths, 2005)

Tolerance has developed when a person feels a need to gamble for longer periods of time or with increased amounts of money, paralleling the phenomenon in which substance abusers need to take increasing amounts of a substance in order to achieve the desired effect. Betting with increased amounts of money, which is indicative of tolerance, is listed among the criteria for pathological gambling in the DSM-IV-TR (American Psychiatric Association, 2000).

Withdrawal symptoms refer to the unpleasant physiological and/or psychological effects that occur when gambling is discontinued. Empirical evidence for a withdrawal syndrome in abstinent gamblers remains scarce. Based on self-reports, some authors have suggested that, during abstinence, pathological gamblers experience withdrawal symptoms that are comparable to those observed in substance abuse (Rosenthal & Lesieur, 1992; Wray & Dickerson, 1981), whereas others suggest that withdrawal symptoms in gambling are modest in most cases (Petry, 2004).

The conflict component describes intrapsychic conflicts or interpersonal disagreements that arise as the result of a person's gambling, such as arguments with significant others over money spent on gambling. Paradoxically, when

gambling serves as a coping strategy, such conflicts might lead to an observed increase in gambling activities (Griffiths, 2005).

Finally, relapse refers to the phenomenon whereby a person returns to gambling after a period of abstinence. Indeed, it is not uncommon to observe gamblers resuming behaviour similar to that in their most intensive periods of gambling after several years of abstinence (Griffiths, 2005). Griffiths (2005) argues that all six components are needed in order to define addiction and that identifying the absence of one or more of the components might indicate a healthy enthusiasm rather than addiction.

Again, a discussion of the role of structural mechanisms in the development of pathological gambling is missing from the components model of addiction, and, consequently, several important questions are still understudied. For instance, what role do structural mechanisms such as variable/random ratio schemas of reinforcement play in the development of the salience component? What structural characteristics determine whether a form of gambling is better suited to avoiding unpleasant affective states than to inducing pleasant states of arousal? Clearly, empirical research is needed on the role of structural mechanisms in the development of the various components that characterise pathological gambling.

1.2.3 A Syndrome Model of Addiction

According to the syndrome model of addiction (Shaffer, et al., 2004), addiction is best understood as a syndrome that can be expressed in a number of ways, such as substance abuse, pathological gambling or smoking. The model suggests that all addictions share a set of neurobiological antecedents, psychosocial antecedents and experiences. Figure 2 illustrates the model.
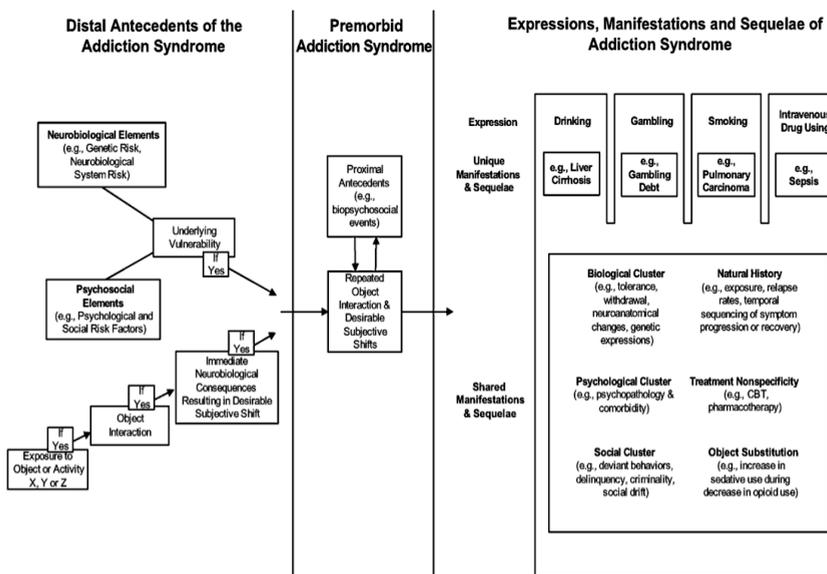
Figure 2. A syndrome model of addiction (Shaffer et al., 2004;
Reprinted with permission from Informa Healthcare).

By suggesting that the main predisposing factors for developing

addiction are neurobiological and psychosocial antecedents that are shared

across the different expressions/types of addiction (drinking, gambling,

smoking or drug use), this model implicitly downplays the role of structural

mechanisms in the development and maintenance of addiction. Basically, the

model suggests that, if the required biopsychosocial risk factors are present,

any object or activity can serve as an expression of the syndrome. This

assumption leaves some questions unanswered, however. In gambling, for

example, it can be observed that the proportion of pathological gamblers as

opposed to recreational gamblers is higher for slot machine gambling than for

lottery gambling (Gotestam & Johansson, 2003; Lund & Nordlund, 2006;

Petry, 2004). This would seem to suggest that specific structural mechanisms

characteristic of distinct forms of gambling play a role in moderating the

development of addiction. That is, although convincing evidence exists that

some biopsychosocial factors are shared across addictions, all objects do not

appear to share the same potential for eliciting addiction. Consequently,

investigating structural mechanisms may be a viable approach to improving our understanding of how different objects and activities moderate the development and maintenance of addiction.

1.3 Structural Characteristics in Gambling

Structural characteristics in gambling are the main object of investigation in this thesis. In its widest sense, this addresses the question of how situational factors influence the person as an agent in the gambling context. More specifically, research questions in this area will target how various characteristics of gambling situations or gambling apparatus influence a person's behaviour or thought process when engaged in the activity of gambling. One object of investigation focusing on the gambling situation could therefore be how the architectural layout or interior design of casinos influences patrons' spending. In contrast, a project focusing on aspects of the gambling apparatus could investigate how the use of colours in slot machine symbols affect patrons' gambling behaviour. In this thesis, all three of the studies presented investigate different aspects of gambling apparatus.

Parke and Griffiths (2007) recently developed a comprehensive taxonomy of structural mechanisms related to gambling. More than 60 such structural characteristics were identified and grouped into the following six categories: payment characteristics, playability characteristics, speed and frequency characteristics, educational characteristics, ambient characteristics and reward characteristics. In the following section, I will review some of the central characteristics and then describe how this thesis investigates specific structural characteristics.

1.3.1 Payment Characteristics

Payment characteristics are factors relating to how people pay to gamble. They include betting limits in games, the payment method (e.g. smart cards vs. cash), and the presence or absence of bill acceptors. The use of smart cards

may have a harm-reducing effect on gambling by encouraging (or even forcing) limits on overall expenditure. However, smart card technology can also have some negative aspects. Transferring money to a smart card functions as a pre-commitment to spend the amount in question on gambling, since it can no longer be used for other purposes unless it is withdrawn from the card. Furthermore, electronic cash could be seen as psychologically less valuable than physical money. Smart cards could also encourage uninterrupted play by removing the need to put cash into gambling machines after experiencing losses (Nisbet, 2005). Some empirical research exists on the effects of payment characteristics on gambling behaviour and cognition. One study reported that poker players gambled more when payment was made in the form of chips instead of cash (Lapuz & Griffiths, 2010), and another found that, when a visual display counter on the gambling machine displayed dollars rather than credits, pathological gamblers (but not recreational gamblers) stopped playing earlier (Loba, Stewart, Klein, & Blackburn, 2001). In Norway, a longitudinal survey of a sample of 20,000 students concluded that overall gambling frequency and the proportion of problem gamblers was significantly reduced as a result of the introduction of a nationwide ban on bill acceptors (Hansen & Rossow, 2010).

1.3.2 Playability Characteristics

Playability characteristics are features and events that add to the feeling of playability in the gambling situation – that is, features and events that make gambling feel more like playing a game. According to Parke and Griffiths (2007), specialist play features, such as 'stop', 'hold' and 'nudge' buttons that are introduced to increase the perceived element of skill in the game, are examples of this. Feature games are another example. They are further extensions of the specialist play features where a more complex game design is present. Feature games allow for a large variation of gambling machines, many of which are variations on well-known existing board games (e.g. *Monopoly* or *Snakes and Ladders*). The increased complexity of feature games compared

with traditional slot machines requires a higher degree of player involvement, which may facilitate an increased illusion of control. Unfortunately, empirical research into the effects of such feature games is lacking.

Another significant playability characteristic is the so-called *near miss*. Parke and Griffiths (2007) define this as "any nonwinning outcome of a gamble that is *perceived* as being almost successful" (p. 230). Note that the definition emphasises player perception, so that a number of outcomes can actually be construed as a near miss. A typical example on a traditional reel-based slot machine would be two matching symbols on the win line, followed by the third matching symbol directly above or below the win line in the third reel. Near wins have been found to be associated with increased persistence in gambling (Côté, Caron, Aubert, Desrochers, & Ladouceur, 2003; Kassinove & Schare, 2001), with one study indicating that the relationship is curvilinear and that the effect on gambling persistence peaks when the proportion of near misses is around 30% (Kassinove & Schare, 2001). Other studies have shown that near-misses elicit brain responses similar to monetary rewards (Chase & Clark, 2010; Clark, Lawrence, Astley-Jones, & Gray, 2009). A variation on the near miss commonly found in modern electronic gaming machines is *negative wins*, in which a bet results in a win that is smaller than the bet placed. Research into negative wins has been negligible so far.

1.3.3 Speed and Frequency Characteristics

Speed and frequency characteristics include bet and event frequency, as well as duration. These concepts are closely related, but not identical. Event frequency refers to the total number of events available for betting within a given time frame. Bet frequency refers to the number of bets made within a given period of time. In slot machine gambling, the event frequency will usually be identical to the number of bets placed; each bet triggers an event. In lotteries and sports betting, however, several bets can be placed before a single event, i.e. the lottery draw or the sports event, takes place. Event duration

refers to the speed of the event. Slot machine events (e.g. reel spin) might last for only a couple of seconds, whereas sports betting events can last for several hours or even up to a year (e.g. betting on the winner of a sports league). Research on speed characteristics is still needed, but at least two studies have found an association between short bet-to-outcome intervals and gambling persistence (Chóliz, 2010), as well as more excitement and a stronger desire to play (Linnet, Rømer Thomsen, Møller, & Callesen, 2010) among pathological gamblers in connection with short compared with longer bet-to-outcome intervals.

1.3.4 Educational Characteristics

Educational characteristics have been implemented in gambling machines as harm-minimising measures. They include the presence of clocks enabling players to keep track of time, warning messages informing players of the risks involved in the game, or statements on expenditure, informing players about their net loss (or win) during their gambling sessions. Some gambling machines also display information about how to get help in case of excessive or problematic gambling. Some studies have reported a link between educational characteristics and gambling-related cognitions such as increased knowledge about the risks and rewards involved in gambling (Steenbergh, Whelan, Meyers, May, & Floyd, 2004), and a decrease in erroneous beliefs (Cloutier, Ladouceur, & Sévigny, 2006). However, since no effect on gambling behaviour has been reported, more research on this aspect is warranted.

1.3.5 Ambient Characteristics

The presence and manipulation of sound and light are considered to be ambient characteristics, that is, factors influencing the game situation, or factors contributing to the other characteristics previously mentioned. Both sound and light are commonly used as cues in gambling machines, signalling the occurrence of significant events. Another example is the sound of coins being emitted from a machine in connection with wins, which is often

magnified by having them fall into a metal plate. This could suggest to other players that the chance of winning is imminent. Where cash payment is not present, a similar effect is often achieved by the use of fanfares or joyful melodies easily identified by nearby patrons as signalling wins. Research on the effects of music on gambling has shown that participants watching a video where music replaced ambient casino sounds reported increased at-risk gambling intentions when the video showed casino environments designed to elicit a playground feeling (spaciousness, vegetation, warm colours, flowing water), but not when the video displayed environments where attention was drawn towards the gambling equipment (Marmurek, Finlay, Kanetkar, & Londerville, 2007). Furthermore, up-tempo background music has been reported to be associated with faster betting (Dixon, Trigg, & Griffiths, 2007). Again, empirical research on the effects of ambient characteristics is scarce, and more evidence detailing how it is linked to behaviour and cognition in gambling is needed.

1.3.6 Reward Characteristics

Reward characteristics concern the different ways in which financial rewards are provided to the gambler, including differences in potential rewards and different ways in which the gambler can increase the potential rewards. For example, many gambling machines offer multiple betting lines, or buttons for multiplying the bet on a single betting line, both of which multiply the stake on any given bet – and the potential reward from the bet. Although multiplier potentials and multiple betting lines are assumed to increase spending (Parke & Griffiths, 2007), empirical research demonstrating that this actually happens is lacking. Pay-out ratios are another aspect of reward characteristics. Gambling machines vary greatly with respect to the expected return on the stake, but they are usually within the range of 70-90%. That is, in the long run, gamblers can on average expect to win 70-90% of their original stake. Finally, most forms of gambling deliver rewards on a variable ratio (VR) schedule of reinforcement,

which is a potent way of maintaining behaviour, and therefore a highly significant reward characteristic (Ferster & Skinner, 1957; Petry, 2004).

1.3.7 Characteristics Studied in this Thesis

A review of the existing knowledge of structural mechanisms in gambling has identified a definite need for more empirical research. More controlled experimental studies are warranted, in particular. The present thesis describes three such studies focusing on different aspects of the above-mentioned characteristics. Study 1 investigates reward characteristics by manipulating the sequential occurrence of big wins in a gambling sequence. Study 2 focuses on speed and frequency characteristics by manipulating the event duration in a simulated slot machine. Finally, Study 3 investigates ambient characteristics by varying the musical soundtrack in a gambling situation.

1.4 Gambling in the Laboratory

Problems with the laboratory setting in general. Generally, when people use gambling machines, this is done in a setting of leisure and amusement, be it in arcades or in designated areas of shopping centres, bars or pubs (regulations on the placement of gambling machines vary greatly from country to country). This is in stark contrast to the relatively sterile setting of a laboratory, where many of the salient cues present in real-world gambling situations are lacking. It may be that the absence of such cues influences gambling behaviour in the laboratory, but exactly how behaviour is influenced remains unanswered.

Intention to gamble. Normally, people use gambling machines relatively spontaneously, acting on impulse and with specific intentions to gamble, i.e. an impulse or a desire to gamble occurs, and the decision to gamble is often made on the spot. It is likely that this spontaneous kind of gambling is especially common in gambling machine types of games. This is in stark contrast to the procedure generally employed when recruiting participants to experimental

studies, where participants are booked for a laboratory session days in advance and are expected to show up and gamble whether or not they in fact have gambling intentions at that time. Again, this is likely to influence gambling behaviour in the laboratory.

Monetary risk. Due to ethical considerations, gambling studies in the laboratory do not generally involve any risk for the participants of losing money. Instead they are usually given credits or money at the start of the experiment and get to keep any winnings they have left when the experiment ends. This means that, in the laboratory, participants can normally only win, never lose. Thus, this is yet another potentially important difference that makes gambling in the laboratory qualitatively different from gambling in the real world.

Potential reward. In naturalistic gambling situations, the potential monetary reward is usually substantial. In the case of slot machines, it is common that every single reel spin could potentially lead to a significant win – up to thousands of dollars, or even millions in the case of jackpots. In bigger lotteries and some gambling machines in casinos, winning the first prize or jackpot will usually yield a reward worth several months' salary for most people. Due to financial and ethical limitations on research, it is usually not possible to offer participants such potential wins.

Expected manipulation. It is likely that participants in psychological experiments will expect that some form of manipulation is taking place. This is perhaps particularly true when participants are psychology undergraduates with some prior knowledge of current experimental paradigms. Because of this, participants in gambling experiments will probably often expect the game they are taking part in to be rigged in some way, which, in turn, might lead them to (unconsciously) alter their behaviour in line with their interpretation of the experiment's purpose (demand characteristics; Orne, 1962). This contrasts with real-world gambling, where gamblers will typically believe that the outcome is

completely determined by chance, or perhaps even more commonly, that they themselves can control the outcome to some extent.

Advantages of laboratory studies. Of course, conducting gambling experiments in a laboratory setting also has its advantages. The most striking one is perhaps the experimental control that is gained. Nowhere is the possibility of phasing out confounding variables greater than in the laboratory. Moreover, the fact that the experimenter has complete control over the outcome of each individual trial enables a wide range of possible studies that would otherwise have been very difficult to conduct in the gambling field. An example of this is seen in Study 1, where a game was set up so that one group would always win a substantial monetary reward early in the game, and another late in the game. Studying this phenomenon as it occurs in naturalistic settings would indeed be very difficult.

Another advantage of experimental research becomes evident when we recall how the big win hypothesis, that experiencing a big win early in a playing carreer can be a predisposing factor for subsequent problem gambling (Custer, 1984), came about. The evidence supporting this hypothesis mainly stems from interviews with pathological gamblers who recall experiencing a big win early on in their gambling careers. Such retrospective recollections are notoriously inaccurate, given the known shortcomings of the human memory system, which have been consistently demonstrated even for highly salient events (Loftus, Miller, & Burns, 1978; Talarico & Rubin, 2003). In fact, one can assume that many gamblers will have such recollections, given that experiencing a big win will inevitably stand out as a more salient memory than all the small and easily forgotten losses that most gamblers experience. In a laboratory setting, however, these issues are dealt with prospectively – that is, the experimenter knows exactly when in the gambling sequence the different significant events will occur.

Finally, it should be noted that, in spite of the possible shortcomings of laboratory studies listed above and the general assumption that laboratory studies have low external validity, research comparing findings from laboratory and naturalistic settings in a wide range of domains has identified high correspondence between the findings from these two approaches (Anderson, Lindsay, & Bushman, 1999).

1.5 Research Aims and Questions

1.5.1 Thesis Aims

The research literature reviewed above describes the existing knowledge base derived from empirical studies regarding structural mechanisms in gambling. A general need for more empirical research was revealed. This thesis presents laboratory-based studies on some of the core structural characteristics identified by Parke and Griffiths (2007), thereby taking an initial step to meeting this need. The overarching aim of the thesis was therefore to gain more knowledge about some of the central structural factors that might influence gambling behaviour.

More specifically, it was a goal to study the degree to which manipulating some of the structural characteristics would affect gambling behaviour in a laboratory setting. In the following sections, three empirical studies are reported, each of which investigates different structural characteristics in gambling. The first study investigates the effects of winning early as opposed to late in a gambling sequence, thereby targeting *reward characteristics*. The second study investigates tempo in a gambling sequence, one of the *speed and frequency characteristics*. Finally, the third study investigates the effects of different types of musical soundtracks on gambling, which can be regarded as an *ambient characteristic*.

The findings from these studies may provide legislators with important information about the possible use of regulation of the structural mechanisms

of gambling machines, as well as being important to treatment settings by providing information that can be applied in psycho-educational approaches. Finally, the findings may prove useful for generating further hypotheses for future research on the targeted mechanisms.

1.5.2 Aims of Study 1

The main aim of study one was to investigate how within-session events affect subsequent gambling behaviour and gambling urges. Specifically, the aim was to investigate whether making a relatively large win early in a session involving a computer-simulated gambling situation would lead to prolonged gambling and elevated gambling urges, compared with making an identical win late in the gambling session. A review of the existing literature revealed two previously published studies with similar research questions (Kassinove & Schare, 2001; Weatherly, Sauter, & King, 2004). Neither of these studies reported the predicted pattern of intensified gambling as a result of an early win, and one actually reported a significant result in the reverse direction (i.e. an early win was associated with less subsequent gambling; Weatherly, et al., 2004). When reviewing the previously published studies, two issues were identified that needed to be addressed in particular. Firstly, studies were needed in which the big win was of a much greater magnitude than had previously been the case ($10 and $1.60; Kassinove & Schare, 2001; Weatherly, et al., 2004). This was necessary in order to ensure that participants experienced the win as a significant event in the gambling session. Secondly, groups that experienced the big win at substantially different points in the gambling sequence were needed, since previous studies had compared groups winning at relatively similar stages of the session (Weatherly, et al., 2004), or a control group that did not make the big win at all (Kassinove & Schare, 2001). Thus, to further investigate the effects of making a big win early compared to late, the present experiment differed from the previously reported studies in two important aspects: (i) the big win was of a larger magnitude (NOK 250 = USD 50 at the time of testing), and (ii) two groups were compared, where there was

a significant difference with respect to the occurrence of the big win in the gambling sequence (early or late, fourth and 42nd trial, respectively, in a mandatory sequence of 50 trials). The main aims were to investigate the effects of the big win on gambling persistence and gambling urges. A secondary aim was to investigate gender differences in the gambling situation, since this aspect has previously received limited attention with regard to within-session gambling behaviour.

1.5.3 Aims of Study 2

The main aim of study two was to generate more knowledge about speed as a structural characteristic in gambling by comparing the effects of three different bet-to-outcome intervals (BOI; 400 ms, 1700 ms and 3000 ms, respectively) on gamblers bet sizes, game evaluations and the illusion of control while gambling on a computer-simulated slot machine. A second aim was to investigate whether self-reported at-risk gambling would moderate the effects of BOI on gambling behaviour and cognitions.

1.5.4 Aims of Study 3

The main aim of study three was to corroborate and elaborate on the existing findings concerning gambling and music. Since previous laboratory-based studies had only investigated the effects of music in a roulette playing setting, the present study employed a different task in order to investigate whether the findings would be generalisable to other forms of gambling. Secondly, while previous studies used music as background sound, we embedded the music in the gambling task, so that the music would be experienced as part of the gambling session rather than as a mere background factor. Thirdly, in order to investigate whether the tempo of the music could influence the total time spent gambling, and thereby the total money spent, we assessed the number of bets placed rather than the mean bet size as an outcome variable. Finally, previous studies have linked the tempo of music to specific gambling behaviour (i.e. the speed of placing bets). In order to assess whether

music is associated with the overall valence of the gambling experience, we asked participants to indicate the degree to which they enjoyed the gambling task.

2. Method

This section presents an overview of the self-report measures and experimental tasks employed in the three studies comprising this thesis. This is followed by a description of the sample and procedure in each of the three studies.

2.1 Self-report measures

2.1.1 South Oaks Gambling Screen Revised (SOGS-R)

SOGS was first published in 1987 (Lesieur & Blume, 1987), and later revised with the wording of some of the items changed (Lesieur & Blume, 1993). It was developed as a screen for PG in clinical populations and was based on and validated in relation to criteria for PG in the DSM-III (American Psychiatric Association, 1980). Today, SOGS-R is among the most commonly used instruments for screening for gambling problems. It consists of 20 items that respondents either confirm or reject. Eleven of the items concern gambling habits such as hiding evidence of gambling, conflicts with significant others about gambling, or spending more time or money on gambling than intended (e.g. 'Did you ever gamble more than you intend to', 'Have you ever felt guilty about the way you gamble or what happens when you gamble'). The remaining nine items concern borrowing money from various people and financial institutions in order to finance gambling (e.g. 'from household money', 'from loan sharks'). The time frame can be modified to measure lifetime gambling or current (past 6 months or past year) gambling. The questionnaire is scored by counting the number of confirmed item to arrive at a possible total composite score ranging from 0 to 20. According to Lesieur and Blume (1993), a score of 5 or more indicates probable PG, a score of 1 to 4 indicates some problems with gambling, and a score of 0 indicates no problem with gambling. In research settings, PrG is sometimes defined as a score of 3 or 4. Lesieur and Blume (1993) suggested that the SOGS-R might be adapted for use in a range

of different cultures and settings. However, beyond the original development of SOGS, little research has been done on its psychometric properties. This has led some researchers to raise concerns about the screen's properties and classification accuracy under new conditions (Stinchfield, Govoni, & Frisch, 2007). The lifetime version of SOGS-R, with no contextual adaptations, was employed in all three studies presented in the present thesis.

2.1.2 Gambling Urge Scale (GUS)

GUS was developed in order to measure the degree to which respondents are motivated to engage in gambling activities (Raylu & Oei, 2004). Based on the Alcohol Urge Questionnaire (Bohn, Krahn, & Staehler, 1995), the scale consists of six items containing statements which participants indicate how much they agree or disagree with on a seven-point Likert scale (e.g. 'All I want to do now is gamble', 'Nothing would be better than having a gamble right now'). Based on its good psychometric properties, Raylu and Oei (2004) suggested GUS as a suitable screening tool for assessing gambling urges among non-clinical gamblers. GUS was employed in Study 1 in the present thesis. The scale showed good internal consistency, with a Cronbach's alpha of .91.

2.1.3 Gamblers' Beliefs Questionnaire (GBQ)

GBQ (Steenbergh, Meyers, May, & Whelan, 2002) is a 21-item self-report questionnaire measuring gamblers' cognitive distortions. Based on existing theories of gambling-related cognitive distortions and on advice from expert raters, Steenberg and colleagues (2002) originally developed the scale in order to assess gamblers' illusion of control and their overestimation of the likelihood of winning. Factor analysis of the resulting scale identified two dimensions: belief in luck/perseverance (13 items) and illusion of control (8 items). The authors noted one possible limitation of the scale, namely that no item measures beliefs pertaining to specific types of gambling. This thesis employed the illusion of control factor of the GBQ in Study 2. The scale was

adapted, however, so that the items specifically referred to the gambling task that the participants had completed, rather than to gambling beliefs in general. Items were rated on a seven-point Likert scale (1 = Strongly agree; 7 = Strongly disagree). Cronbach's alpha was .75.

2.1.4 Bergen Evaluation of Games Scale (BEGS)

One factor that might moderate gambling behaviour and cognition is how entertaining or positively valenced a gambling task is perceived as being. Since no established and validated scale addressing this topic was found, we developed a scale specifically for this purpose. The resulting scale, BEGS, consists of eight items assessing how enjoyable participants found the gambling task they had engaged in. Participants rated the degree to which they agreed with the items on a seven-point Likert scale. The items included in the scale were as follows:

1. All in all, I enjoyed playing the game.
2. The game was a positive experience for me.
3. The speed of the game suited me fine.
4. I would recommend the game to a friend.
5. If given the opportunity, I would like to play the game again.
6. The game did not suit me.
7. I was quickly bored by the game.
8. I was engaged by the game.

BEGS was employed in Studies 2 and 3, with a Cronbach's alpha of .87 and .95, respectively.

2.2 Behavioural measures

2.2.1 Gambling Persistence

Study 1 involved a design in which participants chose how long they wanted to continue gambling after a mandatory sequence of 50 trials had been completed. Consequently, gambling persistence was defined as the total number of games played in the voluntary phase of the gambling task. In Study 3, no mandatory sequence was involved. Thus, in that study, gambling persistence was defined as the total number of games played. In Study 2, gambling persistence was not measured, since all participants were required to play 100 trials and no voluntary phase followed.

2.2.2 Average Bet Size

In Study 2, the design involved a gambling task in which participants chose how much they wanted to bet on each trial (NOK 10 – NOK 90 in intervals of NOK 10). Thus, the average bet size during the gambling sequence was measured as an indicator of risk-taking behaviour. Studies 1 and 3 had a fixed bet size for each trial and, consequently, this variable was not included in the analyses of those studies.

2.2.3 Reaction Time

Study 3 involved a design in which participants' reaction times were measured. Reaction time was measured in milliseconds, recorded from the point when the fourth card appeared on-screen until the time the participants chose a card (i.e. choice of card) in connection with each placed bet. The median reaction time from the 20 trials following trial number 5 was used, allowing five trials for practice.

2.3 Experimental tasks and paradigms

2.3.1 Study 1: 'SuperJack 1'

A computerised gambling task (*'SuperJack'*) was programmed using E-prime 2. In the programme, participants saw four playing cards being dealt in each trial, the picture sides facing down. The task was simply to select one of the cards by pressing one of four marked keys on a standard QWERTY keyboard. If the selected card turned out to be a Jack of any suit, the participants won NOK 30 (USD 5 at the time of testing). If the selected card was a *SuperJack* (a special card specifically designed for the experiment), the participant won NOK 250 (USD 50). There were no other winning cards. The outcome of the entire gambling sequence was pre-programmed. Wins occurred seven times throughout the sequence (in trials 4, 14, 15, 18, 31, 38 and 42), six of which were small wins (NOK 30). Two versions of the sequence were programmed. In the first sequence, the big win occurred in the fourth trial (early win), in the second sequence it occurred in the 42nd trial (late win). All participants began the experiment with NOK 50 (USD 10), and the cost of each trial was NOK 5 (USD 1). Participants were required to play 50 trials, after which they would have NOK 230 (USD 46) left. In the voluntary phase that followed, participants could continue playing for as long as they liked. No wins occurred during this phase. Figure 3 shows an illustration of the task.

Figure 3. SuperJack. Figure illustrating a situation in which the third card has been selected, revealing a Jack and resulting in a win of NOK 30.

2.3.2 Study 2: 'The Hordaland Slot Machine'

In Study 2, the gambling simulation software, 'The Hordaland Slot Machine' (first used in Brunborg, Johnsen, Mentzoni, Molde, & Pallesen, 2011), comprised a gambling task with a simple layout showing a slot machine, with a centrally located display depicting the amount won per trial. The remaining money available for gambling was displayed in the top left-hand corner. Each gambling session started with a loaded credit of NOK 2,000 (corresponding to USD 340 at the time of testing). Regular Norwegian QWERTY keyboards were used to place bets, where the number keys 1 through 9 denoted bet sizes of NOK 10 – 90 (USD 1.70 – USD 15.40). Each

trial had three possible outcomes: a big win, small win or no win. A big win was 4.5 times the bet size and had a 10% chance of occurring. A small win was 2.25 times the bet size and had a 20% chance of occurring. No win occurred in 70% of the trials. Following each trial, any wins were added to the bank, after deduction of the stake. The slot machine software randomly selected the outcomes of each trial. The Hordaland Slot Machine was programmed in E-prime 2.0 (Psychology Software Tools Inc., 2005). See Figure 4 for an illustration of the software.
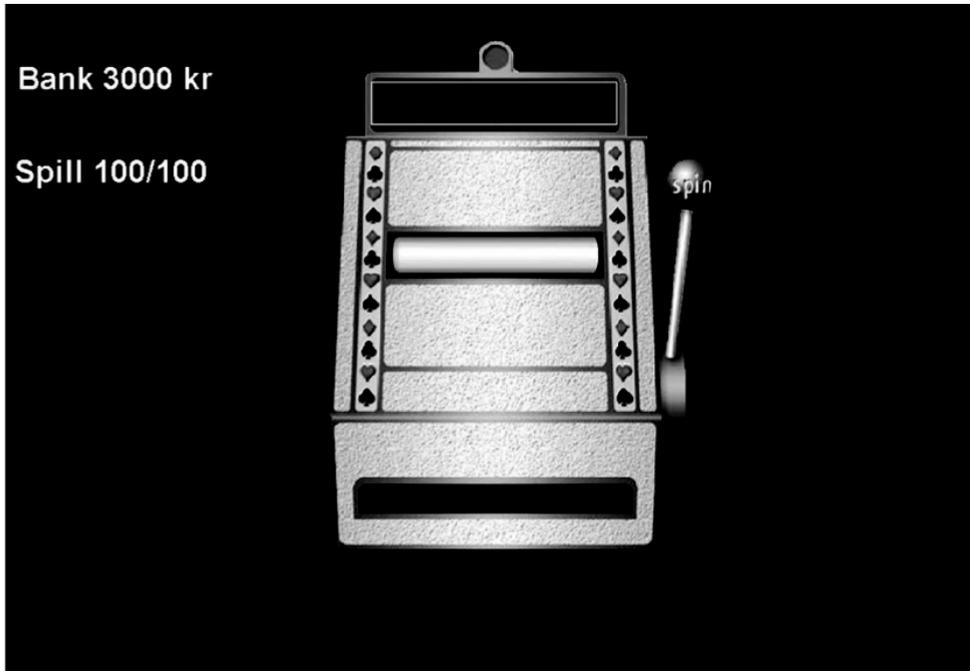
Figure 4. The Hordaland Slot Machine

2.3.3 Study 3: 'SuperJack 2'

The gambling task used in Study 3 was visually similar to the one used in Study 1, but it had some structural differences. '*SuperJack 2*' was programmed using E-prime 2. As in *'SuperJack 1,* each trial depicted four playing cards with their picture sides facing down. The task was to select one of the cards by pressing one of four marked keys on a standard QWERTY keyboard. Each trial

(bet) cost NOK 3 (USD 0.50), and a start-up credit of NOK 50 (USD 9) was provided. Before gambling started, the participants were verbally informed of the following: if the selected card turned out to be a Queen, King or an Ace, a small win of NOK 3 (USD 0.50) would be made. A Jack of any suit would yield a win of NOK 20 (USD 3.50). A Joker would win NOK 100 (USD 18). A *SuperJack* (special card) would win NOK 250 (USD 44.50), and two consecutive SuperJacks would win NOK 850 (USD 151). Any other card resulted in no win in that trial. This information was also available on a sheet placed within eyesight during the gambling task. A notable difference from *'SuperJack 1* was that, in this version, participants were not required to play a set number of trials. Instead, participants could choose to stop playing whenever they wanted, or when their credit was depleted.

2.4 Samples and procedures

2.4.1 Sample and Procedure Study 1

Sample

A total of 101 undergraduate students from the University of Bergen participated in the study (47 males and 54 females). The mean age was 21.9 years (*SD* = 2.09), with a range of 19 to 30 years. Participants volunteered after being informed that the experiment involved a gambling situation, that money for gambling would be provided, and that any winnings made during the experiment would be paid out in cash upon completion of the experiment. No specific information was given about game details or the chances of winning. Because the experiment was pre-programmed and participants had no way of influencing how much they could win, all participants were paid the amount that was left after the mandatory phase (NOK 230).

Procedure

Testing was done in groups of up to four participants separated by partition walls, in a purpose-built laboratory. Participants were consecutively

allocated to one of the two conditions (early or late-occurring big win). Gender was balanced across conditions to ensure comparable distributions of male and female participants. Participants were informed that, in order for the experiment to collect a reasonable amount of data, an initial block of 50 trials (the number of trials was not known to the participants) would be mandatory for everyone. Furthermore, they were informed that, if all the provided money was spent during this block, the experiment would terminate. After the mandatory block, participants could continue gambling for as long as they liked, given that they still had money left. At the end of the mandatory block, all participants had banked NOK 230. In the voluntary phase that followed, no wins occurred and the participants decided when to terminate the gambling session. The participants were informed that when they decided to quit, any remaining money would be paid out in cash. The SOGS-R was completed prior to testing, while GUS was completed during a small break between the mandatory and the voluntary phases.

2.4.2 Sample and Procedure Study 2

Sample

A total of 62 participants were recruited, 29 male and 31 female. Ages ranged from 18 to 38 years, with a mean of 20.8 years (SD = 3.26). All participants were undergraduate psychology students from the University of Bergen. Prior to participation, information was given that the experiment would involve a computerised gambling task, that start-up credit would be provided for gambling, and that 10% of the amount that remained upon completion of the gambling task would be paid out in cash as a reward. No details were given about the specific contents of the gambling task, or about the chances of winning.

Procedure

The experiment was conducted in individual testing booths in a purpose-built laboratory at the University of Bergen. Each booth contained a desktop

computer running E-prime 2 and an office chair. The testing booths were sound attenuated, and sound effects and a musical soundtrack were played via headphones. Sound effects were played during the following in-game events: placing a bet, reel spin and bet outcome (win/loss). Participants were assigned to one of three experimental conditions: long bet-to-outcome interval (3000 ms), medium bet-to-outcome interval (1700 ms) or immediate bet-to-outcome interval (400 ms). Gender was balanced across conditions. All participants were required to play 100 trials. Prior to testing, the SOGS-R was administered. Upon completion of the gambling task, BEGS and the GBQ scales were administered.

2.4.3 Sample and Procedure Study 3

Sample

A total of 101 participants were recruited, 72 female and 29 male. The mean age was 21.0 years (SD = 2.26), with a range of 18 to 29. All participants were undergraduate psychology students from the University of Bergen. Prior to the experiment, participants consented to take part in a computerised gambling task in which a start-up credit would be provided for gambling, and where any wins made during the task would be paid out in cash upon completion. No specific details were given about the content of the gambling task or about the chances of winning.

Procedure

The experiment was conducted in individual testing booths in a purpose-built laboratory at the University of Bergen. Each booth contained a desktop computer running E-prime 2 and an office chair. The testing booths were sound attenuated, and sound effects and musical soundtrack were played via headphones. Sound effects were played during the following in-game events: dealing of cards, small win, medium win, large win and loss.

Participants were informed that they would be asked to partake in a gambling session with a start-up credit of NOK 50. Upon completion of the

experiment, any wins made would be paid out in cash. Participants could play for as long as they liked, or until they ran out of money. Unknown to the participants, the outcomes were pre-programmed, and the participants' selections had no influence on winnings. Participants would run out of money after 86 trials (if they had not quit playing earlier), during which they would have experienced nine small wins (NOK 3), four medium wins (NOK 20) and one large win (NOK 100). The NOK 250 and NOK 850 wins never occurred.

Two different musical soundtracks were used; half of the participants were exposed to a slow-paced jazz music soundtrack, whereas the other half heard a fast-paced pop melody. Both soundtracks were instrumental MIDI tracks played through the computer's on-board soundcard synthesizer.

The SOGS-R was completed prior to testing. BEGS was completed after each gambling block.

2.5 Statistical Procedures

2.5.1 Statistical Procedures Study 1

Initial analyses consisted of a t-test and a chi-square test to determine whether the experimental groups differed with regard to age or gender. The effects of the experimental manipulation (i.e. occurrence of the big win) and gender on gambling persistence were investigated by conducting a 2 (early win / late win) X 2 (male / female) ANOVA. A similar ANOVA was conducted with gambling urges as the dependent variable.

2.5.2 Statistical Procedures Study 2

Bivariate correlations between the study variables (average bet size, the scores for BEGS, illusion of control and SOGS-R scales) were first calculated. Calculated correlation coefficients involving scores for the SOGS-R were Spearman's Rho due to violations of normality in this variable. All other coefficients were calculated using Pearson's product-moment correlations. The

significance level for the correlation between scores on the SOGS-R and bet size was one-tailed due to the expected directional relationship between these variables (Aron, Aron, & Coups, 2006).

To test for associations between bet-to-outcome interval, gambling problems and study outcomes, a multivariate analysis of variance (MANOVA) was conducted with the following three dependent variables: average bet size, evaluation of game, and illusion of control. BOI (long/intermediate/immediate) and gambling problems (no problem/at-risk) constituted the independent variables. Univariate follow-up ANOVAs were then conducted. Planned comparisons were conducted to further investigate the relationship between gambling profile, bet-to-outcome intervals and average bet size.

2.5.3 Statistical Procedures Study 3

Bivariate correlations between the study variables (games played, reaction time, the BEGS and the SOGS-R score) were first calculated. As was the case in Study 2, correlation coefficients involving the SOGS-R were Spearman's Rho due to violations of normality of this variable. All other coefficients were calculated using Pearson's product-moment correlations. In order to investigate the effect of the experimental manipulation on gambling persistence, an independent samples t-test was conducted comparing the mean number of bets placed in the two musical soundtrack conditions. For the reaction time variable, a univariate ANCOVA was conducted in which reaction time was entered as the dependent variable, and musical tempo (fast or slow) was entered as the fixed factor. Game evaluation (the BEGS score) was significantly and positively correlated with reaction time, and it was therefore entered as a covariate. Two participants displayed a response bias in which the same card was chosen on all trials, which is likely to have affected their RT. They were therefore excluded from the analyses. Finally, an independent *t*-test was conducted in order to investigate whether game evaluation was affected by musical tempo.

3. Results

3.1 Results Study 1

Initial analyses showed that there were no significant differences between the early win group (n = 53) and the late big win group (n = 48) with regard to age, $t(99) < 1$, p = .72, or SOGS-R score, $t(99) < 1$, p = .45. In addition, there was no significant difference in the proportion of male and female participants in the two groups, $\chi^2(1, N = 101) = 0.07$, p = .79. On the SOGS-R, 60.4% of the participants obtained a score of 0, indicating absence of problematic gambling behaviour, while 37.6% scored between 1 and 4, placing them in the 'some problems with gambling' category. The majority of these (71%) scored 1. A small minority of the participants (2%) scored 5, which is above the cut-off for probable pathological gambling.

On average, participants played 4.8 trials ($SD = 7.7$) in the voluntary phase. There was a tendency for participants to terminate the session at two particular points. Half of the participants (50.5%) stopped playing immediately after the mandatory phase, whereas just under a quarter of the participants (22.8%) stopped playing after the sixth trial, when exactly NOK 200 remained in the bank. The remaining quarter of the participants (26.7%) stopped after a varying number of other trials. The analysis of gambling persistence in the voluntary phase showed no significant main effect of condition (early/late win), $F(1, 97) < 1$, $p = .41$, or gender $F(1, 97) = 2.19$, $p = .14$, and no significant interaction (Condition x Gender) effect, $F(1, 97) = 1.77$, $p = .19$.

There was a significant main effect of gender on gambling urges (GUS), $F(1, 96) = 6.82$, $p < .05$, with males ($M = 13.78$, $SE = 0.96$) reporting stronger urges to gamble compared to females ($M = 10.35$, $SE = 0.89$). The main effect of condition was not significant, $F(1, 96) < 1$, $p = .61$, nor was the interaction (Condition x Gender) effect, $F(1, 96) < 1$, $p = .55$.

3.2 Results Study 2

Bivariate correlations showed that the SOGS-R score was significantly and positively related to average bet size ($r = .25$, $p < .05$), and significantly and negatively related to illusion of control ($r = -.29$, $p < .05$). No other correlations were statistically significant.

The MANOVA revealed a significant overall main effect of gambling problems ($F(3, 51) = 3.69$, p = .02), but not of BOI ($F(6, 104) = 0.40$, p = .88). There was no BOI*Gambling profile interaction effect ($F(6, 104) = 0.47$, p = .83). Univariate follow-up ANOVAs revealed that there was a significant effect of gambling problems on illusion of control ($F(1, 53) = 5.36$, $p = .03$). Specifically, no-problem gamblers reported more illusion of control ($M = 5.8$, $SE = .19$) compared with at-risk gamblers ($M = 5.1$, $SE = .24$). No other significant main effects or interaction effects were found. Of particular interest was the relationship between gambling profile, BOI and average bet size. A planned comparison revealed that, in the immediate condition, at-risk gamblers had a significantly higher average bet size ($M = 47.2$, $SD = 12.89$) than no-problem gamblers ($M = 32.9$, SD = 14.3), $t(18) = 2.37$, $p = .03$, while no such difference was found with either intermediate BOI ($t(17) = .64$, $p = .53$) or long BOI ($t(18) = .20$, $p = .85$).

3.3 Results Study 3

Bivariate correlations showed that game evaluation was significantly and positively correlated with reaction time, $r = .25$, $p < .05$. No other significant correlations were found.

A significant effect was found, indicating that participants in the slow music tempo group placed more bets than participants in the fast tempo group, $M = 77.3$, $SD = 19.2$ and $M = 66.9$, $SD = 27.8$, respectively, $t(1,99) = 2.20$, $p = .03$.

The ANCOVA revealed a significant main effect of game evaluation on RT, $F(1, 93) = 6.55$, $p = .01$, and a significant main effect of soundtrack on RT, $F(1, 93) = 6.10$, $p = .02$. Participants with the up-tempo soundtrack displayed faster RT than participants with the down-tempo soundtrack, $M = 519$, $SE = 57.2$ and $M = 722$, $SE = 58.5$, respectively.

The independent samples t-test investigating musical tempo and game evaluations showed no difference in terms of game evaluation in the high-tempo compared to the low-tempo condition, $M = 3.8$, $SD = 1.2$ and $M = 3.6$, $SD = 1.2$, respectively.

4. Discussion

4.1 Discussion of Study Results

The main aim of this thesis was to expand the knowledge base regarding how structural characteristics in gambling affect player behaviour and cognition. This overarching question was addressed by the three experimental studies presented here. In the present section, the findings from the three studies are discussed. It is of particular interest to describe what the studies add to existing knowledge, both on their own as regards the specific structural characteristic being investigated, and overall as regards how structural mechanisms in general moderate gambling behaviour and cognitions.

In Study 1, aspects of reward characteristics were investigated by manipulating the placement of within-session win events. There was no effect of this manipulation on either gambling persistence or participants' self-reported gambling urges. Thus, the notion that obtaining a large win early in a gambling sequence would lead to prolonged gambling behaviour and stronger urges to gamble was not supported. As a result, none of the three experimental studies on this topic show an effect of early big wins in the form of prolonged gambling or problematic gambling cognitions (Kassinove & Schare, 2001; Mentzoni, Laberg, Brunborg, Molde, & Griffiths, in press; Weatherly, et al., 2004). In particular, it should be noted that Study 1 in this thesis failed to obtain this effect even after introducing a significantly larger win than in previous studies, and after introducing a significantly larger gap between the occurrence of the large win in the two study groups. Hence, no experimental effect was observed even when the experimental conditions were made more different from each other compared to the two previous studies.

It is worth noting that the two previously published studies (Kassinove & Schare, 2001; Weatherly, et al., 2004) aimed to investigate the *big win hypothesis* about gambling. This hypothesis states that experiencing a big win

early in a gambler's playing career can be a predisposing factor for later
problematic gambling behaviour. The notion that an early big win can lead to
subsequent problems (Custer, 1984) has been included in several models of the
development of pathological gambling (Custer & Milt, 1985; M. Griffiths,
1995; Ladouceur, et al., 2002) According to this reasoning, a gambler's belief
that winning experiences may reoccur will be strengthened by early big wins,
resulting in persistent gambling behaviour that may escalate into problem
gambling. Although none of the studies described here supports this
hypothesis, rejecting it on the basis of these results might be premature. In fact,
the studies may not be optimal tests of this hypothesis at all. Neither
experiment used participants who had made a big win early in their gambling
career. The big wins experienced were within a single gambling session, and in
no way close in magnitude to what is normally considered a big win when
discussing the development of problematic gambling (i.e. a win equalling
several months' pay). Instead, the studies could more accurately be described
as investigating the effects of sequential differences in wins on gambling
behaviour within a single gambling session, using non-pathological
participants. In this respect, the evidence to date suggests that the effects of
making a relatively large win early in a gambling sequence are negligible.
Whether or not a real big win can cause real gambling problems is a question
that can probably never be answered by an experimental procedure.

A secondary aim of Study 1 was to investigate gender differences in
gambling behaviour and cognition. The results showed that, compared to
female participants, males reported stronger urges to continue gambling after
the mandatory phase. However, the lack of significant interaction effects in the
analyses indicates that the difference in the occurrence of the large win did not
affect male and female participants differently. That is, the observed gender
difference was not due to the manipulation of reward characteristics in the
gambling situation, but rather reflected that male and female gamblers differ
with regard to gambling urges even in a sample consisting of predominantly

non-pathological gamblers. This adds to existing knowledge, in which the finding that pathological gambling is more prevalent among males than females is well established (Johansson, et al., 2009; Molde, et al., 2009; Petry, 2004).

Study 2 aimed to investigate speed characteristics in gambling by manipulating the bet-to-outcome interval in a computerised gambling task. There was no overall effect of the experimental manipulation on the study outcomes. However, follow-up analyses revealed that, in the fastest condition (400 ms bet-to-outcome interval), at-risk gamblers had a higher average bet size than did no-problem gamblers. In sum, the results corroborate findings from previous reports (Alex Blaszczynski, Sharpe, Walker, Shannon, & Coughlan, 2005), by indicating that speed does not appear to have a strong overall effect on gambling behaviour or cognition. The results add to existing knowledge by showing that this holds true even in gambling situations with very short bet-to-outcome intervals (< 2000 ms). The results also showed, however, that, for at-risk gamblers, quick bet-to-outcome intervals might lead to intensified gambling in terms of increased bet sizes. This indicates that speed characteristics may influence gamblers differently depending on their initial level of risk of pathological gambling.

Study 3 investigated ambient characteristics in gambling. Specifically, the main aim was to study the effect of different types of music in a gambling simulation on persistence and experienced valence in gambling. Previous studies had shown that, in roulette playing, up-tempo music could lead to intensified gambling in terms of betting speed (Dixon, et al., 2007; Spenwyn, Barrett, & Griffiths, 2010). However, research from other settings has indicated an association between slow music and increased total spending, for instance by showing that restaurant customers spend more time and money when low-tempo rather than up-tempo music is played (Caldwell & Hibbert, 1999; North, Shilcock, & Hargreaves, 2003). The results from Study 3 provide some possible clarification of these apparently contradictory findings. In Study 3,

participants who listened to low-tempo music while gambling placed more bets than participants who listened to up-tempo music (and, consequently, had higher total spending). In contrast, participants who listened to up-tempo music displayed faster reaction times than participants who listened to low-tempo music. Thus, slow music was associated with increased total spending of time and money, whereas fast music was associated with intensified gambling measured in terms of increased reaction time in individual bets. There was no effect of type of music on game evaluations.

The results from Study 3 add to existing knowledge by showing that the relationship between up-tempo music and intensified gambling could be replicated in a gambling situation different to roulette playing. Furthermore, the results are the first to demonstrate that, in gambling, both low-tempo and up-tempo music can lead to more risky behaviour: low-tempo music by increasing gambling persistence, thereby increasing total spending, and up-tempo music by reducing the reaction time for bets placed.

In sum, the three studies presented show that experimental, laboratory-based studies using non-clinical samples are a viable approach to generating knowledge about how structural characteristics influence behaviour and cognitions in gambling.

4.2 Discussion of Ethical Considerations in Experimental Gambling Research

This section discusses some core ethical considerations in relation to the experimental research on gambling presented here. Considerations regarding experimental design and considerations regarding participants are discussed separately.

4.2.1 Considerations Concerning Experimental Design

Presentations of gambling stimuli. One aspect of the studies presented in this thesis particularly warrants ethical consideration and discussion. This relates to the fact that participants in all studies are exposed to stimuli and experimental conditions that are regarded as potentially addictive. In Study 1, participants won a significant amount of money. Winning in gambling is in itself traditionally regarded as addictive, in particular when it occurs early in a gambling sequence (Griffiths, 1995; Kassinove & Schare, 2001). In Study 2, participants were exposed to varying intervals between placed bets and outcomes. In Norway, the legal limit for such intervals is three seconds, whereas in Study 2, participants could be exposed to intervals as low as 400 ms In gambling, short intervals are regarded as more aggressive and thus potentially more addictive. Finally, a crucial aspect of all the presented studies is the presence of a gambling task – easily recognisable to the participant as gambling. In fact, an essential aspect of the outcomes of the experiments is that they are actually experienced as gambling. Again, this means that participants are subjected to an activity regarded as addictive and with potentially detrimental health effects, if engaged in excessively.

While these experiments were first being planned, gambling machines were completely banned in Norway. Correspondence with the Norwegian Gaming Authority clarified that, as long as participants did not gamble using their own funds, the experiments would not violate any Norwegian gaming laws. Since then, gambling machines have been reintroduced in a monopolised context. That is, participants taking part in experiments of the type presented here can currently experience similar gambling situations outside the laboratory should they wish to do so.

One ethical consideration regarding the presented studies that could be discussed is as follows: can the exposure to gambling stimuli presented in our experiments lead to the development of harmful gambling in participants, and

if so – to what extent? In all likelihood, the extent of the exposure (one gambling session lasting a total of 1-2 hours, including informed consent, the completion of questionnaires and debriefing) was not likely to be salient enough to lead to harmful effects, even in participants reporting potentially problematic gambling behaviour on the SOGS-R. To further ensure that no problematic effects occurred, participants were systematically debriefed. This involved giving them information about the programming of the gambling tasks, the likelihood of winning and the degree to which participants' choices could influence the gambling outcomes. Furthermore, participants were given an opportunity to consult a licensed clinical psychologist (this author) if they felt a need to discuss problematic gambling after taking part in the experiments.

A second ethical consideration concerns the possible effects of using real money in the studies. All the studies presented in this thesis involved actual monetary rewards. That is, participants were given an initial starting credit for gambling, and they were informed that they could keep whatever they won during the gambling session (in Study 2, 10% of the remaining credits, in Studies 1 and 3 the actual amount of money displayed when they opted to quit). In practice, this meant that participants won between NOK 100 and NOK 300. The presence of real monetary rewards was essential in order to raise the studies' ecological validity and induce an experience in participants that actual gambling was taking place.

It could be argued that monetary rewards signalled to the participants that gambling is a viable way of making money. However, two aspects lead to the conclusion that this was not harmful enough to prevent the experiments from being conducted. Firstly, the systematic debriefing in which the fact that the gambling sequence had been pre-programmed, and that, in reality, participants had little control over the outcomes, would downplay any misconstruing of gambling as a meaningful source of income. It also reduced any sense of control participants might have felt in the gambling situation. Secondly, the size of the monetary rewards was not of a magnitude that would

be likely to induce any harmful gambling. Although the experience of a big win is included in some models of the development of pathological gambling (Custer & Milt, 1985; Griffiths, 1995; Ladouceur, et al., 2002), such wins are usually defined as equalling several months' worth of income. The wins involved in our studies are only a fraction of this. In conclusion, although the presence of monetary rewards in gambling situations can be ethically debatable, the gains of including them in the present research outweighed the potential problems. Moreover, as far as possible, efforts were made to prevent any harmful effects.

4.2.2 Considerations Concerning Participants

All participants completed the South Oaks Gambling Screen – Revised (SOGS-R; Lesieur & Blume, 1993) as part of the studies. This enabled the identification of participants who have no gambling related problems, which participants were at risk of developing pathological gambling and which participants were likely to be current pathological gamblers. Unique ethical dilemmas arise when dealing with both participants with no prior gambling problems and with participants who are likely pathological gamblers.

When a participant has no prior gambling problem, the main ethical dilemma is as follows: by taking part in the experiments, the participant is in effect exposed to stimuli that are viewed by some as both harmful and addictive. The experiments were programmed in such a way that most participants ended up winning money, and no participants suffered financial loss. Thus, there is a risk that participants would leave the experiment with the idea that gambling is a viable way of making money. As mentioned above, the crucial step in preventing such misperceptions was to systematically debrief the participants to make sure that participation would not lead to harmful gambling outside the laboratory.

When a participant was identified as a probable pathological gambler, at least two ethical dilemmas arose: firstly, should the participant be allowed to

take part in the experiments, and, secondly, should any treatment be offered to the participant in order to help alleviate the identified harmful behaviour. In the present studies, data from pathological gamblers could potentially provide interesting information if compared and contrasted with data from participants with no gambling problems and participants displaying some problems, but at a subclinical level. Consequently, participants scoring as pathological gamblers were not excluded from taking part in the experiments. In practice, however, none of the studies included a large enough sample of pathological gamblers to allow meaningful comparisons with this group. The systematic debriefing provided was a crucial means of ensuring that participation would not increase the participants' engagement in harmful behaviour.

With regard to the second dilemma, whether pathological gamblers should be offered treatment, the solution in these studies was to give all participants an opportunity to arrange a consultation with a clinical psychologist working on the project, subsequent to participation. The aim of the consultation would be to perform a screening of present gambling problems, and provide information and guidance about where the participant could get further treatment if needed. A number of participants in the studies reported problematic gambling behaviour, and some scored as pathological gamblers. However, none of the participants availed themselves of the opportunity to arrange a consultation with the project's clinical psychologist. This could be interpreted in at least two ways. Firstly, the participation was not harmful, and providing subsequent consultation with a clinical psychologist was not actually necessary. Secondly, participants who were in need of treatment and who could have benefited from the consultation offered did not make use of this offer. If the second alternative is true, it could be argued that further steps should have been taken in order to make sure proper treatment was given. For instance, participants identified as pathological gamblers could have been actively contacted subsequent to participation instead of requiring them to initiate contact with the clinical psychologist.

4.3 Implications for Future Research

Overall, the findings presented in this thesis demonstrate that valuable information about how structural mechanisms in gambling influence player behaviour and cognitions can be gained from laboratory-based experiments on non-pathological samples. Two of the three studies yielded results in which manipulating a structural characteristic (bet-to-outcome interval and musical tempo) in a gambling situation subsequently influenced participants' behaviour. This indicates that laboratory-based studies, although perhaps disadvantageous with regard to ecological validity, can be a viable approach to addressing basic research questions raised in this thesis by allowing strict control over the study variables. However, the generalisability of the results is hampered by several factors. Firstly, participants ran no financial risk, since funds for gambling were provided. Secondly, the experiments took place in a laboratory on the university campus, rather than in a naturalistic gambling environment (e.g. a casino, or from a computer at home). Thirdly, the experiment sessions were booked days or weeks in advance, whereas gambling typically occurs when people act on an impulse to gamble. Thus, the findings from the present thesis should ideally be validated using other methodological approaches, such as quasi-experimental designs in naturalistic settings, or qualitative studies employing samples of experienced gamblers.

The three studies can all serve as a basis for suggestions for future studies. The findings in Study 1 failed to support previous self-report data from survey and interview studies in which early big wins are reported to be associated with subsequent problematic gambling behaviour (e.g. Griffiths, 1990a; Griffiths, 1990b, 1991; Lund & Nordlund, 2003). Future experimental studies should employ larger wins than was the case in Study 1, and they should measure behaviour across a wider time span than Study 1 did. If behaviour were measured across several days, weeks or even months, this would provide better information about the long-term effects of making early big wins. Furthermore, technological and legislative advances in the gambling

industry allow for quasi-experimental designs that are arguably better suited to investigating the effects of early big wins than laboratory studies. Specifically, some organisers (for instance Norsk Tipping in Norway) now require gamblers to use smart cards that track player history, including when bets are placed, when win occurs and overall losses. This enables a comparison of subsequent gambling behaviour between players who make big wins with players who do not win within a given time frame. Investigations of such electronically recorded gambling behaviour would be a promising next step that would add substantially to the existing knowledge base.

Study 2 indicated that, for at-risk gamblers, very fast games might produce intensified gambling in terms of higher average bet size. A useful next step would be to conduct a follow-up experiment in which a sample of pathological gamblers could be compared to healthy controls and at-risk gamblers. This would enable an investigation of which category of gamblers are most susceptible to influence from variations in game speed. Furthermore, data from naturalistic settings in which games varying in tempo, but otherwise identical, are compared, would be a welcome addition. However, game tempo is often subject to legislative regulation, and providing games with bet-to-outcome intervals similar to Study 2 would mean violating such regulations in many jurisdictions.

In Study 3, it was demonstrated that both slow and fast music could have adverse effects on gambling behaviour, slow music by prolonging gambling in terms of the number of bets placed, and fast music by intensifying gambling in terms of quicker bet placement. One possible addition to this line of research would be to investigate the role of gamblers' musical preferences in these relationships. To date, the question of how gamblers evaluate the music present when gambling remains unanswered. Furthermore, Study 2 investigated one aspect of music, namely tempo. Another aspect that might influence gambling behaviour and cognition is volume, and investigations into this factor would be

a welcome addition. As is the case with Studies 1 and 2, data from naturalistic settings would add substantially to the current knowledge base.

4.4 Implications for Clinical Practice

All the studies in the present thesis were conducted using predominantly non-pathological samples. Generalising to clinical populations should therefore be done with caution. Nevertheless, the findings contain information that may be applicable in clinical settings. In particular, Studies 2 and 3 provide results that clinicians could consider incorporating into psychoeducative approaches to gamblers. It is conceivable that at-risk gamblers could benefit from being informed that they are part of a group in which increased game tempo has been found to increase risk-taking in gambling. Likewise, gamblers could benefit from being aware of the different ways in which music can act as a contextual cue that will subtly influence their behaviour, even though the music might not lead influence how the gamblers evaluate the gambling experience as a whole. However, the degree to which awareness of these points will actually benefit gamblers is an issue that needs to be subjected to empirical scrutiny.

Furthermore, the findings from Study 2 lend some support to the idea of tempo restrictions as a harm-reduction measure in relation to gambling. Several jurisdictions enforce strict limits on the tempo of slot machine games, and the finding that at-risk gamblers had a higher average bet size in the quickest condition in this study indicates that such limits could indeed serve such a harm-reduction purpose.

4.5 Conclusion

This thesis presents results from three experiments on structural characteristics in gambling. Study 1 failed to yield an effect of early-occurring wins on subsequent gambling behaviour or cognitions. However, a gender effect was found in which male participants reported stronger urges to continue

gambling upon completion of a mandatory set of gambling trials. In Study 2, at-risk gamblers had a higher average bet size in a very fast game, compared to no-problem gamblers. Study 3 showed that slow music can lead to prolonged gambling behaviour, whereas fast music can lead to quicker bet placement. The fact that in two of the three presented studies, the manipulation of the structural characteristic in question had an effect on behavioural measures, is a strong indication that situational factors are important and should be taken into account in explanations of gambling behaviour. The results from these studies add to existing knowledge by building on previous findings and they help generate proposals for future investigations.

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