

The Impact of Electronic Gaming Machine Jackpots on Gambling Behaviour

**Commissioned by
Gambling Research Australia**

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ACRONYMS

ABS	Australian Bureau of Statistics
CPGI	Canadian problem gambling index
EGM	Electronic gaming Machine
GRA	gambling research Australia
NLES	Negative Life events Scale
PGSI	Problem gambling Severity Index
SA	South Australia

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Chapter 1: Executive Summary

This report was commissioned by Gambling Research Australia (GRA) to examine the impact of EGM jackpots on player behaviour. Specifically, the research was devised to answer the question: “Do jackpots and linked jackpots increase the likelihood of risky gambling behaviour and gambling related harm, and to what extent do jackpots enhance the player experience?” A \$250,000 project budget funded research activities from November 2011 to December 2013. This report documents those activities, including summaries of:

- Past literature related to the behavioural influences of EGM Jackpots
- 3 experiments examining the motivating influence of common structural features of jackpots, including accumulation methods and payout mechanics
- 1 experiment examining ‘jackpot expiry’, which is a new proposed player protection feature
- An observational study that explores the influence of Jackpots on EGM gambling in real pubs and clubs in both Queensland and New South Wales

This research question was approached using two methodologies: 1) lab-based experiments that simulated structural features of common types of jackpots, and 2) an in-venue ‘shadowing’ study whereby the researchers followed and recorded the play of volunteer EGM gamblers. The experimental studies maintained a high degree of control and internal validity in assessing the behavioural effects from various structural features of jackpots. The ‘shadowing study’ assessed the influence of jackpots in a natural setting (i.e., pubs and clubs) where the influence of structural features was less tractable, but nevertheless allowed for some important insights into the influence of jackpots on play. The strength of this dual approach; experiment and in-venue observation; was found in the convergence of evidence that indicates EGM jackpot have a demonstrable influence on intensification of player behaviour.

1.1 Literature Review

This report includes a literature review on the behavioural impacts of EGM jackpots. Some of the information in the review was first published in the *Journal of Gambling Studies* as a strategy for early dissemination of results from the larger project.

As outlined in the review, prior to this report there has been little direct evidence on the influence of EGM jackpots on behaviour, which suggests that the original data reported here is timely. Nevertheless, there is a host of more general evidence on lotteries and other prize draws (e.g., so-called “big wins”) that indicates that EGM jackpots should have an influence on player behaviour.

First, the review recognises that jackpots have a primary effect through the promise of an outsized win, instead of the actuality of winning. For non-regular gamblers, jackpot prizes are exceedingly rare. Therefore, at least for most players, jackpots are likely to exert a behavioural influence mainly through the mere possibility of winning rather than modifying play after receiving a rare jackpot prize.

The review identifies a distinction between *rational*, *biased* and *irrational* motivations that attract people to EGM jackpots. The evidence cited in the review suggests that EGM jackpots should generate additional consumption on EGMs above machines that do not have such lottery-like features. Rational motivations are likely to lead to consumer surplus (i.e., a gain by paying less for a product than what consumers are willing to pay), whereas biased and irrational motivations are likely to contribute to excessive and harmful consumption. Moreover, there is evidence that excessive gambling consumption is strongly associated with gambling-related harm.

1.2 Experiments on Structural Features of EGM Jackpots

There are structural characteristics of EGM jackpots that potentially impact on how players perceive the value, excitement or enjoyment derived from a jackpot prize. Three experiments

were devised to investigate these common features of jackpots, and determine if the nature of the presentation of jackpots affects play behaviour and enjoyment. A fourth experiment investigated on original idea on *Jackpot Expiry*, which is a player-protection feature of a pre-commitment system whereby jackpots would expire after a fixed amount of play.

1.3 Progressive and Deterministic Jackpots

Jackpots are financed from an accumulation of funds (losses) from regular play. In a *Progressive Jackpot*, the prize amount grows incrementally with every new bet placed. In contrast, a non-progressive jackpot has a fixed dollar prize. *Deterministic Jackpots* have a payoff mechanism whereby the EGM will payoff at some fixed interval (# of bets) that is determined in advance, but hidden from the player. These jackpots are guaranteed to payoff at sometime within a fixed interval of play. In contrast, non-deterministic jackpots may payoff at any time, as calculated at random with each bet.

Experiment 1 investigated the joint influence of Progressive and Deterministic jackpot feature sets on player behaviour in a crossed-design. Using real money, players gambled on a laptop-simulated EGM with real jackpot prizes of either \$500 cash or 500 Instant Scratch tickets for a \$25,000 top prize. The results revealed that players placed the largest bets on high jackpots EGMs (\$25,000 ticket prize) that were represented to be deterministic and *non-progressive*. These results were supportive of a hypothesized 'goal distance effect', whereby players may have felt subjectively close to an inevitable payoff for a high-value prize. Thus, this experiment shows that high-value deterministic jackpots may encourage more intensive play.

Large jackpots (\$25,000 top prize) that were *non-deterministic* and progressive also promoted high bet sizes. This is a common configuration of jackpots in real venues, and further suggests that some jackpot configurations do have an intensifying effect on player behaviour, with betting sizes for this combination 18.4% higher than the average of other jackpot configurations. The high bet sizes in this condition may be due to the *rolled-over*

effect noted in lottery betting, whereby players imagine that their large bets can be later recouped through a big win.

Lastly, there was no evidence of differences in player enjoyment of the EGM experience based on these jackpot configurations.

1.4 Veiled Jackpots

Another structural feature of some jackpots includes the ability to conceal aspects of the jackpot from players. In a *Hidden Jackpot*, the exact dollar-value of the jackpot prize is concealed from players. This may cause some extra inducement and/or enjoyment for players due to the unknown – and therefore potentially unlimited – value of the top prize.

In a *Mystery Jackpot* the exact combination of symbols for the “winning state” of the machine is concealed from players. This is often a natural consequence of a jackpot accumulation system that sits outside of EGMs in a linked jackpot scheme, and uses the EGM only as a triggering device. It would be procedurally complicated to have a fixed symbol combination on each machine trigger the payout of the jackpot.

A crossed experimental design examined both ‘veiled’ aspects of EGM jackpots, *Hidden* and *Mystery*, to determine their influence on player behaviour and enjoyment. The results showed that suggestively large jackpot prizes (lottery tickets) where the dollar value of the prize was *hidden* from players (i.e., *not* shown on the EGM as the potential \$25,000 top prize), but where the winning symbol combination was displayed (a non-mystery) contributed to both the fastest gambling speeds (Bets per Minute) and greatest persistence while losing (Total Trials Played). It is possible that Hidden Jackpots can suggest a very large prize, and furthermore that a display of winning symbols can suggest that the prize is obtainable.

Thus, the present study suggests that suggestively large Hidden jackpots (a concealed prize) can contribute to intense gambling, but there is no evidence that Mystery Jackpots (a concealed winning combination) do the same. There was no evidence for differences in self-rated enjoyment of the EGM for either type of concealment.

1.5 Socially Networked Jackpots

Linked Jackpots can potentially be won on several machines, but the trigger of a win on one machine necessarily precludes a win on another. Linked jackpots can be shared only within one venue (a local area) or shared across multiple venues (a wide area).

Linked jackpots (also termed Socially Networked Jackpots) may artificially increase the perceived likelihood of winning a large prize, particularly as a very large prize can be pooled across many contributing machines. Socially networked jackpots allow for higher jackpot prizes with a smaller contributing investment per machine, and therefore are less taxing on EGM intermittent win schedules.

The experiment used a fake video-conference paradigm to simulate groups of remote participants (wide area), or alternatively a collection of confederate subjects to simulate a venue-based linked-jackpot (local area). There were no significant differences in player behaviour or enjoyment between the conditions. However, we purposefully did not attempt to simulate other in-group/out-group effects that potentially could also influence player behaviour and enjoyment. This is an area for future research.

1.6 Jackpot Expiry

Given the evidence for the motivating influence of EGM jackpots on intensifying player behaviour (as outlined in more detail below), there is good reason to explore consumer-

protection features. *Jackpot Expiry* is a potential feature of a mandatory pre-commitment system whereby the availability of jackpots expires after a fixed interval of play.

In the test condition, players were shown a “relevant” message stating that the promised jackpot had expired and could no longer be won by the participant (after the 20th trial). In the irrelevant message condition a similar pop-up message simply said to push the button to continue. Lastly, a control condition had no pop-up message about the jackpot expiring. The results showed that betting speeds (one indicator of gambling intensity) were significantly slowed by the relevant ‘expiry’ message. Most importantly, all wagers past the 20th trial were programmed as losses. Player receiving the ‘expiry’ message quit with significantly more money remaining on the machine. Therefore, Jackpot Expiry is effective in limiting player losses, as well as providing additional evidence on the motivating effects of jackpots on player behaviour. Lastly, there was no evidence that Jackpot Expiry reduced self-rated player enjoyment of the EGM experience.

1.7 Shadowing Jackpots

To enhance the external validity of our findings, another study was conducted in three gambling venues (2 in QLD and 1 in NSW), whereby the researchers shadowed volunteer players as they gambled in their local venue. Prior to play, approximately ½ of participants were ‘primed’ to think about what aspirational purchases they might make with a jackpot win.

At-risk gamblers who were ‘primed’ to think about jackpot wins were more likely to select large-jackpot oriented machines. These results suggest that large jackpots have a preferential bias in attracting players with problems, as long as these players are thinking about what the wins might buy them.

Moreover, at-risk gamblers responded to jackpot-oriented machines (with more and larger prizes) by playing more rounds. There is evidence that at-risk gamblers both preferentially select jackpot oriented machines and play more intensively on them.

More generally, jackpot-oriented machines were reliably associated with a greater spend on the machines across all participants (problem and non-problem players). This finding confirmed the intensifying effects of EGM jackpots on player behaviour. It is consistent with some of the findings on common jackpot combinations explored in the experimental studies, as well as theoretical consideration outlined in the literature review. Part of the higher spend, however, may be a consequence of greater persistence on the jackpot-oriented machines. Moreover, it was not possible in the dataset to distinguish between greater spend or persistence as being a primary consequence of jackpot-oriented machines as the two are functionally related. A higher spend allows greater persistence on the machines, and greater persistence on average implies a greater spend.

The results also showed some notable observations about EGM gambling that are not specific to jackpots. First, players with more gambling-related problems spent a longer total time at the venue gambling, which is consistent with prior survey research. Second, players with gambling problems played relatively fewer trials per EGM machine (bets placed). This may be a consequence of higher average bet sizes that quickly expended available funds. Lastly, the study explored the functional relationship between money-in on EGMs, number of bets, money won and money out. There was surprisingly little direct relationship between money put into a machine and money out. Funds withdrawn at the end of a session appear to be primarily driven by the random and highly variable return schedule of the EGM. Moreover, money-in during an EGM session was reliably related to wins. As a consequence, a player experiencing wins was actually at greater risk of losing more money at cash-out. This counter-intuitive finding can be understood in terms of the intensification of gambling behaviour due to the experience of wins.

1.8 Final Remarks

This report provides some of the first direct evidence on the motivating influence of EGM jackpots on player behaviour and enjoyment. While we found little evidence for large differences in enjoyment based on the jackpot features of machines, this cannot be taken as evidence that players do not value this feature of EGMs. Our literature review suggests that people have *rational*, *biased* and *irrational* means to value jackpot EGMs over similar machines without jackpots. Moreover, experimental and in-venue research demonstrates that high-value jackpot machines intensify betting behaviour, and are differentially attractive to at-risk players. The research suggests jackpots are an appropriate target for regulatory attention. Lastly, we provided an experimental evaluation of a player-protection feature, *Jackpot Expiry*, that maintains the consumer-surplus value of jackpots while minimising the potential for jackpots to contribute to excessive gambling expenditure.

Chapter 2: Literature Review

Note: Please note that a version of this chapter has been published as: Rockloff, M. & Hing, N. (2013, online first). The impact of jackpots on EGM gambling behavior: A review. *Journal of Gambling Studies*. DOI: 10.1007/s10899-012-9336-7. The link to this paper is: <http://link.springer.com/content/pdf/10.1007%2Fs10899-012-9336-7.pdf> The authors have permission from Springer to re-use parts of this article in this chapter.

2.1 Introduction

Gambling Research Australia commissioned this current report in response to a call by the Productivity Commission (2009) for research on the potential of EGM Jackpots to exacerbate gambling problems. The primary research question to be addressed in this report includes, 'Do jackpots and linked jackpots increase the likelihood of risky gambling behaviour and gambling related harm, and to what extent do jackpots enhance the player experience?'

This chapter reviews literature on the influence of jackpots on gambling behaviour, focusing on jackpots and so-called "big wins" on Electronic Gaming Machines (EGMs, including, fruit, slot and VLT machines) (Kassinove & Schare, 2001). Evidence linking jackpots to risky behaviours on EGMs (e.g., gambling persistence, bet size, speed of betting, etc.) and relating these so-called "risky" behaviours to identifiable harms is also reviewed.

In structuring the chapter in this way, this review aims to provide an evidence base for understanding features of jackpots that may be important in relation to problematic play. It also aims to clarify what behaviours and features need to be measured in future studies to inform evidence-based policy decisions in relation to EGM jackpots.

2.2 Definition and Structural Features of EGM Jackpots

While a jackpot has been defined as the largest prize possible on a gamble (Webster, 2006), various EGM jackpot schemes offer more than one “top prize”, and the size of these top prizes means that each is generally considered a jackpot win. Thus, jackpots are distinguished from ordinary wins by their magnitude rather than by other structural features, even if jackpots have concrete definitions in legislation and regulation. Nevertheless, these legal definitions vary by jurisdiction and may include structural features, such as the means by which a jackpot prize accumulates (cf., The State of Queensland, 2010).

Various types of jackpots exist, with this variation underpinned by their structural features which, in turn, determine the jackpot prizes. These structural features may impact on how people value prospective gambles or game attractiveness, but research evidence is unclear. Common types of EGM jackpots with varying structural features include: progressive versus non-progressive; deterministic versus non-deterministic; hidden jackpots; mystery jackpots; linked versus standalone jackpots; and local-area versus wide-area jackpots (e.g., The State of Queensland, 2010). These types of jackpots are described in Box 2.1. It is important to note that EGM jackpots, both nationally and internationally, may have other exotic payoff and accumulation mechanics that are not described here. Moreover, terms used to describe these jackpot features are used somewhat inconsistently by the gambling industry.

2.3 Types of EGM jackpots

Progressive versus Non-progressive Jackpots

McPherson provides a definition of jackpots as “An accumulated amount that is contributed to, and available within, the prize pool” (2007, p. 316). Ultimately, all jackpots are funded by an accumulation of player expenditures (losses), but progressive (aka cumulative) jackpots incrementally grow in value as players make additional bets. In contrast, non-progressive jackpots are for a fixed prize amount - even though that amount is funded by an accumulation of losses from other players.

Deterministic versus Non-deterministic Jackpots

Deterministic jackpots have a guaranteed payout after a fixed number of gambles (the target), which is determined at random and concealed from the player's view. As a result, the likelihood of winning necessarily grows as players continue to bet, although the interval until the next payoff is not known. It is difficult for the player to capitalize on this continuous improvement in the likelihood of winning, however, as the interval until the next jackpot win could be very long. As a possible exception, Hing (2007) reported on syndicates of players that attempted - with some apparent success - to dominate play on EGMs that draw near to an inevitable payoff. Non-deterministic jackpots, in contrast, have a constant probability of winning. Potential awards are assessed at random with every bet. While the probability of winning the jackpot is fixed in non-deterministic jackpots, this probability of winning may be based on each bet placed or the cash value of each bet. If the chance of winning is based on each bet placed then, perversely, a series of small bets has a greater likelihood of winning a jackpot than one large bet of equal cash value.

Hidden Jackpots

In a hidden jackpot, the prize amount(s) is not shown to the player, although the existence of a jackpot prize is advertised. This may cause some extra excitement and/or enjoyment for players due to the unknown – and therefore potentially unlimited – value of the top prize.

Mystery Jackpots

In a mystery jackpot, the “winning state” of the machine (e.g., combination of symbols) is not shown to the players. Mystery jackpots can be a natural consequence of jackpot systems that are independent of the core operation of the stand-alone EGM. Jackpot systems may be added to several different types of machines, even machines from different manufacturers, and thus each EGM bet is essentially a lottery draw for the grand prize of the jackpot system. In a non-combinative mystery jackpot any losing sequence of symbols on the EGM is just as likely to win the jackpot prize as a winning sequence, because the jackpot system is essentially independent from the machine and uses the EGM only as a triggering device. In contrast, a combinative mystery jackpot has a winning sequence of symbols on the machine, but this combination is not shown to players prior to winning the jackpot.

Linked versus Stand-alone Jackpots

Linked jackpots draws can be won on several machines (often a bank of machines located in close proximity) and the trigger of a jackpot win on one machine necessarily precludes a win on another. Stand-alone jackpots, in contrast, are tied to one machine, where the prize can only be claimed on that machine.

Local-area versus Wide-area Jackpots

Linked jackpots might be either shared only within the same venue (local area), or shared across multiple venues (wide-area). Multiple venues that share a jackpot often belong to the same organization, but jackpots can also be shared across organizations through a common relationship with the EGM manufacturer or other contracting agency that administers the jackpot scheme.

Source: Rockloff & Hing, 2013.

2.4 Lotteries and EGM Jackpots: Similarities and Differences

Most research relevant to understanding jackpots has been conducted in the context of lotteries. Both lottery prizes and EGM jackpots offer the prospect of a large prize for a comparatively small bet and, thus, share structural similarities. Because each EGM bet purchases a virtual lottery ticket in the draw of the major jackpot prize, simple EGM jackpot schemes can be considered as conceptually equivalent to lotteries. Thus, the more developed knowledge base on lotteries can inform this consideration of EGM jackpots. Nevertheless, exploring how lotteries and EGM jackpots differ despite their structural similarity remains a useful line of inquiry. For example, EGM jackpots may differ markedly from lottery prizes in their motivational influence on players, as discussed later.

Due to the structural similarities between lotteries and EGM jackpots, Ariyabuddhiphongs' (2011) review of research on the psychology underlying lottery play can inform an understanding of EGM jackpots. EGMs with jackpot features are a composite product, combining regular play that involves minor wins and losses with the potential to win a very large prize of the magnitude associated with lotteries. Of all lottery products, instant scratch tickets are most similar to EGM jackpots because of the potential to win both very small and very large prizes, and because the win or loss result is provided immediately by both forms of gambling. Thus, instant scratch tickets have been described as a "slot machine on paper" (Ariyabuddhiphongs, 2011, p. 2; Griffiths & Wood, 2001). However, unlike lottery products, EGMs combine regular play with a chance to win a jackpot through a continuous, repetitive and electronic betting medium (Griffiths & Wood, 2001).

A major difference between EGMs and lottery/instant lottery products is that EGMs are strongly associated with gambling problems, while few players report loss of control or harms arising from purchasing lottery/instant lottery products (Productivity Commission, 1999). This difference suggests that the motivational influence of EGMs is different from that for lottery play, despite their similarities in bet size relative to potential prizes. This motivational influence might differ because, to have a chance at winning an EGM jackpot, players must also engage in a fast paced game that provides small wins and losses in a short timespan. Because EGM jackpots are usually inseparable from regular play, the subjective experience of consuming jackpot EGMs is different from the subjective experience of consuming lotteries and instant scratch tickets. The most notable differences are in the fast pace of play, opportunity for continuous betting and repeated small wins and losses. Further, EGM play and the excitement of winning are visible to others in a gaming room, in contrast to lottery/instant lottery play which is typically done in private. Evidence suggests that gambling intensity is influenced by social motivations (Rockloff & Dyer, 2007; Rockloff & Greer, 2010a; Rockloff, Greer, & Evans, 2012; Rockloff, Greer, & Fay, 2010).

EGM jackpots might influence player behaviour in two distinct ways – through offering “potential” and “actual” large jackpot prizes. Because EGM jackpots are won by only a small minority of players, their influence for most people is psychological; being based on the possibility rather than actuality of winning. Second, the actual experience of a jackpot win, while rare amongst players, can influence subsequent gambling behaviour. Indeed, experiencing a big win (although not necessarily a jackpot) is often implicated as a motivating factor in the gambling trajectories of problem players (Custer & Milt, 1985).

2.5 Potential EGM Jackpot Wins

Limited research has investigated how potential EGM jackpots influence gambling behaviour, although some experimental and other research is discussed below. More relevant and important information, however, can be derived from research into lotteries. Additionally, people’s decision making under risk has long attracted the interest of economists (Kahneman & Tversky, 1979), who have often considered gambling as a prototypical example. Thus, both the economic literature and research specific to gambling can help to explain demand for jackpot EGMs.

2.6 Theories Applied to Jackpots

Theoretical explanations for the demand for lotteries (Ariyabuddhiphongs, 2011) can be extended to at least partially explain the purchase value of jackpot EGMs. As noted earlier, EGMs might be viewed as a composite product combining regular play accompanied by modest wins with a highly unlikely, but nonetheless potential, jackpot prize. EGMs with jackpots usually have lower payouts during regular play than EGMs without jackpots, because an additional proportion of the turnover of jackpot EGMs is used to fund the jackpot

prizes. Thus, one might expect that EGMs with jackpots provide a comparatively less attractive gambling experience during regular play. However, this expectation assumes that players can detect the lower regular payouts on jackpot EGMs. This may not be the case, given the large short run variability in EGM game outcomes. Instead, the lottery-like component of the EGM, that is the potential jackpot prize, may increase the EGM's attractiveness despite the lower long run payouts during regular play. To understand the demand for EGM jackpots, this "added value" of the potential big win must be assessed. Both economic theory addressing decisions under risk and the gambling-specific literature can assist in this assessment.

2.7 Rational, Biased and Irrational Views of EGM Jackpots

Theoretical explanations for the attraction of EGM jackpots are underpinned by three common themes, with each theme based on varying assumptions. One theme, the rational approach, assumes that gambling is an economic activity that people pursue for financial gain and an entertainment experience. A second theme suggests that gamblers value EGM jackpots on a rational basis, but misunderstand and incorrectly overvalue EGM jackpots due to systematic biases. A third theme suggests that gamblers have an *irrational* basis for valuing EGM jackpots, including emotional reactions and/or superstitious beliefs. Because these reactions and beliefs do not reflect a thoughtful process, they go beyond simple biases or divergences from rationality. Thus, *rational*, *biased* and *irrational* motivations can be proposed to explain why people value EGM jackpots. These three types of motivations are not, of course, mutually exclusive. However, little is known about which motivations most often underpin the valuing of EGM jackpots and which personal or situational factors contribute to rational, biased or irrational views of EGM jackpots.

2.8 Rationality: Utility Theory and Expected Utility Theory

Economists use the term “utility” to describe the satisfaction or enjoyment derived from the consumption of a good or service. Utility Theory attempts to quantify this satisfaction or enjoyment, or the unique “utility” gained from any consumption experience. As a key component of neoclassical economic theory, Utility Theory suggests that, while consumers may not be able to assign an exact utility to a product or service, their preferences reflect a well ordered ranking of available alternatives according to their perceived utility. However, this logic assumes that consumers make purchase decisions in an entirely rational manner by attempting to maximize the satisfaction they gain based on an invariant assessment of the utility of the goods and services on offer (Smith, 2003). However, this assumption has often been criticized (e.g., Sen, 1977) in recognition that most consumers appear to be much more fickle and inconsistent than Utility Theory assumes (Thaler, 1985).

Utility Theory also assumes that consumers know the utility to be derived from each potential purchase and its alternatives; however, in reality consumer purchases are not always, or even often, for a known experience of utility. Thus, Expected Utility Theory (Bernoulli, 1738; Von Neumann & Morgenstern, 1947) was developed to recognize that many choices provide only an uncertain utility. Therefore, consumers must evaluate the utility of a potential purchase based on the estimated probabilities of receiving various outcomes from that good or service.

Applying Expected Utility Theory to gambling, consumers must weigh their decisions by their estimated probabilities of winning when faced with gambling opportunities. Thus, if consumers are assured of winning they would always choose to gamble, and if they were assured of losing - at least according to Expected Utility Theory - they would never choose to gamble. If commercial gambling is assessed in purely monetary terms, its utility will always be negative (Turner & Horbay, 2004) to account for gambling operator profits that are derived from player bets. However, gamblers are also purchasing the possibility of winning

and an entertainment experience, which both add utility to what would otherwise be a losing proposition. Thus, Expected Utility Theory can explain gambling purchase decisions without the need to consider biased perceptions (Marfels, 2001).

2.9 Bias: Alternatives to Expected Utility Theory

Expected Utility Theory has several limitations that are discussed in detail elsewhere (Camerer, 1995). Many experiments using real money (Kahneman & Tversky, 1979), as well as real world examples (List, 2005) have been shown to violate Expected Utility Theory. Alternatives to Expected Utility Theory have been proposed, but consensus has not been reached on an ideal replacement. Most relevant to this discussion is that these alternative models recognize that people typically become more risk averse as their prospects of winning improve, and conversely become more risk seeking as their prospects of winning become more remote. Because EGM jackpots are a remote possibility, a common assumption is that people will positively overweight (or bias) the remote possibility of a win in their judgments of value.

Prospect Theory is one example of such an alternative model (Kahneman & Tversky, 1979; 1981; 1992). Prospect Theory is a psychological theory that attempts to explain some of the departures from rationality observed in real world examples that violate expectations from the standard economic model. Using a consistent approach to Expected Utility Theory, Prospect Theory (Kahneman & Tversky, 1979) focuses on the probability weighted outcomes from alternative consumption decisions. However, the value function in Prospect Theory is more complex. The theory proposes that instead of evaluating products and services according to a fixed value (utility) for consumption, people evaluate the “prospect” of a consumption decision based on heuristics (or rules of thumb) that can depart from rationality. Indeed, the original formulation of Prospect Theory referred to the “prospect” of

winning a lottery, as one of the simplest examples of a consumption decision. Evaluating a prospective lottery is comparatively simple, because the value of a cash prize is not subjective and the probability of winning is (or can be) known.

According to Prospect Theory (Kahneman & Tversky, 1979) and later Cumulative Prospect Theory (Tversky & Kahneman, 1992), people base a decision on whether to make a lottery purchase or likewise gamble on an EGM by choosing a “reference point” that functions as a demarcation line to evaluate whether a potential decision outcome is a gain or loss. Evaluating gambles in the context of a ‘loss frame’ that encourages risk taking may be particularly applicable to problem gamblers. The reference point is chosen based on a heuristic, several of which are described in past research by Tversky and Kahneman (1974). Several of the heuristics proposed by Tversky and Kahneman (1974) are relevant to considering how jackpots may influence EGM gambling.

2.10 Representativeness Heuristic

People tend to judge the probabilities of a win based on similarities to a perceived parent population (Tversky & Kahneman, 1974). Thus, for example, a player who observes that one particular club or casino paid a jackpot may perceive a better likelihood of winning a jackpot at that venue than at other venues. When a newsagent has sold a winning lottery ticket, it sometimes advertises this fact, presumably in an attempt to strengthen this heuristic amongst potential lottery ticket purchasers. Similarly, a jackpot win on one particular EGM or type of EGM can create a positive reference point for that EGM or EGM type that exceeds the objective probabilities of winning.

2.11 Availability Heuristic

One common way by which people evaluate probabilities, or prospects, is by the ease with which they can recall similar examples of outcomes (Kahneman & Tversky, 1979). Therefore, an EGM gambler may recall a person winning a jackpot at a local venue or nearby, and thereby incorrectly overestimate their personal probability of winning a similar jackpot prize. The availability heuristic describes on the chronic accessibility in memory for the features of winning states, rather than subjective interpretations of representativeness of winning states to a parent population.

2.12 Anchoring and Adjustment Heuristics

Individuals will often anchor or fixate on an initial value when ordering preferences, even if this has no rational basis. People may subsequently alter their original estimates from this anchor value to account for more information (adjustment), but then neglect to completely break free from the initial flawed estimate (Kahneman & Tversky, 1979). Thus, advertising slogans such as “you have to be in it to win it” and “wouldn’t it be nice” may not be completely trusted, but can nonetheless underpin the basis for an anchor by generating the impression that it is at least possible to win. People may subsequently revise downward their estimate of their own likelihood of winning the jackpot, but nevertheless do not correctly revise it to “virtually impossible” - as would be warranted by a more objective evaluation.

The above heuristics should not be considered exhaustive of all possible ways by which people choose a reference point. Indeed, other heuristics may exist that have not yet been identified. Nevertheless, these three heuristics clearly could influence people’s perceptions of the probability of winning EGM jackpots.

2.13 The S-Shaped Value Function

After selecting a reference point against which a prospective gamble might be considered either a gain or loss, people must evaluate the gamble according to a value function. Tversky and Kahneman (1979) explained that a sigmoid (S-shaped) value function results in a fourfold pattern of risk orientation in decision making. This fourfold pattern (Table 2.1) aligns with many empirical observations (Thaler, Tversky, Kahneman, & Schwartz, 1997).

Table 2.1 The Fourfold Pattern of Risk in Prospect Theory

	Gains	Losses
Low probability	Risk seeking	Risk averse
High probability	Risk averse	Risk seeking

The fourfold configuration of risk suggests that individuals do not make purely rational judgments among alternative choices (or gambles) as posited by Expected Utility Theory (Von Neumann & Morgenstern, 1947), but instead weight these valuations according to whether they perceive them as high or low probability outcomes. So, while a person who is motivated to play EGMs because of the jackpot feature perceives the “gain” of the jackpot as a “low probability” event, the valuation function indicates that people are risk-seeking with respect to this decision (see Table 2.1). That is, the EGM player perceives the potential of a large jackpot prize as a “possibility”, when instead it should more accurately be perceived as a “near impossibility”. Interestingly, the fourfold pattern of risk indicates that small but more frequent jackpots should be less prone to this distortion than large but less frequent jackpots.

Therefore, Prospect Theory predicts that small (but higher probability) jackpots should be less motivating to EGM players than large (but lower probability) jackpots.

The gambling literature confirms the motivating influence of large prizes (Cook & Clotfelter, 1993). Per capita lotto sales strongly increase as the population base increases and consequently jackpots grow, demonstrating the predicted motivating influence of large, low probability prizes. Cook and Clotfelter (1993) utilize the *availability heuristic* described above to explain how people may overestimate the value of a lottery, thereby demonstrating a biased evaluation.

2.14 Irrationality: Faulty Cognitions about EGM Jackpots

Some effects that can influence the attractiveness of EGMs entail more than simple biased judgments, but instead indicate irrational thinking (Rogers, 1998). Applying many of the irrational cognitions reviewed by Rogers (1998) could assist in understanding the motivating influence of EGM jackpots on gambling behaviour. As discussed below, many of these irrational cognitions appear more prevalent amongst problem gamblers as compared to non-problem gamblers. This introduces the possibility that jackpots influence the EGM gambling behaviour of problem players differently than they do for non-problem players. Anecdotally jackpots have also been implicated in the development of gambling problems (Custer & Milt, 1985), suggesting that some people may be more vulnerable to the influence of a possible jackpot win on their future gambling behaviour. Nevertheless, more empirical evidence is needed.

2.15 Gambler's Fallacy

People tend to see chance events as somewhat evenly distributed across time, and so expect that deviations from an expected sequence will correct themselves by making recently infrequent outcomes more frequent in the future. These beliefs give rise to the *gambler's fallacy*. A common example of this fallacy is to believe that a long dry spell on one particular EGM makes that machine “due” to payout sooner than other machines. People can also apply the gambler's fallacy to fixed-probability (non-deterministic) EGM jackpots. For instance, a jackpot that has not paid out recently may be considered “due” to payout soon, and therefore encourage more EGM play to capitalize on the perceived improvement in odds. Thus, linked jackpots may exacerbate gamblers' tendency to chase losses, and may give rise to false expectations of success based upon a belief in the gambler's fallacy (Delfabbro, 2012). The gambler's fallacy has been observed amongst lottery players (Clotfelter & Cook, 1991, 1993; Suetens & Tyran, 2012; Terrell, 1994), roulette players (Croson & Sundali, 2005) and EGM players (Walker, 1992a) and appears to be more common amongst problem than non-problem EGM players (Joukhador, MacCallum, & Blaszczynski, 2003; Turner, Zangeneh & Littman-Sharp, 2006).

2.16 Entrapment

When gamblers take personal responsibility for losing outcomes, their commitment to gambling may escalate and they may continue to invest in their gambling to justify their sunk investment in time and money (Brockner, Rubin, Lang, 1981). More generally, researchers have long recognized that individuals fail to acknowledge that sunk costs are irrelevant to their current decisions, and often inappropriately adhere to losing courses of action (Knox & Inkster, 1968). Entrapment may be relevant to how EGM jackpots influence gambling behaviour, because problematic players can continue to justify their gambling in the face of

mounting losses by rationalizing that a jackpot prize would bring them back past even money.

In support, Hare (2010) found that problem gamblers preferred to sit at machines with the best jackpots or features compared to players with less severe or no gambling problems. Additionally, one of the top triggers for players who exceeded their pre-commitment decisions on EGMs was the availability of large linked jackpots. Further, compared to other players, both moderate risk gamblers and problem gamblers more often played linked jackpot machines and EGMs with higher jackpot prizes. Lastly, prior to playing, problem gamblers were also more likely to think about what jackpots were available at the venue. Similarly, Hing and Haw (2010) found a positive association between prioritizing the availability of linked jackpots and problem gambling severity when choosing where to gamble amongst people in treatment for gambling problems (N = 186). These findings are at least consistent with problem players becoming entrapped by losses which they hope to recuperate through a large jackpot win.

2.17 Optimism

People generally expect more positive outcomes for themselves than for others, but naturally in aggregate these expectations cannot hold true. Similar to *belief in good luck* (Darke & Freedman, 1997), which imagines luck as a personal attribute possessed by some people, *optimism bias* is a descriptive explanation for people's belief that they are likely to win a jackpot prize when objective consideration of the odds would show such an outcome to be virtually impossible. Optimism may increase the appeal of EGMs, particularly if individuals consider that their odds of winning a jackpot are better than those of other players, and thus they irrationally overvalue this feature of the machines.

Hing and Breen (2005) found that some venue staff reported that jackpots – and particularly wide-area linked jackpots – enticed them to gamble. Hing (2008) later found a statistical association between problem gambling severity amongst gaming venue staff and being tempted by the big jackpots on offer that they see at work. Although many gaming venues prohibit staff from gambling at their workplace, the availability of wide-area jackpots (encompassing other venues) as well as the experience of witnessing others win jackpots may lead to unrealistic optimism for these employees and thus boost their motivation to gamble.

2.18 Superstitious Beliefs

Some gamblers hold superstitious beliefs that logically unrelated events or objects can influence the probability of wins (Chan & Ohtsuka, 2009; King, 1990; Joukhador, Blaszczyński, & MacCallum, 2004, Toneatto, 1999). Although likely of only minor relevance to EGM jackpots, superstitious beliefs that improve the perceived likelihood of winning the jackpot prize (such as a lucky day or advertising symbol) may increase the attractiveness of EGM play. Further, there is some preliminary evidence that problem EGM gamblers endorse more superstitious beliefs than non-problem EGM gamblers and that such beliefs are correlated with gambling intensity (Joukhador, Blaszczyński & MacCallum, 2004).

2.19 Illusion of Control

Illusion of control (Langer, 1975) is a phenomenon where players believe they can exercise some control over randomly determined events. Although probably only a minor contributor to the influence of EGM jackpots on gambling, players may believe they can exert some control over the award of jackpot prizes by playing in venues or on EGMs that have won

before. Further, experimental studies (Coventry & Norman, 1998; Ladouceur & Mayrand, 1984; Langer & Roth, 1975) have found that participants experiencing early big wins attribute their results more to skill and personal control than participants not experiencing early big wins. Jackpots, if won, may therefore potentially foster an illusion of control. Additionally, Joukhador, MacCallum, & Blaszczynski (2003) found that illusion of control was stronger amongst problem gamblers compared to non-problem gamblers.

2.20 Near Miss

The near miss is a motivating factor in gambling where a player perceives that they just missed out on a winning event (Reid, 1986). Most commonly, a near miss on EGMs is when a series of reels almost align in a winning combination, but fall short by just one errant symbol. Near misses may also be relevant to EGM play if, for example, a player observes that someone else wins a jackpot on a day when they did not gamble or wins a jackpot on a machine they have just stopped playing. Experiencing a near miss can intensify commitment to gambling, as the player perceives that increased commitment could convert a near win into an actual win in the future. Thus, for instance, the gambler who did not play on the winning day for a jackpot may commit to play on more days (or all days) to avoid falling short again. Similarly, the player who witnessed someone else winning a jackpot on a machine they had just ceased playing may commit to playing for longer sessions in the future. It is also likely that this commitment is enhanced where the near miss pertains to a large jackpot rather than to a smaller EGM prize.

2.21 Roll Over Effects

Progressive EGM jackpots may have an extra motivating effect, given that that rolled over lotteries tend to attract greater sales than original lotteries (Rogers, 1998). Progressive EGM jackpots can be considered a type of lottery that is continually rolled over until won. For deterministic jackpots, the odds of winning increase as the jackpot nears the trigger. For non-deterministic jackpots, the lack of winning outcomes over time may instead make a payout only appear due (in accord with the gambler's fallacy). Moreover, roll-overs simply increase the prize pool of EGMs over time, and therefore should directly contribute to demand as prize amounts become large. Delfabbro (2012) raises several concerns about progressive EGM jackpots. They can encourage gamblers to bet more per spin to increase the accumulation amount; they provide a very strong justification for chasing and continued gambling; and they may reinforce the view that persistence at gambling increases the likelihood of winning the jackpot and so undermine responsible gambling messages (Delfabbro, 2012). This view is accurate in the case of deterministic jackpots.

2.22 Theory of Demand for Gambles

Nyman, Welte and Dowd (2008) explain a Theory of Demand for Gambles that usefully highlights another motivating feature of gambling. Beyond the anticipated monetary gain from engaging in gambling, Nyman et al. suggest that people also perceive value in getting "something for nothing". That is, people perceive utility not only in winnings, but also in not having to work for those winnings. This theory suggests that gambling should be particularly attractive to individuals who are vulnerable in the labour market, because it provides them with a perceived means of earning income without having to work for it. Likewise, the Theory of Demand for Gambles predicts that economically vulnerable people will be particularly attracted to EGM jackpot winnings, because these represent a substantial form of possible

income that they do not have to work to obtain. This demand is irrational, however, considering the poor likelihood of winning.

2.23 Advertising

While many jurisdictions place limits on EGM jackpot advertising (e.g., The State of Queensland, 2010), even straightforward signage may have an effect in promoting EGMs as a lottery vehicle, and remind potential players that large or life-changing prizes can be won from gambling on EGMs when this would not be the case without the presence of jackpots (Delfabbro, 2012). Thus, people can be drawn to EGMs by prominent advertisement of the top prize (the jackpot), even though other subsequent factors, such as intermittent wins, keep them playing. Policies to restrict gambling promotional activities are based on the belief that these activities may induce gambling in vulnerable groups, such as problem gamblers and minors, or may serve to counteract advertising that promotes responsible or low-risk gambling (Williams, West & Simpson, 2007). There is some support for these assertions. For example, in one study almost half (46%) of a sample of pathological gamblers reported that advertising triggered them to gamble (Grant & Kim, 2001). The second most common trigger was “boredom/free time” (24%), and the third was “thoughts of winning” (19%). Thus, promoting the size of a jackpot appears to provide two of these triggers – an advertising trigger and a winning trigger. Other empirical studies (Binde, 2009; Derevensky, Sklar, Gupta & Messerlian, 2010; Korn, 2005) have also found that gambling advertising appears to trigger gambling amongst problem gamblers. Thus, exposure to jackpot promotions may encourage problem gamblers to gamble more and it may also hinder their recovery attempts (Binde, 2009).

2.24 Ignorance of probability

Prospect Theory (Kahneman and Tversky, 1979), outlined above, provides one logical account for how people distort probabilistic reasoning; however, a simpler proposition is that people are ignorant of the true probabilities of winning a jackpot prize (Toneatto, 1999). Even clearly presented objective odds may not impact meaningfully on a person's subjective judgment of the likelihood of winning. Thus, for example, a 1 in 14 million chance of winning may not have as much impact as "if you gambled every day from birth and lived to be 100, it would take you 383 lifetimes to win the jackpot." (Ariyabuddhiphongs, 2011). It is likely that people focus on the prize amount, rather than the probability of winning – as the probabilities are far outside of commonplace likelihoods, gamblers appear to have difficulty incorporating this information into decision making (Griffiths & Wood, 2001). This disregard of probability is more aligned with what we have designated as an 'irrational' means of valuing EGM jackpots. Whereas Prospect Theory (1979) suggests a biased view of EGM jackpots where the low probability of winning is over weighted, ignorance of probabilities provides no rational means for evaluating why an individual might want to take part in the gamble. In fact, many of the irrational motivations discussed above are simply means by which people make ignorant estimates of the probabilities of winning.

2.25 Evidence on Wins Affecting Behaviour

Most of the evidence discussed so far focuses on how the prospect of winning an EGM jackpot may motivate gambling involvement. This focus is most important, since very few gamblers – even regular gamblers – win large jackpots. Nevertheless, smaller jackpot amounts may be within the aspirational reach of regular gamblers. Thus, it is also helpful to understand whether a jackpot, once won, further stimulates EGM gambling involvement.

2.26 Anecdotal and Self-Report Evidence for Gambling Motivation from Jackpot Wins

A frequent observation from clinical work and empirical studies is that many problem gamblers experience a “big win” early in their gambling careers (Custer & Milt, 1985; Greene, 1982; Livingstone & Woolley, 2008; Turner, Zangeneh & Littman-Sharp, 2006). Gambling prevalence studies have also found that problem gamblers are likely to report early big wins. For example, the Queensland Household Gambling Survey 2006-07 (Queensland Government, 2008) found that 68% of problem gamblers remembered a big win when they first started gambling, compared to 51% of moderate risk gamblers and 42% of low risk gamblers. In a psychological study with a battery of instruments administered to social gamblers, sub-clinical problem gamblers and pathological gamblers, Turner, Zangeneh and Littman-Sharp (2006) found that most gamblers reported wanting to gamble more after a big win, although this varied between 73% of pathological gamblers and 21% of non-problem gamblers. Further, nearly one-third of the sub-clinical and pathological gamblers reported experiencing a big win just before gambling became a problem for them.

An early big win is subjectively felt to be a motivating factor in an individual’s continuing gambling involvement (Custer & Milt, 1985). In particular, an early big win may create the impression that reasonably large wins are fairly common, and thus gambling could represent a net economic gain over time. Consistent with Walker’s Cognitive Theory of Gambling Involvement (1992b), an early big win might also foster an individual’s belief in their own ability to succeed at gambling and thus encourage persistence. Further, a big win, if used to continue EGM gambling, leads to increased gambling involvement due to the numerous extra spins made possible by the win. Blaszczynski and Nower’s (2002) Pathways Model would predict that this strengthened behavioural conditioning may increase the likelihood of later development of gambling problems. Thus, both big wins *per se* and the associated

behavioural conditioning when big wins are recycled, may be associated with later gambling problems (Harrigan & Dixon, 2010). Therefore, anecdotally, winning jackpots seems to have the potential to exacerbate, or even cause, gambling problems (Custer & Milt, 1985).

2.27 Counter Evidence for Gambling Motivation from Jackpot Wins

Weatherly, Sauter et al. (2004) conducted a simulated EGM experiment with subjects who were not experienced gamblers and with real money outcomes. In a between-subjects design, these researchers included both small and large wins that were triggered at different times during play. A control group had no wins. Participants who experienced a big win on the 1st play stopped gambling earlier than other participants who experienced the same win on the 5th play. Although the results appear consistent with behavioural theories related to gambling (as extinction is delayed along with the delayed win), the researchers also stated that the result appeared to question the “big win” as a motivating factor in continuation of behaviour. In another experiment, Pisaniello (2003) also failed to find notable effects from so-called “jackpot” wins on motivating persistence at gambling. Naturally, the big wins in these experiments were necessarily much smaller than typical jackpot payouts, and thus may not be entirely instructive in understanding how behaviour is influenced by winning larger amounts. These studies are also not able to clarify whether big wins lead to persistence across gambling sessions, that is, more frequent and/or longer subsequent gambling sessions.

Lottery winners may be instructive in understanding the effects of large EGM wins on subsequent gambling. A survey of 1986 Ohio millionaire lottery winners (Kaplan, 1988) found that these prize winners spent relatively little money on tickets, did not appreciably increase their expenditures on tickets, and rarely participated in other forms of gambling either before or after they won. These results, of course, may simply reflect differences in the

characteristics of people who typically play lotteries as opposed to EGM gambling; with EGM gamblers more likely to participate in several forms of gambling and to have greater gambling involvement overall (Holtgraves, 2009). Nevertheless, the findings of this lottery study contradict the stereotype of the gambler who fritters away gambling winnings on additional gambling products (Business Pundit, 2009). Moreover, research shows that lottery winners are often better off after winning (Kaplan, 1987, 1988); and these gains in life satisfaction are relatively lasting – extending up to three years.

Despite the structural similarity to EGM jackpots, lotteries are unlikely have the same psychological appeal. Jackpots on EGMs are inseparable from the fast-paced repetitive electronic betting medium used to purchase the chance at winning. Most importantly, realized EGM jackpot wins may temporarily justify the large investment in play, whereas monetary investment in lotteries is often so small as to be inconsequential.

2.28 Some Evidence for Gambling Motivation from Jackpot Wins

Young et al. (2008) conducted an EGM experiment in which participants experienced either a large win or a series of small wins, and could continue gambling thereafter for as long as they wished. All subsequent trials were programmed as losses. A single item measured subjects' desire to continue gambling. The results indicated that high-risk gamblers who experienced a big win were more motivated to continue with their gambling than other participants. This experiment therefore provided at least some evidence that winning modestly large amounts stimulates the desire to continue gambling amongst at-risk players. This finding does not necessarily imply, however, that these same players would return to gamble on another occasion if they left a venue with a large win. Furthermore, like all EGM experiments, the amounts won were relatively modest and not comparable to the jackpot amounts typical of EGMs in real venues. Thus, the results must be interpreted with caution.

Finally, Wilkes, Gonsalvez and Blaszczynski (2010) provided evidence that big wins reliably produce changes in electrodermal response that are associated with physiological arousal. Moreover, Rockloff and Greer (2010b) and Rockloff, Signal and Dyer (2007) have further shown that arousal during EGM play is associated with risky gambling behaviours; including increases in gambling speed, bet size and persistence; particularly for players with pre-existing gambling problems who interpret their arousal as a positive feeling state.

In summary, some evidence exists that modest wins within experimental paradigms increase gambling excitement and desire to continue playing. Further, excitement has been associated with traces of behaviour indicative of gambling intensity; including betting speed, bet size and persistence. However, surveys with Ohio lottery winners did not provide evidence of increased gambling involvement after large, million-dollar-plus wins. Thus, the best current evidence is that the mere presence of EGM jackpots may provide motivational effects on gamblers, whereas the damaging effects of actual jackpot wins are more ambiguous. Importantly, the experience of winning lotteries is not directly comparable to winning EGM jackpots, because play on EGMs is also connected with an electronic betting medium encompassing rapid, continuous play and intermittent small wins.

2.29 Connection between Risky Behaviour and Harm

Because few EGM players will experience a large jackpot win, it is most important to understand whether the mere presence (or promise) of outsized jackpots leads to risky behaviours that are implicated in producing harm.

2.30 Gambling Intensity as a Measure of Harm

Measures of gambling intensity, such as betting speed, bet size and persistence, are functionally related to harm because these behaviours tend to increase gambling losses during long term play. The Productivity Commission Report (1999) calculated that playing style can have a dramatic impact on costs, whereby players could expect average losses of anywhere between \$1.20 and \$1,200 per hour dependent on their betting choices. Some evidence also exists that such intense play behaviours are symptomatic of problematic play.

Braverman and Shaffer (2010) analysed a sub-sample of client data from the Internet betting service provider “bwin” of all people who opened an account in February 2005 (N = 21,996). The sub-sample comprised 599 people who gambled more than three times with the service, and subsequently closed their account for a stated cause within a one month to two year timeframe. Seventy-three percent (73%) of the people in this sub-sample eventually closed their account due to gambling-related problems. When compared to the other respondents, the behaviours of this self-identified high-risk subgroup included: (i) frequent betting, (ii) intensive betting, (iii) high variability across wager amount, and (iv) an increased bet size during the first month of wagering (p. 1). These markers of gambling intensity, therefore, are also manifestly associated with self-identified problems from gambling.

2.31 Consumption as an Indicator of Harm

Other evidence points to excessive consumption of gambling products as an indicator of the harms associated with problem gambling. Rockloff (2011) developed a Consumption Screen for Problem Gambling (CSPG) that reliably predicts the existence of gambling problems based on three questions regarding the frequency, amount and duration of gambling. This research demonstrated that excessive consumption of gambling is strongly associated with gambling problems. A cut-off score of 4+ on the scale accurately identified all 14 problem

gamblers in sample of 1,396 people (100% sensitivity). In contrast, 7.3% of non-problem gamblers scored at the 4+ level (specificity = 92.7%). Lastly, a more narrow 3% of gamblers without any self-reported gambling problems scored over 4+ on the scale. Although the scale showed a high number of false positives, high levels of consumption nonetheless proved to be strongly associated with gambling problems.

In Canada, a survey (N = 19,012) conducted by Currie et al. (2006) found that the risk for gambling problems increases with gambling frequency and expenditure. Receiver operating characteristics analysis showed a cut-off for low risk participation in gambling to include: 1) gambling no more than two to three times per month, 2) spending no more than CAN\$501-1000 a year (in net losses), and 3) spending no more than 1% of gross family income on gambling. Further, Currie et al. (2008) replicated these findings in three independently collected Canadian gambling surveys, compiling further evidence that validated these cut-off values for harmful levels of gambling. Currie et al. (2006) and Currie et al. (2008) thus provide additional evidence to suggest that any feature that increases gambling consumption increases the risk of gambling-related harm. Therefore, EGM jackpots logically at least have the potential to increase gambling consumption to harmful levels.

2.32 Harm Associated with Rational, Biased and Irrational Views of EGM Jackpots

Understanding whether gambling consumption is excessive, and therefore is likely to result in harm, must take some consideration of how people value EGM jackpots. If people value EGM jackpots on a purely rational basis, including the expected value of the prizes and the entertainment value of imagining a jackpot win, then consumer surplus is created. In contrast, bias in valuing the EGM jackpots may cause some people to overvalue EGM jackpots and therefore overinvest their time and money in gambling on EGMs. There may be avenues to correct these biases, however, through consumer education or structural reforms

to maintain a more rational commitment to gambling. Lastly, some people may value EGM jackpots on an entirely irrational basis, and the only avenue to reducing consumption below harmful levels is to counteract these irrational means of valuing EGM jackpots.

An important part of the future research agenda is to evaluate which of the available explanations for EGM jackpots (rational, biased and irrational) predominate, and what explanations are more valid for whom – such as those at-risk of or already experiencing gambling-related problems. As reviewed in this chapter, there is evidence that problem gamblers are more likely than non-problem gamblers to hold a range of irrational beliefs about gambling, but whether and how gamblers apply these irrational beliefs specifically to EGM jackpots is unclear. Efforts needed to correct any biases or irrational motivations need to be targeted appropriately.

2.33 Literature Summary

This literature review has provided an overview of research to date that contributes to an understanding of the motivating influence of EGM jackpots on gambling behaviour. Specific evidence about EGM jackpots is scant, but research and theorizing yields explanations for motivation that can be broadly characterized as rational, biased and irrational. In particular, theoretical perspectives including the rational approach of Expected Utility Theory (Von Neumann & Morgenstern, 1947), various alternatives to Expected Utility Theory that assume some bias (Kahneman & Tversky, 1979), and other more strictly irrational motivations (Rogers, 1998), generate expectations that EGM jackpots should motivate additional consumption on EGMs above those EGMs that do not have such lottery-like features.

Experimental evidence implies that modest wins may stimulate greater excitement and desire to continue gambling, although this effect may be specific to problem gamblers and is bound within a gambling session. Conversely, little direct evidence exists to suggest that large wins generate increases in gambling involvement (Kaplan, 1987, 1988), but this may

simply reflect that no direct evidence is yet available exploring EGM winnings as opposed to lottery winnings. Lotteries and EGMs are likely to have dissimilar clientele and motivations for gambling involvement.

The mere presence of jackpots in EGMs, rather than winning a jackpot, is likely to stimulate gambling consumption. Further, excessive consumption is indicative of gambling problems, and likewise, the harm associated with gambling problems (Currie et al., 2008; Currie et al., 2006; Rockloff, 2011). Problem players demonstrate behaviours that contribute to higher consumption rates, such as frequent betting, intense betting, and larger bet sizes (Braverman & Shaffer, 2010).

An important distinction was drawn between rational, biased and irrational motivations attracting people to EGM jackpots. Rational motivations alone imply few problems from EGM jackpots, because gamblers participate in EGM play to gain monetary rewards and entertainment that generate consumer surplus. Conversely, biased motivations that instead lead individuals to overinvest time and money in gambling may contribute to the experience of gambling problems. Nevertheless, there may be opportunities to correct the bias through education or regulation, and thus more closely align EGM gambling with desirable levels of personal expenditure. Probably most troubling, however, are irrational motivations that tend to overvalue EGM jackpots. These motivations are not simply biased deviations from rational reasons for participating in gambling, but instead represent forces that are distinct from the enjoyment and reward of the activity. It is important that future research explains which of these broad categories of motivations predominate, and how these motivations might differ between individuals who are vulnerable to problems and others who gamble without problems. Further, it is also important to understand how jackpots with different structural features; such as progressive, deterministic, hidden, mystery, linked and wide-area jackpots; might differentially appeal to rational, biased and irrational motivations to engage in EGM gambling.

More research is needed to fully understand the effects of EGM jackpots on gambling behaviour (Livingstone, Woolley, Zazryn, Bakacs, & Shami, 2008, p. 154). Although there are reasons to expect that large jackpot prizes will have an outsize influence on gambling behaviour, these reasons need to be tested in the context of venue-based EGMs. Moreover, little is known about how jackpots with different structural features that determine how jackpots are awarded might similarly affect gambler behaviour. Because jackpots are an integral and important feature of many – if not most – EGMs, it is critical to understand their value to players, and likewise their potential influence on excessive consumption and by extension problematic patterns of gambling. The original research in this report contributes to this agenda.

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Chapter 3: Experiment 1 Progressive and Deterministic Jackpots

As documented in the literature review, there is little existing direct evidence on the influence of the structural characteristics of EGM jackpots on gambling behaviour. To redress this deficit, this present study examined two common structural features of EGM jackpots: progressive versus non-progressive jackpots, and deterministic versus non-deterministic jackpots. These features, as described below, were examined in an experimental design for their potential effects on intensity of gambling and enjoyment, and for how jackpot size may moderate such effects.

3.1 Progressive versus Non-progressive Jackpots

Progressive jackpots incrementally grow in value as players make additional bets. Alternatively, non-progressive jackpots generate a fixed dollar payout irrespective of the precise accumulation of losses from players. Two conflicting views can be postulated regarding whether progressive or non-progressive jackpots should have more motivating effects on players' gambling intensity. On the one hand, evidence from lottery betting (Rogers, 1998) suggests that progressive jackpots may lead to a "rolled over effect", whereby gamblers are encouraged to bet more as higher bets help increase the accumulated amount of the jackpots. That is, each bet adds to the jackpot and that amount may be seen as recoverable investment in the jackpot prize. On the other hand, EGM players who consider hitting the jackpot as their goal may experience a "goal distance effect" (Kivetz, Urminsky & Zheng, 2006). That is, progressive, rather than non-progressive jackpots, may increase the perceived distance to the goal as the jackpot value grows after each additional bet, and therefore decrease players' motivation to pursue the jackpot reward.

Moreover, progressive jackpots may make bettors more aware of their contributions to the jackpot, which may be properly seen to be most likely to benefit someone else.

3.2 Deterministic versus Non-deterministic Jackpots

Deterministic jackpots have a guaranteed payout after a fixed number of bets, which is determined at random but hidden from players. Non-deterministic jackpots, on the contrary, have a potential payout assessed at random with every bet. Hence, a key difference between them lies in the fact that the likelihood of winning a deterministic jackpots increases as players continue to bet, whereas there is no guaranteed winning outcome over time for non-deterministic jackpots (Rockloff & Hing, 2012). Therefore, deterministic jackpots may lead to heightened betting motivation and reinforce persistence at EGM playing as players have increasing odds of winning with every bet placed. Of course, gamblers likely have little notion of how close they are to an inevitable payoff. Thus, deterministic jackpots are only motivating if players perceive the payoff to be near, whereas they are less motivating than non-deterministic jackpots if players feel that the payoff event is likely distant.

3.3 Jackpot Size

According to Kahneman and Tversky's (1979) Prospect Theory, individuals tend to value alternative choices (e.g., gambles) based on their perceived outcome probabilities. Small jackpots payout more frequently than large jackpots, and regular players understand that jackpot size is inversely related to the probability of winning. That is, small jackpots payout more frequently than large jackpots. Prospect Theory predicts that EGM players should be more motivated to place bets with small-probability large prizes, however, because people are generally more risk-seeking with respect to low-probability events framed as a gains

(Rockloff and Hing, 2012). The motivating influence of large, low probability prizes is also supported by evidence from US lottery sales, where larger population states have higher per-capita purchases of lottery tickets (Cook & Clotfelter, 1993).

3.4 Purpose of the Experiment

The present experiment was devised to investigate the interactive effects of (non-) deterministic jackpots, (non-) progressive jackpots, and jackpot size on EGM gambling behaviour in the forms of bet size, betting speed and betting persistence. In particular, we sought evidence on the differential motivating effects of progressive versus non-progressive feature of jackpots, in order to confirm evidence for the “rolled over effect” or the “goal distance effect” effect on aspects of play and player enjoyment.

3.5 Methods

3.5.1 Participants

One hundred and twenty-three participants, including 51 male and 72 female subjects, aged 18 - 82 ($M = 50.4$, $SD = 16.4$) successfully completed the experiment following recruitment from newspaper-flyer advertisements in Bundaberg, Queensland Australia. The cultural backgrounds of participants included: 114 Australian (92.7%), 3 English (2.4%), 2 New Zealand (1.6%), 2 German (1.6%), 1 South African (0.8%), and 1 other (0.8%). As calculated from the post-experiment 9-item Problem Gambling Severity Index (PGSI, Ferris & Wynne, 2001), the problem-gambling status of participants included: 41 (33.3%) no identifiable problems, 42 (34.2%) low-risk, 26 (21.1%) moderate-risk, 13 (10.6%) problem gamblers, and

1 (0.8%) unclassified due to an incomplete questionnaire. Seventy-five percent (75%) of the sample gambled on a casino style game at least once within the last 12 months.

3.5.2 The Simulated EGM

A simulated EGM was created by the study authors in Visual Basic (see Figure 3.1) and run on a laptop computer. The machine had 3 reels and 3 pictured 'fruits' on each reel. Three matching fruits defined winning outcomes across the win-line, and all winning bets paid-off at 10 times the amount bet. Players could bet amounts of 25, 50 or 100 cents on each trial (or spin), with potential payoffs of \$2.50, \$5.00 and \$10.00, respectively. Credits were presented in cents, with an initial bankroll of 2,000 cents (\$20) appearing at the start of play. Although presented to the player as random, the machine was programmed with a fixed sequence of 5 wins (on spins 2, 6, 8, 13 and 20) and infinite losses thereafter. The theoretical maximum payout was \$61.25, which is calculated from the \$20 initial bankroll, plus \$50 in maximum wins, and less \$8.75 in minimum bets required. The EGM produced the typical noises associated with play, including the musical sounds of spinning reels and winning bells.

Figure 3.1 Illustration of Simulated EGM



3.6 Procedures

Participants were given \$20 upon arrival at their session as compensation for their time. After completing a brief questionnaire including demographic questions and the Lie-Bet Scale (Johnson et al., 1988), participants were asked whether they would like to wager their \$20 compensation on the EGM. The \$20 cash compensation was retrieved from the participants and loaded to the EGM for their subsequent play. Given the modest sample size, stratified random assignment based on participants' gender, age, and Lie-Bet score was utilised to allocate participants to play the EGM in the different conditions (as described below). Each participant had a finger sensor measuring skin conductance attached to the middle finger of his or her non-dominant hand (Biograph Infinity System).

3.7 Design

The experiment was based on a 2 (progressive vs. non-progressive) × 2 (deterministic vs. non-deterministic) × 2 (small jackpot vs. large jackpot) factorial design with an additional no-jackpot control condition. Participants in (non-) progressive and (non-) deterministic conditions were informed of the mechanisms of the specific structural characteristics of their EGM before they started playing both verbally and with an information-screen prior to play.

Further, participants in the small (versus large) jackpot conditions were told there was the opportunity to win \$500 as a cash jackpot (versus the opportunity to win instant scratch-it tickets for a \$25,000 jackpot) and shown a jar with \$500 cash (versus 500 instant scratch-it tickets). The language described each feature in functional terms without emotive words. As an example, the deterministic, progressive, \$25K jackpot condition players were told:

“The \$25,000 prize amount will be shown on the top of the screen once you begin. You’ll notice that the jackpot prize grows with every bet you make.

The ticket-jackpot will payout after a certain number of bets have been placed. The number of bets that must be made before the jackpot is triggered has been determined in advance and at random.”

The top jackpot prize, either \$25,000 or \$500, was additionally shown on the EGM as illustrated in Figure 3.1. In the progressive condition, the displayed prize increments as a function of player betting.

3.8 Results

3.8.1 Data Analysis

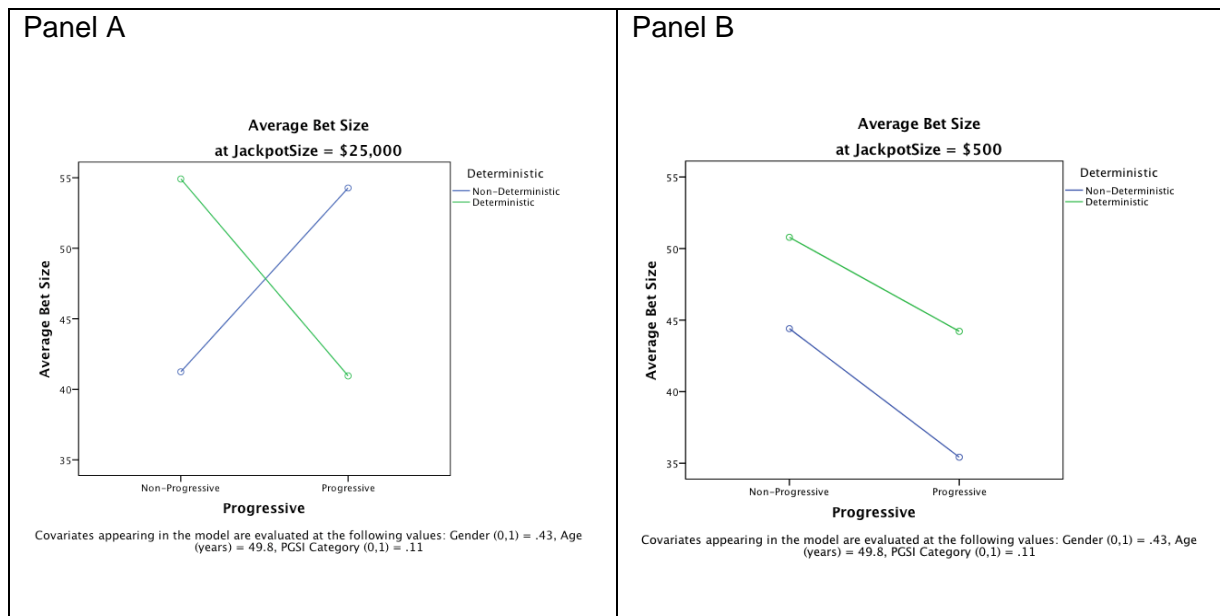
The primary dependent variables of interest included the behavioural outcomes of average bet size, betting speed (bets per minute), persistence (total trials played), and a one-item self-reported measurement of subjective enjoyment of playing the EGM (a six-point Likert scale). Each outcome was analysed with an ANCOVA model using (non-) progressive feature, (non-) deterministic feature, and jackpot size as the primary predictive variables in a crossed design. Gender, age, and Problem Gambling Severity Index (PGSI, Ferris & Wynne, 2001) were entered as covariates, as none of these variables proved useful in producing significant interactions.

3.8.2 Average Bet Size

The first ANCOVA model showed a significant three-way interaction effect of (non-) progressive feature, (non-) deterministic feature, and jackpot size on participants' average bet size ($p < .05$). The three-way interaction is illustrated in Figure 3.2. Like many three-way interactions, this pattern of results is difficult to interpret. However, interactions can be decomposed into a series of simple effects, only some of which are significant as pairwise comparisons. When the jackpot was deterministic and large (Figure 3.2, Panel A), participants placed higher bets on the EGM with non-progressive ($M = 54.9$ cents, $SD = 23.3$) rather than progressive jackpot ($M = 38.0$ cents, $SD = 12.8$, $p < .05$). In contrast, when the jackpot was non-deterministic and large, the progressive feature was more likely to contribute to large bet sizes, although the simple effects were marginally non-significant, $p > .05$, ns.

Figure 3.2 Panel B shows the Average Bet Sizes for small jackpots (\$500) in each condition combination. For small jackpots, deterministic jackpots attracted larger bets than non-deterministic; and non-progressive jackpots attracted higher bets than progressive jackpots.

Figure 3.2 Average Bet Size by (non-) progressive characteristic, (non-) deterministic characteristic, and jackpot size (Panel A and B)



3.8.3 Speed of betting (Bets per Minute)

The second ANCOVA model found no significant effects for the jackpot features (progressive vs non-progressive and deterministic vs non-deterministic) on player betting speed. Moreover, there were no significant effects for the interactions or covariates, with the exception of PGSI status. Players with pre-existing gambling problems bet more slowly ($M = 4.66$, $SD = 2.93$) than players with few or no problems ($M = 6.13$, $SD = 2.29$), $p < .05$.

3.8.4 Persistence (Total Trials Played)

The third ANCOVA model found no significant effects for the jackpot features (progressive vs non progressive and deterministic vs non deterministic) on player persistence while losing. All bets were programmed as losses past the 20th trial, but the jackpot feature did not reliably predict continued play, nor did any interactions or covariates, $p > .05$.

3.8.5 Subjective Enjoyment

The fourth ANCOVA model showed no significant effects for the (non-) progressive characteristic or the (non-) deterministic characteristic on participants' subjective self-rated enjoyment in playing the EGM, $p > .05$, ns. Moreover, the interaction and covariates also proved non-significant, $p > .05$, ns.

3.8.6 Physiological Arousal (GSR/Skin Conductance)

A fifth ANOVA model used the change in skin conductance (GSR), subtracting average skin conductance during play from a baseline period of 2 minute prior to play. There were no significant effects for skin conductance (a physiological measure of player excitement) for any of the jackpot features, interactions or covariates, $p > .05$, ns.

3.8.7 No-jackpot Condition

Each of the eight conditions in the factorial design was compared with the no-jackpot condition through ANCOVA models using the conditions as the primary predictive variables and gender, age, and PGSI as the covariates. None of the conditions were significantly

different from the control for average bet size (all p 's > .05, ns), bets per minute (all p 's > .05, ns), Total Trials (all p 's > .05, ns), subjective excitement (all p 's > .05, ns), or skin conductance (all p 's > .05, ns).

3.9 Discussion

The present experiment sought to examine the effects of (non-) progressive and (non-) deterministic jackpots on EGM playing behaviour, and how jackpot size may moderate such effects. In a crossed-design, the results revealed a significant interaction between jackpot size, the (non-) progressive feature and the (non-) deterministic feature on participants' average bet size on the EGM. In particular, the largest bets were made on high jackpot machines (\$25,000) that were represented as deterministic (i.e., a payoff after x spins, where x is determined at random) and non-progressive (i.e., for a fixed jackpot amount). These machines may have appeared more valuable because of the 'goal distance effect'. The incremental bets may have encouraged larger bet sizes as the player felt they were drawing nearer to an inevitable payoff event. Each bet places the gambler closer to the goal of winning the jackpot prize. The experiment demonstrates that intensity of betting, at least by measure of bet size, is largest in the presence of this type of jackpot. In fact, the average bet size for the large, deterministic and non-progressive jackpot was 20.3% higher than the bet-size average for all studied jackpot feature combinations ($M = 54.9$, $SD = 23.3$ vs $M = 45.6$, $SD = 20.4$).

Importantly, large jackpots that were non-deterministic (potential payoff determined at random with each bet) and progressive (each bet adds to the jackpot prize) also promoted high average bet sizes. This is a common configuration for jackpots in Australia as measured in our observational study (see Chapter 7), and in this experiment demonstrated bet-sizes are 18.4% higher than the average for all studied jackpot configurations ($M = 54.0$,

SD = 27.9 vs $M = 45.6$, SD = 20.4). This jackpot configuration may be attractive for the rolled-over effect that is hypothesised to make rolled-over lottery prizes more attractive (Rogers, 1998). If players are lucky, large bets that add to the large jackpot prize can be later recouped through a big win.

Consistent with Prospect Theory, larger prizes (\$25,000) generally attracted higher bet sizes than the smaller jackpot prizes (\$500), although these differences were not significant as a main effect. For smaller jackpot prizes, both deterministic (payoff after x spins, where x is determined at random) and non-progressive (fixed \$500 prizes) features attracted the highest bet sizes.

3.10 Limitations

As is true for all lab-based experimental studies, there are concerns about the external validity of the results. The artificial environment of the lab, as well as the way in which the jackpots were described, may not be entirely true to the information player receive in a real venue. Nevertheless, the jackpots were described in simple and functional language, and these descriptions produced reliable effects on average bet size. We take the view of experimental realism, where it is important to understand the psychological constraints and contingencies that operate in real venues (including real money prizes), rather than attempting to faithfully recreate every mundane detail of the gambling environment.

3.11 Summary

This experiment provided some evidence that common jackpot configurations are associated with higher average bet sizes, which are one component of gambling intensity. That such jackpot configurations are relatively common in venues (see Chapter 7) is likely a consequence of the natural evolution of EGMs, where only the most popular and profitable machines survive competition on the gaming floor.

3.12 References

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Chapter 4: Experiment 2 Veiled Jackpots

EGM jackpots have structural characteristics that can potentially impact on the playing behaviour of gamblers. In Chapter 3, an experiment revealed that specific structural characteristics (Deterministic and Progressive) that describe how the jackpot is triggered can have discernible and reliable influences on the bet-size of gamblers, even though the actual triggering of jackpots is so rare as to be functionally irrelevant for players – and thus should be largely irrelevant for their gambling choices and playing experience.

In this present experiment, another structural aspect of jackpots is explored to determine its potential effects on the gambling decisions and enjoyment of players. In *Veiled Jackpots* the triggering event mechanics are purposely obscured from the participants. Two types of veiled jackpot features that are explored in this study are *Hidden* and *Mystery* jackpots.

4.1 Hidden Jackpots

In a hidden jackpot, the prize amount(s) is not shown to the player, although the existence of a jackpot prize is advertised. This may cause some extra inducement and/or enjoyment for players due to the unknown – and therefore potentially unlimited – value of the top prize. Thus, by degree, the potential power of hidden jackpots relies on the potential overestimation of the actual jackpot prize on offer. Of course, if players assume the jackpot is likely to be smaller than the actual prize on offer, the attractiveness of hidden jackpots is less. Therefore, the experiment will evaluate whether both suggestively large and small hidden jackpots are more or less motivating and enjoyable than jackpots that are shown to players.

4.2 Mystery Jackpots

In a mystery jackpot, the “winning state” of the machine (e.g., combination of symbols) is not shown to the players. Mystery jackpots can be a natural consequence of jackpot systems that are independent of the core operation of the stand-alone EGM. Jackpot systems may be added to several different types of machines, even machines from different manufacturers, and thus each EGM bet is essentially a lottery draw for the grand prize of the jackpot system. In a non-combinative mystery jackpot any losing sequence of symbols on the EGM is just as likely to win the jackpot prize as a winning sequence, because the jackpot system is essentially independent from the machine and uses the EGM only as a triggering device. In contrast, a combinative mystery jackpot has a winning sequence of symbols on the machine, but this combination is not shown to players prior to winning the jackpot.

For the purposes of the present experiment, the distinction between a non-combinative mystery jackpot and a combinative mystery jackpot is not relevant. In both types of jackpots, the “symbols” needed to win the jackpot are not known to the player and thus the psychological effect on the player is equivalent.

4.3 Veiled Jackpots Experiment

The present study sought to investigate the effects of Hidden and Mystery Jackpots in an experimental paradigm. Experiments offer a high degree of internal control, whereby the effect of Veiled Jackpots can be reliably related to aspects of player behaviour. Veiled jackpots are effective if players believe their expected value is in excess of the player contributions to the jackpot. Thus, we had no prior expectations about whether hidden and mystery jackpots should be effective in intensifying player behaviour or increasing enjoyment.

4.4 Method

4.4.1 Participants

One-hundred and seven (107) adults (58 female, 49 male) from Bundaberg QLD, Rockhampton QLD and the surrounding Queensland areas responded to flyer advertisements placed in local community newspapers (the Rockhampton Mirror, Capricorn Coast Mirror, and Bundaberg News-Mail). Ages of participants ranged from 20 to 86 years ($M = 47.0$, $SD = 16.4$). Cultural backgrounds of participants included: 74.8% Australian, 10.3% English, 3.7% Philippine, 2.8% New Zealander, and a further 8.4% of people nominating another background (each less than 1% frequency). A further 4.7% of participants (5) also identified as being Indigenous Australians. Eight-two percent (82%) of the sample gambled on a casino style game at least once within the last 12 months.

4.5 Procedure

4.5.1 The Simulated EGM

Subjects played a 3 reel laptop simulated EGM created in Visual Basic (see Figure 4.1 below). The EGM was programmed with a fixed sequence of wins on trials 3, 4, 7, 12, 17, 19, 29, 36, 42, 48 and 50, and infinite losses thereafter. Reel size varied such that the six icons (banana, 4 leaf clover, watermelon, horseshow, star and grapes) appeared with a varied frequency per reel. Six icons were presented on reel 1 (once each), 9 icons on reel 2 and 12 on reel three. Consequently, we were able to ensure that the 'winning combination'

icons appeared relatively infrequently compared with other icons, ensuring that the perceived probability of producing the winning combination was not artificially inflated.

Players were given \$20 cash on arrival at their appointed time. After completing a brief demographic questionnaire, participants were asked if they would like to wager their \$20 compensation on the EGM. The \$20 cash compensation was retrieved from the participants, and participant played the EGM pre-loaded with 2000 in 1c credits. Subjects bet 25, 50 or 100 cents on each spin, and all wins paid x10 the amount bet for a theoretical maximum of \$120.25. The EGM produced the typical sights and sounds of EGM play, including the musical sounds of spinning reels and winning bells.

Physiological measurements were taken as potential indicators of arousal and an excited emotional state. Physiological arousal was measured via galvanic skin response (GSR) using Biograph Infiniti software for participants 1-30 (Bundaberg), while similarly variations in electrodermal activity (GSR) were measured using Affectiva Q-Sensor systems for the Rockhampton sample (participants 31-107). Equipment availability necessitated using different measurement apparatus at each site; however, all results reported below are robust with respect to the study location / equipment.

Figure 4.1. Simulated EGM depicting the jackpot amount and winning symbol combination.



4.6 Conditions

Participants were assigned to conditions using a crossed design (see Table 4.1). Given the modest sample size, stratified random assignment based on participants' gender, age, and Lie-Bet score was utilised to allocate participants to play the EGM in the different conditions described below. Within four of these conditions, participants were presented with a potential \$500 cash jackpot in a mason-jar prior to play. Participants in a further four conditions were presented a jackpot of 500 lottery tickets for a potential \$25,000 prize (also shown in jar).

The remaining participants in the control condition were not informed of any jackpot prize. All participants, aside from those in the control condition, were told that someone in the experiment would win the jackpot prize.

Table 4.1 Assignment of Subjects to Conditions.

Condition	Cash	Tickets	Jackpot \$ Hidden	Jackpot \$ Shown	Combo Mystery	Combo Known
1	✓		✓		✓	
2	✓		✓			✓
3	✓			✓	✓	
4	✓			✓		✓
5		✓	✓		✓	
6		✓	✓			✓
7		✓		✓	✓	
8		✓		✓		✓
9	N/A	N/A	N/A	N/A	N/A	N/A

In another crossed condition, participants were assigned to either a “hidden” or “shown” jackpot dollar value. All participants, aside from those in a control condition, were informed that a jackpot could be won (cash or ticket value), but those in the hidden jackpot condition were not informed of the monetary value of the jackpot. In a final crossed condition, participants were assigned to either a known or mystery (unknown) winning-symbol combination. All participants, aside from those in the control condition, were informed that the jackpot would be won if a pre-determined combination of symbols appeared on screen, but the winning combination was only revealed to those in the known combination condition.

4.7 Results

4.7.1 Data Analysis

The primary outcomes were Average Bet Size, Speed of Betting (Bets per Minute), Persistence (Total Trials Played), Self-rated enjoyment (1 item Likert 6 points), and Physiological Arousal (GSR/Skin Conductance). For each outcome, the data analysis calculated two models: a Full Factorial ANCOVA Model and a so-called Control ANCOVA Model. The Full Factorial Model included all potential interactions between the Hidden and Mystery Jackpot conditions, but consequently could not include the control condition (no jackpots) as this latter condition necessarily could not be included in a crossed-jackpots design. The Control ANCOVA model, in contrast, analysed each condition (as outlined in Table 4.1) in a main-effects design without crossing conditions and included the no-jackpots control condition.

4.7.2 The Full Factorial Model

ANCOVA models were run with each of these dependent measures and the crossed conditions of Jackpot Prize (\$500 Cash or 500 Instant Scratch Tickets), Jackpot Value (Hidden or Shown) and Jackpot Combination (Known or Unknown) as the primary independent variables. In addition, each model used Gender, Age and Dichotomised Problem Gambling Severity Index Scores (PGSI 0, PGSI 1+) as covariates. The covariates did not show any significant interactions with the other study variables.

4.7.3 The Control ANCOVA Model

The no-jackpots control condition could not be analysed in a factorial model, and thus an additional set of ANCOVAs models (the Control Models) were evaluated with Condition (1-9, see Table 4.1) as the primary dependent variable, and Gender, Age and Dichotomised Problem Gambling Severity Index Scores (PGSI 0, PGSI 1+) as covariates. No interactions were used in these models. Fisher's LSD was used to test for potential differences between conditions.

4.7.4 Average Bet Size

As shown in Table 4.2, the outcome of Average Bet Size was not predicted by any of the experimental conditions or model interactions, $p > .05$, ns. Nevertheless, PGSI status approached significance, $p = .055$, whereby subjects with gambling problems had non-significantly higher average bet sizes than those with no identifiable problems.

Table 4.2 ANCOVA predicting Average Bet Size from Jackpot Prize (\$500 Cash or 500 Instant Scratch Tickets), Jackpot Value (Hidden or Shown) and Jackpot Combination (Known or Unknown)

Variable	df	MS	F [^]	Eta ²
Prize (\$500 Cash or 500 Instant Scratch Tickets)	1	13.41	.03	.00
Value (Hidden or Shown)	1	123.78	.26	.00
Combination (Known or Unknown)	1	784.90	1.66	.02
Prize x Value	1	32.44	.07	.00
Prize x Combination	1	14.47	.03	.00
Value x Combination	1	5.91	.01	.00
Prize x Value x Combination	1	1150.67	2.43	.03
Age	1	1685.04	3.56	.04
Gender	1	507.66	1.07	.01
PGSI Status (PGSI 0, PGSI 1+)	1	1799.11	3.80	.04
Error	83	473.67		
Total	94			

[^] no effects were significant at $p < .05$.

The Control Model assessed each of the 9 conditions of the experiment (see Table 4.1) as the primary independent variable, with Age, Gender and Dichotomised PGSI as covariates. Fisher's LSD tests revealed no significant main effects between conditions for Average Bet Size.

4.7.5 Speed of Betting (Bets per Minute)

As shown in Table 4.3, the outcome of Speed of Betting (Bets per Minute) was not predicted by any of the experimental conditions, $p > .05$, ns. However, PGSI status was significant, $p < .05$, showing that gamblers with some problems bet at a higher rate of speed ($M = 7.76$ bets per minute, $SD = 1.68$) than gamblers with no problems ($M = 7.16$ bets per minute, $SD = 1.68$), $p < .05$.

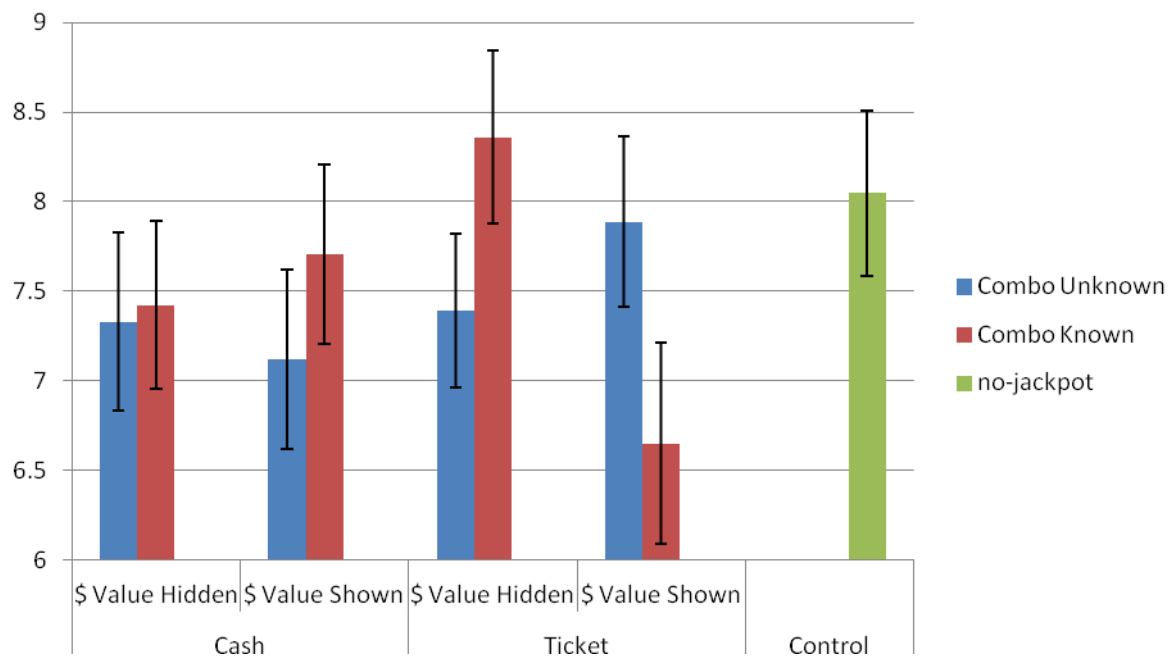
Table 4.3 ANCOVA predicting Speed of Betting (Bets per Minute) from Jackpot Prize (\$500 Cash or 500 Instant Scratch Tickets), Jackpot Value (Hidden or Shown) and Jackpot Combination (Known or Unknown)

Variable	df	MS	F	Eta ²
Prize (\$500 Cash or 500 Instant Scratch Tickets)	1	.60	.22	.00
Value (Hidden or Shown)	1	1.88	.69	.01
Combination (Known or Unknown)	1	.24	.09	.00
Prize x Value	1	2.59	.95	.01
Prize x Combination	1	1.40	.51	.01
Value x Combination	1	4.35	1.60	.02
Prize x Value x Combination	1	9.68	3.55	.04
Age	1	17.48	6.41	.07
Gender	1	1.79	.65	.01
PGSI Status (PGSI 0, PGSI 1+)	1	16.79	6.16*	.07
Error	83	2.73		
Total	94			

* $p < .05$

The Control Model assessed each of the 9 conditions of the experiment (see Table 4.1) as the primary independent variable, with Age, Gender and Dichotomised PGSI as covariates. Fisher's LSD tests revealed that in the conditions where the prize was 500 tickets and the jackpot combination was shown, there was a significant higher betting speed for the hidden \$-value jackpot when compared to the shown \$-value jackpot, $p < .05$ (see Figure 4.2). Furthermore, in conformity with the prior Factorial Model, gambling problems (PGSI status) again positively predicted Speed of Betting, $p < .05$.

Figure 4.2 Betting Speed by Condition*



* Bars show Standard Errors

4.7.6 Persistence (Total Trials Played)

The number of trials played is a measure of gambling persistence, as all trials past 50 were programmed with losses. There were no effects for the experimental conditions or interactions on persistence, $p > .05$, ns (see Table 4.4). However, there was a significant effect for PGSI status, such that subjects with some gambling problems (M Trials = 105.4, SD = 54.0) bet for more trials than those with no problems (M Trials = 80.4, SD = 49.7), $p < .05$.

Table 4.4 ANCOVA predicting Persistence (Trials Played) from Jackpot Prize (\$500 Cash or 500 Instant Scratch Tickets), Jackpot Value (Hidden or Shown) and Jackpot Combination (Known or Unknown)

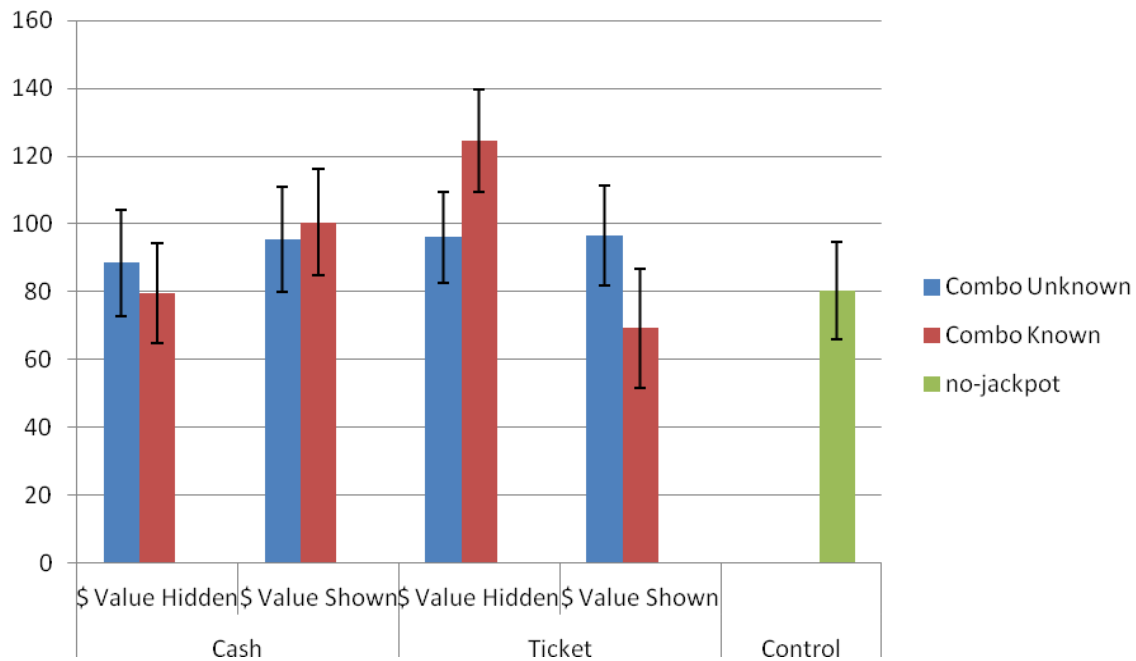
Variable	df	MS	F	Eta ²
Prize (\$500 Cash or 500 Instant Scratch Tickets)	1	656.07	.24	.00
Value (Hidden or Shown)	1	1069.430	.39	.01
Combination (Known or Unknown)	1	13.45	.01	.00
Prize x Value	1	9748.09	3.51	.04
Prize x Combination	1	22.75	.01	.00
Value x Combination	1	2535.82	.91	.01
Prize x Value x Combination	1	6711.94	2.42	.03
Age	1	2.76	.00	.00
Gender	1	2079.77	.75	.01
PGSI Status (PGSI 0, PGSI 1+)	1	23204.67	8.35*	.09
Error	83	2778.82		
Total	94			

* $p < .05$

The Control Model assessed each of the 9 conditions of the experiment (see Table 4.1) as the primary independent variable, with Age, Gender and Dichotomised PGSI as covariates. In accord with the finding for Betting Speed, Fisher's LSD tests revealed that in the conditions where the prize was 500 tickets and the jackpot combination was known, there was a significant higher persistence (Total Trials Played) for the hidden \$-value jackpot when compared to the shown \$-value jackpot, $p < .05$. Moreover, this combination of the ticket-jackpot and shown \$-value combination had reliably higher persistence (Total Trials

Played) than the no-jackpot control condition, $p < .05$; and the cash jackpot where the jackpot value was hidden and the combination was shown, $p < .05$ (see Figure 4.3).

Figure 4.3 Persistence (Total Trials Played) by Condition



4.7.7 Self-rated Enjoyment

Subjects rated their enjoyment of the EGM on a 6 point Likert scale immediately after playing. There were no significant effects for the experimental conditions, interactions or covariates, $p > .05$, ns (see Table 4.5). Nevertheless, Gender approached significance, with females ($M = 4.63$, $SD = 1.09$) marginally enjoying the EGM more than males ($M = 4.13$, $SD = 1.52$), $p = .051$, ns.

Table 4.5 ANCOVA predicting Enjoyment (6 point Likert item) from Jackpot Prize (\$500 Cash or 500 Instant Scratch Tickets), Jackpot Value (Hidden or Shown) and Jackpot Combination (Known or Unknown)

Variable	df	MS	F [^]	Eta ²
Prize (\$500 Cash or 500 Instant Scratch Tickets)	1	2.51	1.40	.02
Value (Hidden or Shown)	1	2.14	1.19	.01
Combination (Known or Unknown)	1	.02	.01	.00
Prize x Value	1	1.57	.87	.01
Prize x Combination	1	.21	.12	.00
Value x Combination	1	.003	.00	.00
Prize x Value x Combination	1	.56	.31	.00
Age	1	.99	.55	.01
Gender	1	7.02	3.91	.05
PGSI Status (PGSI 0, PGSI 1+)	1	1.28	.71	.01
Error	83	1.80		
Total	94			

[^] no effects were significant at $p < .05$. Gender approached the sig F of 3.96.

The Control Model assessed each of the 9 conditions of the experiment (per Table 4.1) as the primary independent variable, with Age, Gender and Dichotomised PGSI as covariates. Fisher's LSD tests revealed no significant main effects between conditions for Self-rated Enjoyment, $p > .05$, ns.

4.7.8 Physiological Arousal (GSR/Skin Conductance)

Physiological arousal was measured through GSR/Skin Conductance as the difference between measurements during the experiment and a baseline 2-minute period immediately

prior to the experiment. There was a significant main effect for the Combination (see Table 4.6), such that an unknown winning symbol combination ($M = 0.273$ standardised) produced a greater increase in Physiological Arousal (GSR) than a known combination ($M = -0.310$ standardised).

Table 4.6 ANCOVA predicting Physiological Arousal (GSR/Skin Conductance) from Jackpot Prize (\$500 Cash or 500 Instant Scratch Tickets), Jackpot Value (Hidden or Shown) and Jackpot Combination (Known or Unknown)

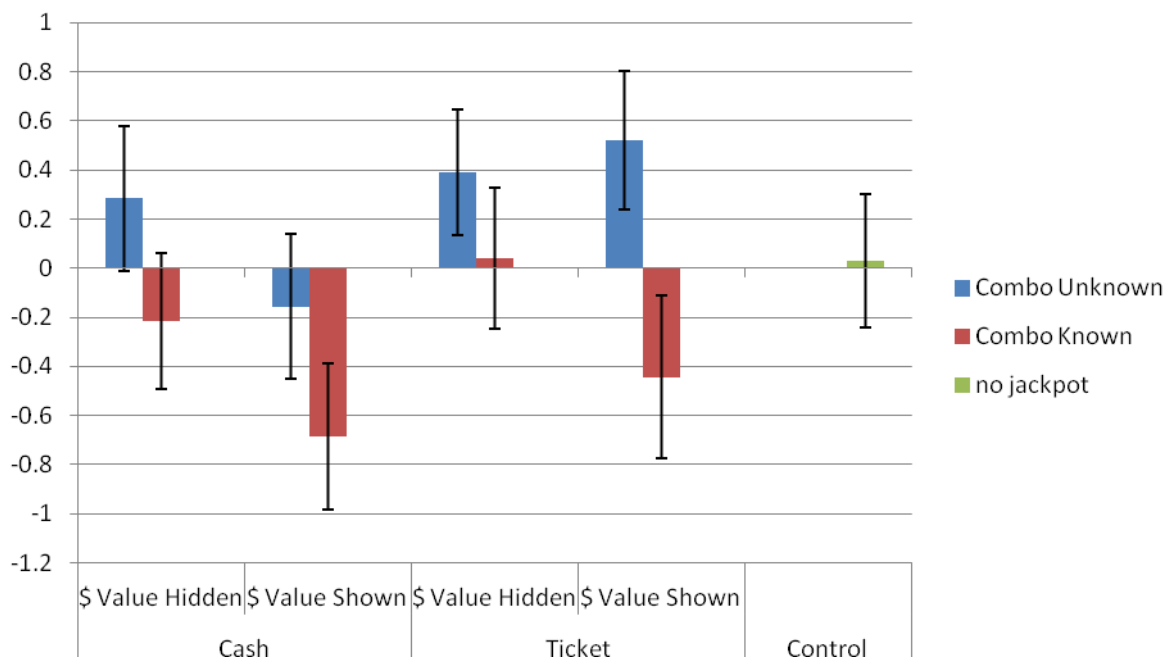
Variable	df	MS	F	Eta ²
Prize (\$500 Cash or 500 Instant Scratch Tickets)	1	2.208	2.08	.02
Value (Hidden or Shown)	1	2.204	2.07	.02
Combination (Known or Unknown)	1	7.869	7.41*	.08
Prize x Value	1	.429	.40	.01
Prize x Combination	1	.124	.12	.00
Value x Combination	1	.603	.57	.01
Prize x Value x Combination	1	.427	.40	.01
Age	1	.003	.00	.00
Gender	1	.060	.06	.00
PGSI Status (PGSI 0, PGSI 1+)	1	.007	.01	.00
Error	83			
Total	94			

* $p < .05$

The Control Model assessed each of the 9 conditions of the experiment (per Table 4.1) as the primary independent variable, with Age, Gender and Dichotomised PGSI as covariates. Fisher's LSD tests revealed that the positive change in physiological arousal (GSR) was

greatest for the Ticket jackpot where the jackpot \$-value was shown (\$25,000) but the winning symbol combination was unknown. More generally, consistent with the Factorial Model, the unknown “Mystery” winning symbol combination contributed to a greater positive change in physiological arousal than the known combination (see Figure 4.4).

Figure 4.4 Physiological Arousal (GSR)



4.8 Discussion

The Full Factorial Models failed to show systematic effects for either Hidden Jackpots (where the \$ value is withheld) or Mystery Jackpots (where the winning combination is not shown) on player behaviour, with the exception of the measure of Physiological Arousal (GSR/Skin Conductance). Physiological arousal changes from the baseline period to the experiment were most positive when the winning jackpot combination was a Mystery. Therefore, there is some evidence to suggest that *not* showing a winning combination can contribute to physiological arousal. In past research, physiological arousal has been

associated with greater gambling intensity, but only if this experience is subjectively interpreted as a positive emotion (Rockloff and Greer, 2010).

The Control ANCOVA Models revealed some detail on the specific jackpot combinations that generally contributed to more intense gambling behaviour. In particular, the suggestively large “ticket” jackpots where the \$ value of the prize was hidden from players (i.e., not shown on the EGM as the potential \$25,000 top prize), but where the winning symbol combination was displayed (a non-mystery) contributed to both the fastest gambling speeds (Bets per Minute) and greatest persistence while losing (Total Trials Played). Speculatively, this may have resulted from a subjective feeling that a winning combination was possible to achieve. The jackpot symbols, while rare, did occasionally fall on the win line. This seemed to be most attractive to players, however, when the top prize of the ticket jackpot was *not* known to players – and therefore potentially very large. Importantly, the persistence of play in this condition combination was greater than the control condition (no jackpot), suggesting that large hidden value jackpots can contribute to gambling intensity – if accompanied by advertised symbols that suggest such a win is possible. It is also noteworthy that although non-mystery jackpots generally were associated with lower increases in physiological arousal, the high-value hidden jackpots still had the highest increases in arousal within that set.

4.9 Limitations

It is important to recognise the limitations of experiments in general with regard to threats to external validity. This study did not attempt to faithfully recreate all the aspects of a real gambling venue, but rather simulated the psychological contingencies that should act upon real world decision making.

It is possible that the findings can be somewhat sensitive to the specifics of operation for a particular machine, as our machine occasionally (although rarely) showed the jackpot winning symbol on the win-line. Nevertheless, these findings could be considered at least indicative of a cause for concern for hidden jackpots that suggest high-value prizes.

4.10 Conclusion

This experiment demonstrated that suggestively large-value hidden jackpots (where the \$ value prize is not shown, but might be considered high-value) potentially contributes to intensive betting in the form of gambling speed and persistence; especially when a winning-symbol combination suggests that such a win is possible. Thus, hidden jackpots may deserve further scrutiny. There is no evidence here to suggest that such jackpots contribute to greater player enjoyment, but nevertheless there is some preliminary evidence to suggest a contribution of hidden jackpots to risky playing behaviour.

4.11 References

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SurveyMonkey [Computer Software]. (1999). Portland, Oregon, USA.

Chapter 5: Experiment 3 Socially Networked Jackpots

Linked jackpots draws can be won on several machines (often a bank of machines located in close proximity) and the trigger of a jackpot win on one machine necessarily precludes a win on another. Linked jackpots might be either shared only within the same venue (local area), or shared across multiple venues (wide-area).

Linked Jackpots may artificially increase the perceived likelihood of winning a large prize (Hare, 2010). Linked jackpots may also be more attractive through the offer of typically large jackpot prizes, which are made possible by multiple contributing machines. However, it is hitherto unknown whether the impact of linked jackpots on player optimism is greater when jackpots are linked locally (within venues) or remotely (across venues). Evidence suggests that gambling intensity is magnified by social motivations (Rockloff & Dyer, 2007; Rockloff & Greer, 2010; Rockloff, Greer, & Evans, 2012; Rockloff, Greer, & Fay, 2010). The presence of other gamblers vying for a locally linked jackpot may create a sense of urgency or competition, thereby increasing EGM gambling intensity. However, Hing and Breen (2005) found that the availability of linked jackpots linked across multiple venues might lead to unrealistic optimism, which also contributes to gambling intensity.

5.1 Impact of Socially Networked Jackpots on Gambling Intensity and Player Enjoyment

Socially Networked Jackpots allow for higher jackpot prizes with a smaller contributing investment per machine. Thus, machines can still provide small wins and the potential for a large jackpot prize. Socially Networked Jackpots can also introduce social factors into gambling decisions, such as a perception of competition amongst players who are gambling simultaneously. Of course, this same competition may exist on stand-alone jackpot machines; however the player only relinquishes their attempt for the jackpot when they leave

the machine. While playing, they have exclusive access to the potential jackpot. In Socially Networked Jackpots, players compete for an available jackpot simultaneously. A long research tradition in Social Facilitation shows that simultaneous competition intensifies performance (Zajonc, 1965).

5.2 Socially Networked Jackpot Experiment

The present study sought to investigate the effects of Socially Networked Jackpots in an experimental paradigm. Our primary outcomes were measures of gambling intensity, including Average Bet Size, Speed of Betting (Bet per Minute), Persistence (Total Trials Played), and Final Payouts (Wins/Losses). Additionally, we measured subjective player enjoyment with a 1 item 6-point Likert item at the conclusion of the experiment. We had no *a priori* hypotheses about which Socially Networked Jackpot (Linked or Wide-area) should contribute to gambling intensity, as there was no strong theory or past findings that address this comparison.

5.3 Method

5.3.1 Participants

One hundred and fifteen (114) subjects (female = 69, male = 45) from the Rockhampton city and surrounding (QLD) areas responded to flyer advertisements placed in local community newspapers (the Rockhampton and Capricorn Coast Mirrors). Ages ranged from 18 to 81 year ($M = 40$, $SD = 18.13$). One additional male participant elected not to continue after

having completed the initial pre-gambling survey and was not included in the data set. Seventy-two percent (72.6%) of participants identified as Australian, 6.2% as Filipino, 3.5% as English, 2.7% as New Zealander, 2.7% as Chinese, 1.8% each from India and the United States, and a further 8.9% as 'other'. Additionally, 2 (1.8%) participants also identified as being Indigenous Australians. Seventy four percent (74%) of the sample gambled on a casino style game at least once within the last 12 months.

5.4 Procedure

5.4.1 The Simulated EGM

Subjects played a 3 reel laptop simulated EGM created in Visual Basic (see Figure 5.1 below). The EGM was programmed with a fixed sequence of wins on trials 3, 5, 11, 19, 25 and 34, and infinite losses thereafter. Players were given \$20 cash on arrival at their appointed time. After completing a brief demographic questionnaire, participants were asked if they would like to wager their \$20 compensation on the EGM. The \$20 cash compensation was retrieved from the participants, and participant played the EGM pre-loaded with 2000 in 1c credits. Subjects bet 25, 50 or 100 cents on each spin, and all wins paid x10 the amount bet. The EGM produced the typical sights and sounds of EGM play, including the musical sounds of spinning reels and winning bells.

Physiological measurements were taken as potential indicators of arousal and emotional state. Physiological arousal was measured from galvanic skin response (GSR) using Biograph Infiniti system and software.

Figure 5.1 Simulated EGM depicting the jackpot amount.



5.5 Conditions

Participants were assigned to conditions using a crossed design (see Table 5.1). Due to the small cell size in the experiment, randomised block assignment was used to assign participants to condition based on a pre-experiment questionnaire answers on age, gender and lie-bet score. Based on this random assignment, approximately 1/3 of participants were presented with a potential \$500 cash jackpot in a jar prior to play. A further 1/3 participants were presented a jackpot of 500 lottery tickets for a potential \$25,000 prize (also shown in jar). A final 1/3 of participants were assigned to a control condition (no jackpot).

In another crossed condition, participants were assigned to either a Local Area Network (LAN) or Wide Area Network (WAN) social group. In the LAN condition, participants were lead into a room containing a group of 5 confederates posing as research volunteers whom

each played a separate laptop-based EGM simulator. In the WAN condition, participants were informed that they would be playing a remotely networked EGM along with five players at another location. Participants in this condition were shown a simulated live video feed of a group of five confederates playing in another room. All participants were told that someone in the experiment would win the jackpot prize, and that the prize could be won on any machine at any time (locally or remotely networked).

Table 5.1 Assignment of Subjects to Conditions

Condition	Cash	Tickets	Control	LAN	WAN
1	✓			✓	
2	✓				✓
3		✓		✓	
4		✓			✓
5			✓	✓	
6			✓		✓

5.6 Results

5.6.1 Data Analyses

An ANCOVA model was calculated for each outcome, including Average Bet Size, Betting Speed (Bets per Minute), Persistence (Total Trials Played), and Last Bank (Cash Out); as well as Player Enjoyment measured with one 6 point Likert item and Skin Conductance (GSR) measured with the Biograph Infinity System. Covariates for the models included Age, Gender and Problem Gambling Status (PGSI Score).

5.6.2 Average Bet Size

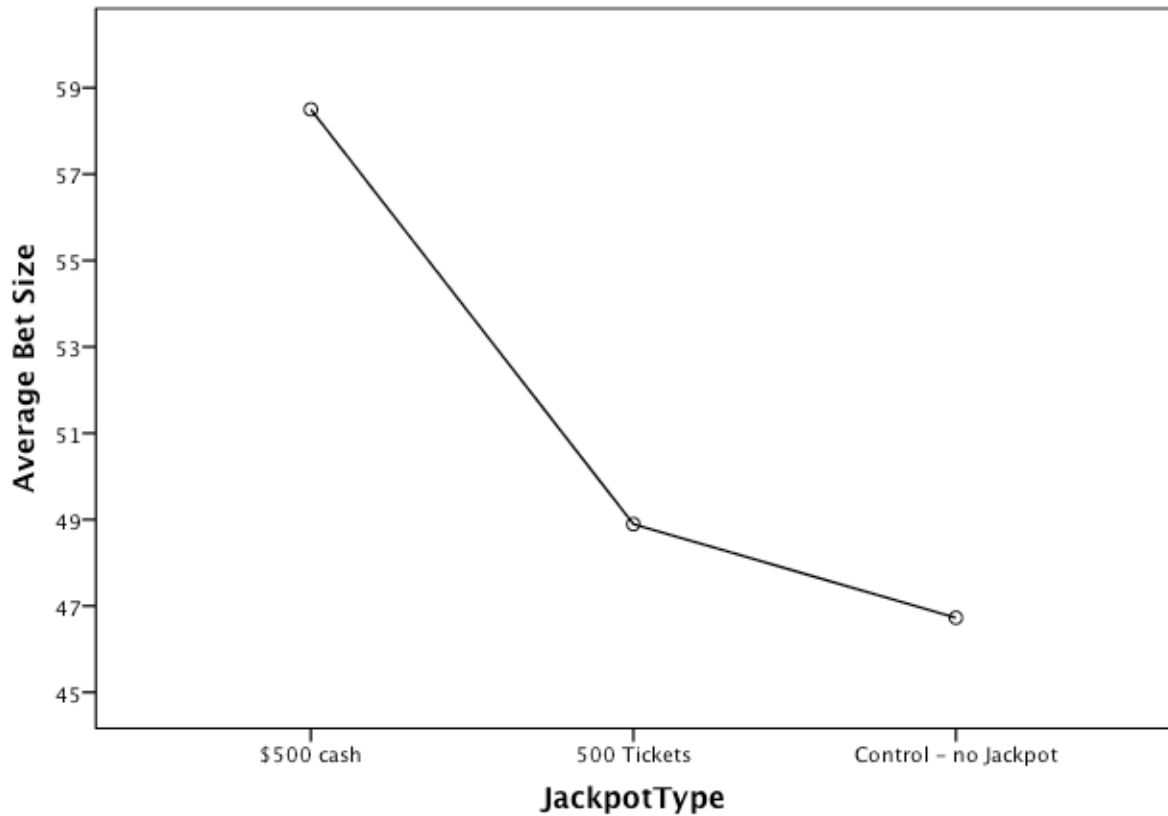
The ANOVA results predicting Average Bet Size are shown in Table 5.2. The Prize variable showed a significant main effect, whereby subjects shown the \$500 cash jackpot had higher bet sizes than those in the 500 ticket condition and the no-jackpot control condition (see Figure 5.2).

Table 5.2 ANCOVA predicting Average Bet Size from Jackpot Prize (\$500 Cash or 500 Instant Scratch Tickets), Network (LAN or WAN)

Variable	df	MS	F	Eta ²
Prize (\$500 Cash, 500 Scratch Tickets, No Prize)	2	1470.78	3.10*	.06
Network (LAN or WAN)	1	272.53	.57	.01
Prize x Network	2	131.61	.28	.01
Age	1	136.38	.29	.00
Gender	1	1489.93	3.14	.03
PGSI	1	189.88	.40	.00
Error	104	475.08		
Total	112			

* p < .05.

Figure 5.2 Average Bet Size by Jackpot Type



Covariates appearing in the model are evaluated at the following values: Gender = .39, Age (years) = 40, PGSI = 1.84

5.6.3 Speed of Betting

An ANCOVA model with Speed of Betting (in Bets per Minute) showed no significant effects for either jackpot prize (\$500 cash, 500 Tickets or No-jackpot Control), or Social Network Type (LAN or WAN). However, the covariate of Age proved significant, $p < .05$, whereby younger players bet faster than older gamblers (see Table 5.3).

Table 5.3 ANCOVA predicting Speed of Betting from Jackpot Prize (\$500 Cash or 500 Instant Scratch Tickets), Network (LAN or WAN)

Variable	df	MS	F	Eta ²
Prize (\$500 Cash, 500 Scratch Tickets, No Prize)	2	2.53	.82	.02
Network (LAN or WAN)	1	10.82	3.53	.03
Prize x Network	2	.21	.07	.00
Age	1	83.27	27.13*	.21
Gender	1	9.89	3.22	.03
PGSI	1	.14	.04	.00
Error	104	3.07		
Total	112			

* $p < .05$.

5.6.4 Persistence (Total Trials Played)

An ANCOVA model with Total Trials Played as the dependent variable showed no significant effects for the experimental variables, interactions or covariates, $p > .05$, ns (see Table 5.4).

Table 5.4 ANCOVA predicting Total Trials Played from Jackpot Prize (\$500 Cash or 500 Instant Scratch Tickets), Network (LAN or WAN)

Variable	df	MS	F [^]	Eta ²
Prize (\$500 Cash, 500 Scratch Tickets, No Prize)	2	454.66	.35	.01
Network (LAN or WAN)	1	2617.05	2.00	.02
Prize x Network	2	155.84	.12	.00
Age	1	234.32	.18	.00
Gender	1	3051.45	2.33	.02
PGSI	1	799.13	.61	.01
Error	104	1307.67		
Total	112			

[^] No significant model effects at $p < .05$.

5.6.5 Last Bank

An ANCOVA model with Last Bank as the dependent variable showed no significant effects for the experimental variables, interactions or covariate, $p > .05$, ns (see Table 5.5).

Table 5.5 ANCOVA predicting Last Bank from Jackpot Prize (\$500 Cash or 500 Instant Scratch Tickets), Network (LAN or WAN)

Variable	df	MS	F [^]	Eta ²
Prize (\$500 Cash, 500 Scratch Tickets, No Prize)	2	1752902.21	.91	.02
Network (LAN or WAN)	1	4010387.46	2.08	.02
Prize x Network	2	287480.24	.15	.00
Age	1	1388825.17	.72	.01
Gender	1	6181788.52	3.20	.03
PGSI	1	502592.81	.26	.00
Error	104			
Total	112			

[^] No significant model effects at $p < .05$.

5.6.6 Enjoyment

An ANCOVA model with Player Enjoyment (6 point Likert Item) as the dependent variable revealed no significant effects for the experimental conditions or interactions, $p > .05$, ns. However, the covariate of Gender was significant, such that Male subjects ($M = 4.64$, $SD = 0.97$) rated enjoyment of the simulated EGM as greater than Female participants ($M = 4.00$, $ASD = 1.61$), $p < .05$ (see Table 5.6).

Table 5.6 ANCOVA predicting Enjoyment from Jackpot Prize (\$500 Cash or 500 Instant Scratch Tickets), Network (LAN or WAN)

Variable	df	MS	F	Eta ²
Prize (\$500 Cash, 500 Scratch Tickets, No Prize)	2	1.37	.70	.01
Network (LAN or WAN)	1	.22	.11	.00
Prize x Network	2	1.62	.83	.02
Age	1	4.28	2.18	.02
Gender	1	9.97	5.09*	.05
PGSI	1	2.26	1.15	.01
Error	104	1.96		
Total	112			

* $p < .05$.

5.6.7 Physiological Arousal (GSR)

An ANCOVA model using GSR as the dependent measure found a significant effect for Network Type, such that there was a greater increase in GSR for the WAN condition ($M = +0.197$ standardised) than the LAN condition ($M = -.254$ standardised), $p < .01$ (see Table 5.7). Moreover, the covariate Age showed a significant effect, such that younger subjects had greater positive changes in physiological arousal/GSR compared to older participants, $p < .01$.

Table 5.7 ANCOVA predicting Skin Conductance/GSR from Jackpot Prize (\$500 Cash or 500 Instant Scratch Tickets), Network (LAN or WAN)

Variable	df	MS	F	Eta ²
Prize (\$500 Cash, 500 Scratch Tickets, No Prize)	2	1.07	1.34	.03
Network (LAN or WAN)	1	5.60	7.02**	.06
Prize x Network	2	.07	.08	.00
Age	1	6.71	8.42**	.08
Gender	1	1.29	1.62	.02
PGSI	1	.41	.51	.01
Error	104			
Total	112			

** $p < .01$.

5.7 Discussion

The present experiment failed to show reliable evidence of differences between the WAN and LAN conditions on Bet Size, Betting Speed, Persistence, Last Bank or Player Enjoyment. Prior research has suggested that social facilitation, and in particular the sights and sounds of other players winning, can motivate greater gambling intensity in groups. However, the present experiment did not find any differences for these outcomes based on whether others were immediately present or, alternatively, only present via a (fake) remote video-conference feed. The only significant finding for Network Type was on change in Physiological Arousal/GSR, whereby subjects in the WAN condition showed greater increases in GSR to the LAN condition. However, this might be explained by the baseline being performed with others present in the LAN condition, whereas the LAN video-feed baseline was performed prior to starting the fake video-conference session.

5.8 Limitations

Failure to find significant effects for the LAN and WAN conditions cannot be taken as evidence that there is no potential importance to the distinction between Local Area and Wide Area jackpots on player behaviour or enjoyment. There may be a critical difference in the social context within real venues compared to the context of the experiment. For instance, players might feel a greater deal of either solidarity or competition with other local and wide-area gamblers in real venues. Players who are members of a club, for instance, may find a local-area jackpot more valuable, as other fellow club members are likely to be the beneficiaries of an eventual payoff. Research on In-group/Out-group bias (Tajfel 1979) consistently demonstrates favouritism towards an in-group, even when the groups are composed on nominally irrelevant criteria (Billig and Tajfel, 1973). We purposefully did not try to simulate group favouritism. Instead, this experiment simulated a neutral consideration

Socially Networked Jackpots

of close or distant confederates. Future studies, however, might explicitly look at elements of group prejudice that might potentially produce behavioural differences between jackpots that are local or wide-area.

5.9 References

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Chapter 6: Experiment 4 Jackpot Expiry

EGM pre-commitment is a system whereby, prior to play, customers nominate a limit to their maximum acceptable losses over a fixed period (e.g., 1 day or 1 week). Player behaviour is tracked with a smart card or other identifying technology, and gamblers who exceed their self-nominated loss limits are temporarily locked out of further gambling. This technological solution may help people to adhere to self-imposed loss limits that they might otherwise be tempted to exceed in the heat of play.

Mandatory pre-commitment insists that all players use the identification and tracking technology to play EGMs; whereas optional pre-commitment allows people to optionally avoid using the player tracking technology.

6.1 Jackpot Expiry Feature

One potential added benefit of pre-commitment is to use the embedded tracking technology to target consumer protection features based on player behaviour. *Jackpot Expiry* is one such added feature of mandatory pre-commitment introduced here, whereby players are given a 'soft brake' on their gambling through a notification that they are no longer eligible for jackpot prizes after a fixed amount of EGM play (e.g., 1 hour, 500 games, etc).

The presence of jackpots prizes can be a potent incentive to continue to gamble in the face of mounting losses, as jackpots can provide a means of realising an instantaneous reversal of fortunes. Thus, the presence of jackpots may be particularly motivating for a player with large accumulated losses, as losing generally tends to make people more risk seeking with respect to large low-probability gambles (Kahneman and Tversky, 1979).

6.2 Validation of Jackpot Expiry

Jackpot Expiry must have a discernible impact on moderating EGM gambling intensity to be effective. Aspects of player behaviour that are associated with long-run losses include: higher average bet size, betting persistence while losing, and faster betting.

6.3 Jackpot Expiry Experiment

The present study sought to investigate the effects of *Jackpot Expiry* in an experimental paradigm. Experiments offer a high degree of internal control, whereby the effect of Jackpot Expiry can be reliably related to aspects of player behaviour. Our hypothesis was that during an experimental gambling session with Jackpots that “expire”, players would exhibit lower intensity gambling following expiry that leads to lower player losses. The experiment can provide evidence for effectiveness of such a system for implementation as an added player protection in a mandatory pre-commitment system.

6.4 Methods

6.4.1 Participants

One hundred and thirty volunteers (males = 56, females = 74) were recruited through Bundaberg area newspaper flyers for an EGM experiment conducted between April and May 2013. The procedure for the experiment, detailed further below, involved presenting a warning message in the test condition informing participants that a promised jackpot had ‘expired’ and could no longer be won. Thus, the behaviour of interest was player actions past the presentation of the warning message, which was always shown on the 21st trial. Twenty-

three (23) participants quit the EGM before reaching the 21st trial. These participants were not informative on the influences of jackpot expiry, and thus were not included in the final analysis. Participants who bet past the 20th trial totalled 107 people, including 45 males and 62 females. The cultural backgrounds of volunteers in the final sample were Australian (78.5%), English (6.5%), Indigenous Australian (5.5%) and other backgrounds (9.5%) each comprising less than 2% of the total. Problem gambling status, as computed from the Problem Gambling Severity Index (PGSI, Ferris and Wynne, 2001), completed after the experiment, included 55.1% no risk, 21.5% low risk, 18.6% moderate risk, and 4.6% problem gamblers. Seventy percent (70%) of the sample gambled on a casino style game at least once within the last 12 months.

6.5 Procedure

6.5.1 The Simulated EGM

Subjects played a 3 reel laptop simulated EGM created in Visual Basic (see Figure 6.1 below). The EGM was programmed with a fixed sequence of wins on trials 2, 6, 8, 13, and 20, and infinite losses thereafter. Players were given \$20 cash on arrival at their appointed time. After completing a brief demographic questionnaire, participants were asked if they would like to wager their \$20 compensation on the EGM. The \$20 cash compensation was retrieved from the participants, and participant played the EGM pre-loaded with 2000 in 1c credits. Subjects bet 25, 50 or 100 cents on each spin, and all wins paid x10 the amount bet for a theoretical maximum of \$61.25. The EGM produced the typical sights and sounds of EGM play, including the musical sounds of spinning reels and winning bells.

Physiological measurements were taken as potential indicators of arousal and emotional state using the Biograph Infinity System. Skin Conductance and skin temperature were measured using wireless wristband sensor and sampled 8 times per second.

Figure 6.1 The Simulated EGM.



6.6 Conditions

Participants were assigned to conditions using a crossed design (see Table 6.1). Randomised block assignment to condition was used to balance potentially important covariates across condition. The blocking variables came from a pre-experiment questionnaire, and included Gender, Age and Lie-bet scores. The randomised block assignment was used to match approximately ½ of participants to being presented with a potential \$500 cash jackpot in a mason jar prior to play. The other ½ of participants were presented a jackpot of 500 lottery tickets for a potential \$25,000 prize (also shown in jar). All participants were told that someone in the experiment would win the jackpot prize. In another

crossed condition, subjects were presented with either: 1) a “relevant” message on the 21st trial saying that the jackpot had expired and could no longer be won, 2) an “irrelevant” popup message that simply said ‘click OK to continue’, and 3) a control condition with no popup message.

Table 6.1 Assignment of Subjects to Conditions

Condition	Cash	Tickets	Relevant	Irrelevant	Control
1	✓		✓		
2	✓			✓	
3	✓				✓
4		✓	✓		
5		✓		✓	
6		✓			✓

6.7 Results

6.7.1 Data Analysis

The primary behavioural outcomes of interest include average bet size, betting speed (bets per minute) and persistence betting (total trials played), where each measure was calculated past the 20th trial, and with the presentation of the Jackpot Expiry message in the test condition. A direct measure of accumulated player losses past the 20th trial was also included as a relevant outcome, as was Physiological Arousal/GSR.

Each outcome was analysed with an ANCOVA model using jackpot type (cash or tickets) and message (relevant, irrelevant or control) as the primary predictive variables in a crossed

design. Problem gambling status (PGSI), gender and age were entered as covariates only, as none of these variables proved useful in producing significant interactions.

6.7.2 Average Bet Size

The average bet size was significantly smaller after trial 20 for subjects who were shown the \$500 cash jackpot ($M = 43.2$ cents, $SD = 13.1$) compared to those shown the ticket jackpot ($M = 51.1$ cents, $SD = 23.2$), $p = .02$. Moreover, average bets were *marginally* higher for players with 1 or more gambling problems ($M = 50.9$ cents, $SD = 18.4$) compared to those with no identifiable problems ($M = 44.6$ cents, $SD = 20.0$), $p = .05$ (see Table 6.2).

Table 6.2 ANCOVA predicting Average Bet Size from Jackpot Prize (\$500 Cash or 500 Instant Scratch Tickets), and Message (Relevant, Irrelevant or Control)

Variable	df	MS	F	Eta ²
Prize (\$500 Cash, 500 Scratch Tickets)	1	2063.09	5.54*	.05
Message (Relevant, Irrelevant or Control)	2	27.18	.07	.01
Prize x Message	2	72.28	.19	.00
Age	1	16.28	.04	.00
Gender	1	107.48	.29	.00
PGSI (0,1)	1	1468.74	3.95	.04
Error	98	372.20		
Total	106			

* $p < .05$.

6.7.3 Speed of Betting (Bets per Minute)

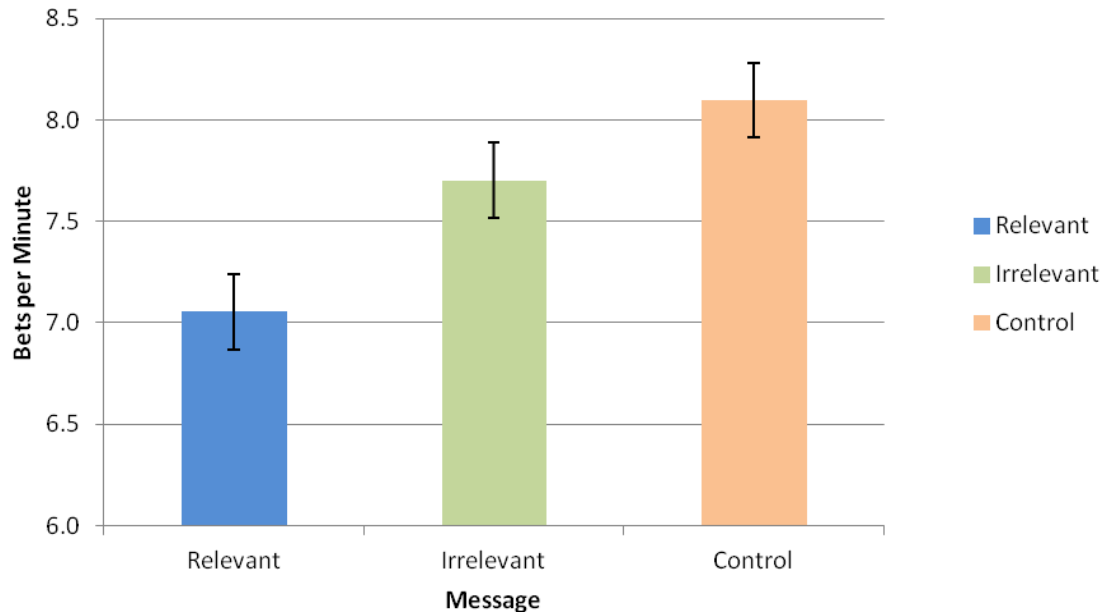
There were significant main effects for both jackpot type and message on the speed of betting, $p = .006$ and $p = .001$, respectively (see Table 6.3). The cash jackpot had significantly faster betting ($M = 7.89$ bets per minute, $SD = 1.40$) than the tickets jackpot ($M = 7.33$ bets per minute, $SD = 0.95$), $p = .006$. Moreover, as shown in Figure 6.2, the speed of betting was significantly slower in the “relevant” test condition compared to the control condition, $p = .001$, and compared to the irrelevant conditions, $p = .015$.

Table 6.3 ANCOVA predicting Speed of Betting from Jackpot Prize (\$500 Cash or 500 Instant Scratch Tickets), and Message (Relevant, Irrelevant or Control)

Variable	df	MS	F	Eta ²
Prize (\$500 Cash, 500 Scratch Tickets)	1	9.30	7.78*	.07
Message (Relevant, Irrelevant or Control)	2	9.63	8.05*	.14
Prize x Message	2	1.83	1.53	.03
Age	1	3.51	2.94	.03
Gender	1	.91	.76	.01
PGSI (0,1)	1	.04	.03	.00
Error	98	1.20		
Total	106			

* $p < .05$.

Figure 6.2 Speed of Betting by Message-Condition.



6.7.4 Total Trials Played

There was a significant main effect for age on the number of trials played after the 20th Trial, with older players being more persistent in their betting than younger players (Partial Eta Squ = .046). There were no significant effects of jackpot type or message type on persistence as measured by trials played (see Table 6.4).

Table 6.4 ANCOVA predicting Total Trials Played from Jackpot Prize (\$500 Cash or 500 Instant Scratch Tickets), and Message (Relevant, Irrelevant or Control)

Variable	df	MS	F	Eta ²
Prize (\$500 Cash, 500 Scratch Tickets)	1	12.54	.01	.00
Message (Relevant, Irrelevant or Control)	2	2000.07	2.29	.05
Prize x Message	2	632.03	.72	.02
Age	1	4118.82	4.72*	.05
Gender	1	143.23	.16	.00
PGSI (0,1)	1	13.22	.02	.00
Error	98	873.61		
Total	106			

* $p < .05$.

6.7.5 Losses past 20th Trial

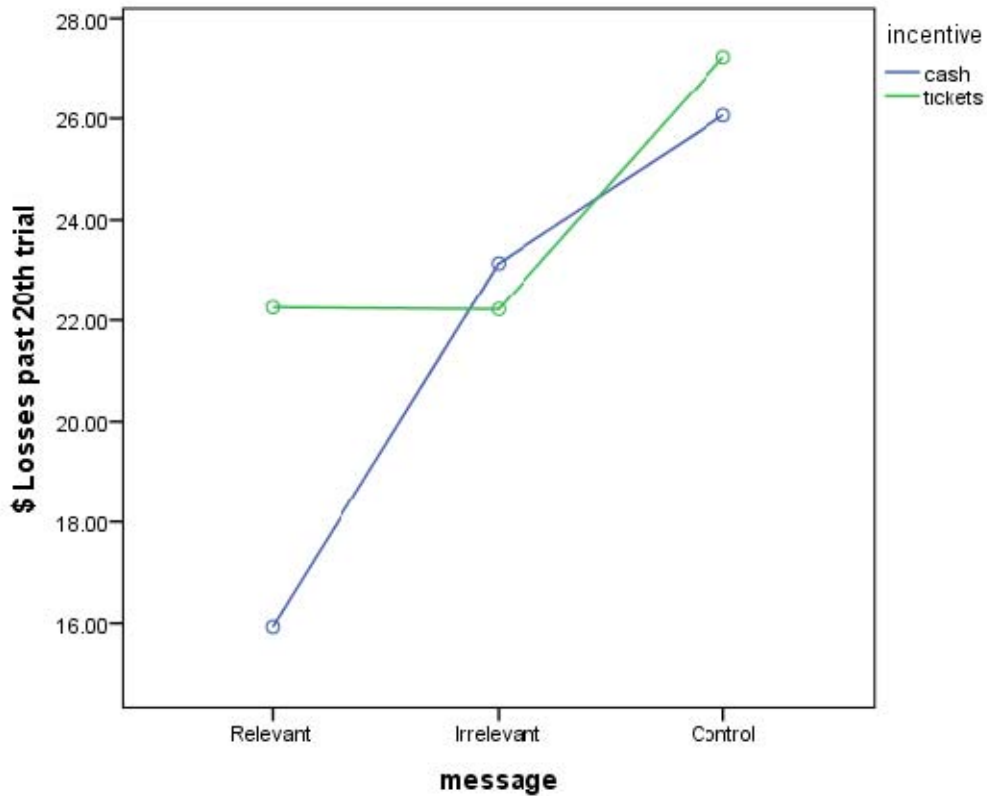
There was a main effect for message type, such that the relevant message (withdrawing the jackpot) reduced total losses for players, $p = .033$. Older participants lost more money, $p = .038$, $Eta = .043$ (see Table 6.5). There was also a significant interaction between jackpot type and message type, which is illustrated in Figure 6.3. The principal nature of the interaction was smaller losses for the cash jackpot, compared to the ticket jackpot, when subjects were shown the relevant Jackpot-expiry message.

Table 6.5 ANCOVA predicting Total Trials Played from Jackpot Prize (\$500 Cash or 500 Instant Scratch Tickets), and Message (Relevant, Irrelevant or Control)

Variable	df	MS	F	Eta ²
Prize (\$500 Cash, 500 Scratch Tickets)	1	116.93	.84	.01
Message (Relevant, Irrelevant or Control)	2	493.33	3.54*	.07
Prize x Message	2	120.51	.87	.02
Age	1	617.61	4.43*	.04
Gender	1	79.37	.57	.01
PGSI (0,1)	1	238.65	1.71	.02
Error	98	139.40		
Total	106			

* $p < .05$.

Figure 6.3 Losses Past Trial 20 by Incentive and Message Type



Covariates appearing in the model are evaluated at the following values: Age = 51.7, Gender (0,1) = .58, pgsi (0,1) = .45

6.7.6 Enjoyment

An ANCOVA model was calculated with post-experiment rated Player Enjoyment (6 point Likert item) as the dependent variable. There were no significant effects for the experimental variables on player enjoyment and no covariates proved significant, $p > .05$, ns (see Table 6.6).

Table 6.6 ANCOVA predicting Skin Conductance Change from Jackpot Prize (\$500 Cash or 500 Instant Scratch Tickets), and Message (Relevant, Irrelevant or Control)

Variable	df	MS	F [^]	Eta ²
Prize (\$500 Cash, 500 Scratch Tickets)	1	.08	.05	.00
Message (Relevant, Irrelevant or Control)	2	.82	.47	.01
Prize x Message	2	.78	.45	.01
Age	1	.76	.44	.00
Gender	1	3.86	2.22	.02
PGSI (0,1)	1	2.89	1.66	.02
Error	95	1.74		
Total	103			

[^] no significant effects at $p < .05$.

6.7.7 Physiological Arousal (Skin Conductance)

There were no significant changes in baseline-to-test skin conductance by experimental condition. Moreover, covariates were not significant predictors of skin conductance changes (see Table 6.7).

Table 6.7 ANCOVA predicting Skin Conductance Change from Jackpot Prize (\$500 Cash or 500 Instant Scratch Tickets), and Message (Relevant, Irrelevant or Control)

Variable	df	MS	F [^]	Eta ²
Prize (\$500 Cash, 500 Scratch Tickets)	1	.96	.91	.34
Message (Relevant, Irrelevant or Control)	2	1.17	1.11	.33
Prize x Message	2	2.13	2.02	.14
Age	1	1.55	1.47	.23
Gender	1	.34	.32	.57
PGSI (0,1)	1	2.40	2.27	.14
Error	95	1.06		
Total	103			

[^] no significant effects at $p < .05$.

6.8 Discussion

The present experiment sought to investigate the effect of Jackpot Expiry on player behaviour by varying the messages shown to players on the 21st trial. In the test condition, players were shown a “relevant” message stating that the promised jackpot had expired and could no longer be won by the participant. In the irrelevant message condition a similar pop-up message simply said to push the button to continue. Lastly, a control condition had no pop-up message about the jackpot expiring.

The hypotheses were that Jackpot Expiry, as represented by the test condition, should moderate behavioural indicators of gambling intensity. The results showed some evidence that behaviour was modified by expired jackpots. First, bet speed was significantly slowed by the jackpot expiry message compared to the irrelevant message condition and the no message control condition. Perhaps most importantly, player losses past the 20th trial were significantly reduced in the jackpot expiry condition, and the effect was most pronounced for cash jackpots. Thus, we can conclude that there is experimental evidence to suggest that jackpot expiry is likely to have a measurable effect in limiting player losses in the long run.

The physiological indicator of Skin Conductance did not show evidence for reliable changes in physiological arousal. Speculatively, the influence of the messages may relate to cognitive factors rather than emotional factors.

6.9 Limitations

Experiments are exposed to threats to external validity. Participants may not have reacted in this experiment entirely in the same way they would in a real venue due to the different environment and perceived contingencies in the artificial confines of the lab. Nevertheless,

players were betting with real money and were allowed to keep their winnings, and thus, some of the same psychological processes should still affect their behaviour. Moreover, the directions of the effects were largely in agreement with *a priori* hypotheses.

6.10 Conclusion

The present experiment provides preliminary evidence to suggest that Jackpot Expiry could be an effective means of providing a 'soft brake' for player behaviour as part of a mandatory pre-commitment system. Jackpot expiry does not interrupt play and should have only a modest effect on player enjoyment. In fact, highly intense betting – including betting in excess of 2 hours in one session – is strongly related to gambling problems (Rockloff 2011). Thus, jackpot expiry can be a targeted solution that preserves the entertainment value of jackpots, yet removes the unwanted side-effect of encouraging gambling persistence among players who are losing.

6.11 References

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Chapter 7: Shadowing Jackpots

In order to enhance the external validity of the experimental work described in previous sections, we followed volunteer regular EGM players while they gambled in their customary venues. This study allowed us to verify some aspects of our laboratory-based experimental results in real venue settings. This involved the unobtrusive 'shadowing' of patrons and the recording of aspects of their gambling behaviour in venues. After each session, we surveyed attitudinal aspects relating to their play. We also examined, via behavioural and monetary measures, whether jackpots have a stronger impact on gamblers who are already experiencing problems. A structural analysis of the gaming session data is also presented. The reader is directed to the literature review delivered in the first phase of this project for a research literature background and theoretical context for this study.

7.1 Method

7.1.1 Participants

Arrangements were made with three major Australia gaming venues located in Queensland and New South Wales to conduct research in their gaming areas. Research observers were recruited from prior volunteers in prior experimental gambling research, as well as graduate students, most of whom had substantive EGM playing experience. In total, 234 players (162 female) were recruited in-venue, and 'shadowed' (described in the next section) by research assistants over the course of 442 EGM play sessions. Each participant was only followed once, but some gamblers switched machines during the observation period. The median age of participants was 58 years ($M = 55$, $SD = 17.7$). This is higher than the Australian population median (37 years), which reflected the demographics of the venue clientele. Most

of participants ($N = 190$, 81%) identified as having an Australian or New Zealand cultural background, with the remainder split between European and Asian / sub-continental nationalities. Eighty-seven participants ($N = 87$, 37%) had achieved year 12 or equivalent qualifications, with a further 19 (8%) possessing a tertiary qualification. The median total annual income was in the \$20,800 - \$31,199 bracket. Each participating player completed the Problem Gambling Severity Index (PGSI) during the post-play survey (described below), which is an established indicator of problematic gambling behaviour (Currie, Hodgins, & Casey, 2013; Sharp et al., 2012). A mean PGSI score of 2.7 ($SD = 4.5$) was observed, with 140 (59%) participants scoring 1+, 47 (20%) scoring 5 or greater, and 21 scoring 8+ (9%).

7.2 Procedure

Observers attended the gaming lounges of each venue and invited players to participate in a 'responsible gambling study'. Players were offered a \$50 venue voucher, which was redeemable for food and beverage purchases. Participants were informed that the aim of the study was to observe how people played the poker machines. Data collection involved three stages:

1. Pre-play survey and priming manipulation
2. Live observation of play
3. Post-play questionnaire

7.3 Player-characteristics: pre-play survey and priming manipulation

During the pre-play survey, participants provided demographic survey information. At this time, observers aimed to make the player as comfortable as possible, engaging in small-talk and asking questions about the participants. This was considered an important process in order to increase the likelihood of natural and uninhibited behaviour during subsequent live observation of play.

Approximately 50% of participants, stratified by age and gender, were randomly assigned to the priming condition. In contrast to the control, the priming condition involved the administration of a further set of four open-answer questions that were designed to encourage jackpot-oriented aspirational imagery. The items were preceded by the statement: 'Imagine that you won a Jackpot today. The lights are flashing and winning music is playing.' The questions were; 'How would your life change?', 'Who would you want to know about your good luck?', 'If you used the money for a trip, where would you go?', and 'If you used the money to buy something else, what would you buy?'

7.4 Shadowing: Live observation of play

The observer explained to each player that playing in their normal manner would help increase the reliability of the study. Players were asked to simply do what they were originally intending to do in terms of EGM play before they were enrolled in the study. Players were encouraged to play for as long or as little as they liked, and to move to different machines or take breaks as they normally would. Observers followed players as they moved through the gambling lounge. Observers stationed themselves at an optimal location near the player so as to be close enough to observe play, but with care to not intrude on the

player. Observers also chose a location where they could observe the EGM screen such that their view was not occluded by the player, and further stood outside of the player's field of view. The recording procedure described below was repeated for each machine the player visited.

7.5 Machine characteristics

At the outset of play on a particular EGM, observers commenced a new machine scoring sheet, which included the full name of the EGM, e.g. 'Queen of the Nile – Special Diamond Edition', and serial number of the machine. This information was used subsequently to source further details of jackpots from the licensed monitoring operator. The following information was also recorded:

1. Denomination: smallest bet size (in cents)
2. Linked jackpots: whether or not a wide area or local area network jackpot was available
3. Jackpot advertising: either above the EGM itself, or above a bank of linked machines, there may be a sign saying 'Win \$50,000' or similar
4. Prizes: the displayed monetary value of each jackpot prize (up to 5 prizes) available on the machine was recorded

7.6 Play characteristics

At the beginning and end of play on a particular EGM, the start and finish times were recorded, allowing calculation of time-on-machine or play-persistence ('Time'). Observers noted funds deposited into the EGM each time players fed notes or coins into the machine, for subsequent calculation of an aggregate 'Money In' measure. When playing the EGMs,

players press the bet or credit button, then the lines button, which activates a particular bet / reel-spin setting. Spins or plays are then usually repeatedly undertaken by pressing the appropriate button. Monitoring this behaviour allowed observers to tally plays (trials played) in an appropriate column of the scoring sheet ('N. Plays'). Through appropriate column weighting, an estimation of the number of credits lost during play was created. By combining 'N. Plays' with 'Time', an aggregate measure of plays per minute ('Play Rate') was also produced.

Wins made by players during the session were also recorded by tallying the number of occurrences in an appropriate column. The column categories were: \$0.01-\$2.00, \$2.01-\$5.00, \$5.01-\$15.00. In the (relatively infrequent) case of wins in excess of \$15.00, the specific amount won was recorded in a separate column. This coding scheme allowed an estimation of an aggregate 'Money Won' during play session-variable. Many modern EGMs incorporate elaborations of basic play, such as the number of free spins and special features. Accordingly, these were also monitored and tallied. However, variability in machine functionality made it difficult to quantify the contribution of these play outcomes in the form of credits won, and therefore was not incorporated into the 'Money Won' calculation. Finally, when players finished their EGM session, the observer would record 'Money Out': the money cashed out of the machine. The total money lost or won by the player was calculated by subtracting 'Money In' from 'Money Out'.

7.7 Results

Table 7.1 displays the summary statistics for both participant- and session-level numeric variables in the study. On an average EGM session, participants lost an average of \$4.20 over 10 minutes of play and 78 spins.

Table 7.1 Summary statistics of numeric player and session variables

Statistic	N	Mean	SD	Min	Max
Age	229	58.4	16.4	19	90
PGSI	228	2.9	3.7	0	27
Money In	432	\$17.0	\$19.9	\$1	\$167
Money Out	432	\$12.8	\$42.9	\$0	\$620
Time (min)	427	9.9	9.5	1	79
N. Plays	427	77.5	73.0	3.0	238
Play Rate (ppm)	322	9.6	6.6	0.3	62

7.8 Total gambling time and EGM switching rate

As noted in the procedure, participants were encouraged to determine themselves the length of time spent gambling, and decide which EGMs they wished to play. Many participants played on only one machine during the monitoring period. However, some participants who switched machines sometimes did so often, leading to positive skew in the distribution of EGM session counts. The number of EGM sessions per participant ranged between 1 and 13, with a mean of 1.89 (SD=1.96). The average total time spent gambling per participant over all EGMs was 9 minutes, with a SD of 9.5; also indicating positive skew ($z = 2.6$) in the total gambling time per participant. The log-transformation of total time spent gambling ('Total Time') was observed to be normal (skew $z = 0.8$). Therefore, this was used as the response in an ordinary least squares (OLS) regression, with participants' PGSI score, age, and gender. We also considered whether the number of EGMs played during the session varied systematically by participant characteristics. In this regression the response was a count of EGMs played, and we used Poisson regression while controlling for the total time observed gambling, which yielded an estimate of the rate at which players switched machines. Table 7.2 summarises these two models, and shows that PGSI score and age were positively related to total time spent gambling during the observation session. Age and gender (male) were positively related to the rate at which participants switched EGMs.

Table 7.2 Regression of player characteristics on rate of play: number of EGMs played during the period (controlling for time spent gambling)

	<i>Dependent variable:</i>	
	log(Total Time)	N. EGMs
	<i>OLS</i>	<i>Poisson</i>
	(1)	(2)
PGSI	0.035** (0.017)	0.001 (0.012)
Gender	0.170 (0.149)	0.269*** (0.102)
Age	0.011*** (0.004)	0.008*** (0.003)
Priming	-0.008 (0.138)	0.026 (0.099)
Total Time		0.003*** (0.0004)
Constant	1.521*** (0.303)	-0.251 (0.226)
Observations	216	216
R ²	0.061	
Adjusted R ²	0.043	
Log Likelihood		-376.469
Akaike Inf. Crit.		764.937
Residual Std. Error	1.008 (df = 211)	
F Statistic	3.412*** (df = 4; 211)	

Note: *p<0.1; **p<0.05; ***p<0.01

7.9 Bivariate relationships between player and session characteristics

Bivariate correlations between EGM-session play characteristics, age, and participant PGSI score are shown in Table 7.3. It illustrates that there were no significant univariate relationships for age and PGSI score and play characteristics. Other significant relationships are clearly due to intrinsic structural relationships between measures (e.g. Money Won and N. Plays). Longer play duration (Time) was related to both the number of plays made ($r = .77$) and a slower play rate ($r = -.26$). Play rate was negatively ($r = -.16$) related to money taken out of the machine. This suggests that those players motivated to extending their gaming experience often do so both by playing more slowly, by investing more funds, and gambling until most or all funds were expended. The positive relationship between Money Out and Time (.18) plus Money Out and N. Plays (.13) suggests that players who gambled more persistently tended to leave the machine with more funds. This apparent paradox is explained by a stronger relationship between Money Out and Money In (.30). We speculate that some players are motivated to leave the machine 'up' (in the limited sense of withdrawing funds after a win), and are willing to invest time and money to achieve this goal. We caution that these bivariate results should be taken as an indication only, as they do not take account of the distributional properties of the data and potential influencing covariates. These will be addressed in the context of more specific questions via multiple regression and path analysis in following sections.

Table 7.3 Bivariate correlations between EGM session play characteristics, age, and participant PGSI score

	Age	PGSI	Money In	Money Won	Money Out	Time	N. Plays
Age							
PGSI	-0.08						
Money In	-0.08	0.07					
Money Won	0.00	0.04	0.45***				
Money Out	0.02	0.00	0.30***	0.48***			
Time	0.03	0.02	0.27***	0.52***	0.18**		
N. Plays	0.05	0.05	0.37***	0.59***	0.13*	0.77***	
Play Rate	0.02	0.02	0.01	-0.03	-0.16*	-0.26***	0.09

Note:

* $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$

7.10 The effect of PGSI score and priming on EGM selection

Participants were free to choose which EGMs to play during the observation period. We therefore considered the question of whether gambler characteristics led them to choose machines that were more 'jackpot-oriented'. In particular, we were interested in whether those with gambling problems, and those who were primed with 'big win' aspirational imagery, were more likely to be attracted to machines offering jackpots. The EGMs considered offered a varying number (0 to 5) of jackpot prizes. Only 22 sessions involved machines that had no jackpot at all. Jackpot prizes ranged from \$10 to \$56,443. Some prizes were of unspecified amount (unadvertised). EGMs with multiple prizes tended to follow a similar distribution of large to small prizes. This resulted in alternate ways in which jackpot prizes could be characterised:

1. The total number of prizes offered (N. Prize)
2. The maximum prize offered, treating machine with only unadvertised prizes as missing data (Max. Prize)
3. The number of prizes offered of advertised amount (N.Ad.Prizes)
4. The maximum advertised prize, treating machines with only unadvertised prizes as 0. (Max. Ad. Prize).

These characterisations were highly correlated. For example, the correlation between N. Prize and Max. Prize was .72, indicating that machines with a larger maximum prize also tended to offer more supplementary or minor prizes. However, since we did not have a prior argument for preferring one parameterization over another, we present combined results for all four characterisations of the jackpot machine characteristics. Table 7.4 presents regression models predicting each of the four prize characteristics with gender, age, problem gambling score (PGSI), and priming condition as explanatory variables, allowing for an interaction between problem gambling score and priming condition. In this, and all subsequent regression tables, bracketed values indicate 90% confidence intervals of the parameter estimate. Because the number of prizes is an ordinal variable, models (1) and (3) are cumulative link models, which estimate the cumulative odds of a player choosing an EGM with a greater number of jackpot prizes as a function of the covariates. Ordinary least squares (OLS) regression was used for models (2) and (4) on the log-transformed maximum monetary prize.

The coefficient estimates in Table 7.4 shows that priming condition appeared to influence selection towards both machines with a larger advertised prize, and also towards machines with more prizes. Females may be marginally more likely to select machines with more or larger prizes. There was an interaction between gambling problems and priming only in the case of predicting the maximum advertised prize of the machine selected to play. Priming showed a significant effect regardless of which jackpot feature was modelled. Coefficient estimates were similar across jackpot feature, but the interaction effect between PGSI and Priming was significant only for the maximum advertised prize measure. Therefore, we shall next consider this effect in further detail using robust methods.

Table 7.4 The relationship between participant characteristics and EGM selection. Models corresponding to four alternative parameterisations of jackpot features are shown.

	<i>Dependent variable:</i>			
	N.Prizes <i>cumulative link</i> (1)	Max.Prize <i>OLS</i> (2)	N.Ad.Prizes <i>cumulative link</i> (3)	Max.Ad.Prize <i>OLS</i> (4)
Gender	-0.330* (0.200)	-0.402** (0.182)	-0.326 (0.200)	-0.392 (0.299)
Age	0.005 (0.006)	0.006 (0.005)	0.005 (0.006)	-0.009 (0.009)
PGSI	-0.016 (0.034)	-0.025 (0.031)	-0.017 (0.034)	0.017 (0.053)
Priming	0.593** (0.250)	0.532** (0.223)	0.595** (0.251)	0.631* (0.364)
PGSI:Priming	-0.071 (0.050)	-0.070 (0.050)	-0.076 (0.051)	-0.171** (0.078)
Constant		8.181*** (0.406)		8.256*** (0.681)
Observations	365	333	365	365
R ²		0.052		0.029
Adjusted R ²		0.037		0.015
Log Likelihood	-489.389		-487.248	
Residual Std. Error		1.582 (df = 327)		2.736 (df = 359)
F Statistic		3.555*** (df = 5; 327)		2.132* (df = 5; 359)

Note:

*p<0.1; **p<0.05; ***p<0.01

The relationship between priming, PGSI and attraction to jackpot machines can be made clearer by dividing subjects according to the rule PGSI ≤ 4 (no gambling problems) and PGSI > 4 (at risk of gambling problems) as well as priming condition (prime or no-prime). Table 7.5 shows the average maximum jackpot of machines selected by subjects in each of the four resulting groups. Primed participants with gambling problems selected machines with the highest average jackpots ($M = \$7,779$), and un-primed participants without gambling problems selected machines with the lowest average jackpots ($M = \$4,838$). A post-hoc non-parametric Wilcoxon rank sum test indicated that the differences between these two groups was significant ($W = 5560$, $p = .023$). We further contrasted the primed, at-risk condition to the three other conditions combined, also indicating a significant difference in medians ($W = 18423$, $p = .003$). Finally, we confirmed the priming versus non-priming contrast observed in the parametric model ($W = 14337.5$, $p = .012$), and found a similar

marginally non-significant contrast for PGSI status ($W = 11726.5$, $p = .065$). These results accord with the parametric effects observed for the maximum advertised prize, and we therefore suggest that the combination of priming and elevated PGSI score did in fact lead participants to select higher jackpot machines.

Table 7.5 Average maximum jackpot of EGM selected by participants by PGSI status and priming manipulation.

	PGSI \leq 4	PGSI $>$ 4
Not Primed	4838.26	5343.61
Primed	5099.60	7778.90

7.11 Effects of PGSI and Jackpots on Money Invested and Number of Rounds Played

We were interested in whether or not PGSI and jackpots interacted to affect player behaviour over play sessions. A single machine indicator of ‘jackpot-orientation’ was required, as entering of multiple indicators was precluded by collinearity issues. N. Prizes was selected (hereto after labelled ‘Jackpots’), as it possesses more suitable distributional characteristics as a predictor in regression models than the (approximately exponentially distributed) maximum advertised prize. Table 7.6 compares four models predicting Money In (models 1 and 2) and N. Plays (models 3 and 4 using generalized linear models (GLMs) assuming an error distribution proportional to the mean (Gamma) and a log-link). During analysis, we compared several alternatives; the model structures reported here are the most conservative in terms of estimation of effects. Alternative, less appropriate models (e.g. those assuming constant-variance) tended to over-estimate the size of the effects of interest. Further, the Gamma GLMs with a log-link appeared to possess the best model fit criteria in terms of AIC and homogeneity of residuals.

Table 7.6 Regressions of gambler and machine characteristics on funds invested ('Money In') and Persistence ('N. Plays') during each session using log-normal and rank-order regression.

	<i>Dependent variable:</i>			
	Money In		N. Plays	
	(1)	(2)	(3)	(4)
log(Money In + Money Won)			0.729*** (0.022)	0.731*** (0.022)
Gender	0.178 (0.116)	0.152 (0.115)	-0.135*** (0.048)	-0.129*** (0.049)
Age	-0.004 (0.003)	-0.004 (0.003)	0.003* (0.001)	0.003** (0.001)
Jackpots	0.088** (0.041)	0.203*** (0.065)	-0.016 (0.017)	-0.034 (0.028)
PGSI	0.025 (0.015)	0.092** (0.043)	-0.006 (0.006)	-0.053*** (0.018)
Priming	-0.131 (0.112)	0.242 (0.262)	0.072 (0.047)	-0.053 (0.111)
Jackpots:PGSI		-0.024* (0.013)		0.011** (0.005)
Jackpots:Priming		-0.122 (0.082)		0.004 (0.034)
PGSI:Priming		-0.024 (0.032)		0.045*** (0.013)
Constant	2.548*** (0.281)	2.272*** (0.295)	1.399*** (0.140)	1.462*** (0.144)
Observations	432	432	432	432
Log Likelihood	-1,642.986	-1,639.266	-2,012.371	-2,007.708
Akaike Inf. Crit.	3,297.971	3,296.533	4,038.741	4,035.416

Note:

*p<0.1; **p<0.05; ***p<0.01

Demographic variables Age and Gender were entered in all four models. The baseline model for both response measures incorporated only main effects for PGSI, Jackpots and Priming (models 1 and 3). The comparison models involved the addition of and associated interaction terms (models 2 and 4). Models 3 and 4 controlled for Money In + Money Won on the same scale as the response. In this context, available funds are a 'nuisance' variable that we assumed to have a linear relationship on N. Plays.

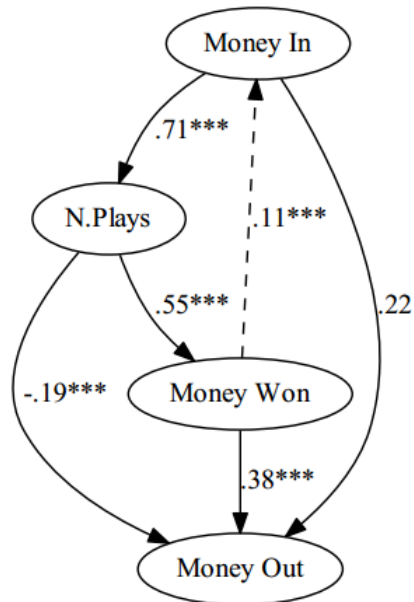
Table 7.6 indicates that players in general tended to invest more money in Jackpot-oriented EGMs. Elevated PGSI scores were also associated with greater investment of funds. Men tended to make fewer plays overall than women, and age was associated with more rounds played. Those with higher PGSI scores tended to play fewer rounds in a single session overall. However PGSI showed a significant positive interaction with Jackpots and Priming, suggesting that at-risk gamblers responded to both priming and jackpots by playing more rounds. As expected, the prime determinant of persistence was 'available funds', considered as an aggregate of Money In and Money Won. We also considered a model which treated $\log(\text{Money In})$ and $\log(\text{Money Won})$ as separate predictors, yielding significant parameter estimates of .09 (SE = .027, $t = 3.5$) and .61 (SE = .021, $t = 29.2$), respectively. While not affecting other parameter estimates, it is interesting because Money Won is a far better predictor of N. Plays, despite the fact that the observational methodology entailed that Money Won was measured with less precision than Money In. This indicates that the 'available funds' interpretation of the action of these variables is insufficient, since it implies that Money In and Money Won are functionally equivalent and therefore should possess similar parameter estimates. It rather suggests that players may interpret lack of wins as a signal that the machine is 'cold', leading to the early termination of play. Conversely a machine that is 'paying off' leads to greater persistence, leading to a tendency of players to utilize funds won in-game to prolong their gambling session on the current machine.

7.12 Structural modelling of EGM session dynamics

The results above indicate the potentially complex interplay between the game/monetary session variables, and motivated our use of a path analytic / model-comparison approach to account for this covariability. All models were implemented using the 'lavaan' structural equation modelling package in the R statistical programming environment (Narayanan,

2012; Rosseel, 2012). As recommended by the package authors, the non-normality of the data was handled by using robust standard errors based on a sandwich-type covariance matrix (Browne & Arminger, 1995). The baseline path model (M0) assumed that funds invested (Money In) financed more plays (N. Plays) and this in turn increased the amount of winnings in the session (Money Won). According to this model, funds taken out of the machine (Money Out) are a linear composite of the other three variables. N. Plays (being a cost) should be negatively related to Money Out after other measures are taken into account. M0 captures the known structural relationships in the game / monetary session data, but explicitly does not include a positive feedback link between Money Won and Money In. Thus, M0 assumes that players are not motivated to increase their session investment based on session winnings. M1, shown in Figure 7.1, differed from M0 in allowing for this in-session feedback effect (dashed line), which is shown to be significant and positive. All other relationships were in line with expectations, including the direct and N. Plays and Money Out. The AIC statistic (Vrieze, 2012) for M1 (AIC=31934) was superior that M0 (AIC=31977), also indicating support for the inclusion of the feedback effect.

Figure 7.1 Path model (M1) of game session variables illustrating structural feedback (dashed line) of money won in-game (Money Won) to money invested (Money In)



We concluded that M1 presented a more accurate model of session-variable covariability, and therefore explored the addition of PGSI and Jackpots as potential predictors of Money In and N. Plays. Essentially, this amounted to a repeat of the regression analysis presented in Table 7.6, using a more sophisticated covariance model. Preliminary analyses indicated that Jackpots also significantly predicted N. Plays ($z = 3.12, p = .002$). However, structural equation modelling demands careful consideration of alternate models (Kline, 2011), and in doing so we concluded that on the basis of the current data, it was not possible to decide upon the following alternative models:

- a) Jackpots positively predict only N. Plays
- b) Jackpots positively predict only Money In
- c) Jackpots positively predict both N. Plays and Money In.

As we shall discuss below, this model indeterminacy appears due to the structural links between N. Plays, Money In, and Money Won. Based on the cross-sectional and observational data at-hand, we are therefore restricted to the less specific conclusion, that EGM Jackpots increase player engagement with the game, which may be manifested via either increased spend or increased persistence.

7.13 Clustered observations over participant and EGM model

The structure of the session-level data analysed above involves limited clustering of samples over observation sessions, including within participants, who played an average of 1.84 sessions under observation. There is also the potential for covariance between observations made on the same EGM model (e.g. 'Queen of the Nile'). However, due to the diversity of EGMs in the market, repeated observations on similar models also occurred relatively infrequently: an average of 2.05 sessions occurring on the same machine. We nevertheless considered whether clustering of data affected the analyses of session-level data by repeating the relevant session-level analyses using random-effects models (also known as linear mixed-effects (LME) models). This framework accounts for the variance attributable to the random factors 'participant' and 'EGM', and prevents Type II errors due to correlated samples. We used the package 'lmer' (Bates, 2005) in the R statistical programming environment (Team, 2011).

We found that, for the current data, the LME models produced fixed-effects estimates and associated criterion probabilities that were substantially identical to the ordinary least-squares (OLS) methods reported above. This was expected, given our small average cluster sizes: LME estimates of fixed effects revert to their OLS counterparts as cluster sizes tend towards 1. Given most readers are more familiar with OLS rather than LME statistical output, and ordinal regression is not available for LME models, we have opted in this case to report

only the output of the OLS models. Future research that employs sampling with a greater degree of clustering may be useful to control for individual and machine differences, and in this case an LME approach would be recommended.

7.14 Effects on money withdrawn at end of session

It can be argued that most behavioural play characteristics within a session can be efficiently measured by a single variable: cash taken out at the end of the session. This is because the amount of funds available at the end of the session is a deterministic function of: the money put into the machine, money won during game (in terms of wins, special features, etc), and the losses incurred. Since these measures in-turn capture player behaviour in terms of number of plays made, a legitimate approach to understand the effect of machine characteristics on player behaviour is to focus on the amount of funds taken out of the machine at the end of the session. Essentially, this addresses the question of whether or not machine characteristics such as jackpot prizes influence players to keep playing until all funds (both stake and wins) are consumed, or alternatively cease play to withdraw funds before they are entirely used. Most sessions end with a zero funds balance. However, when money remains at the end of session, it is usually a function of wins (as shown in Figure 7.1), and is therefore subject to significant volatility, manifested as positive skew or over-dispersion in the distribution. Table 7.7 presents two approaches to predicting this outcome; a logistic model modelling the probability that remaining funds are non-zero, and a GLM (Tweedie) model of the raw that accounts for both zero inflation and over-dispersion. We found no effects significant at the .05 criterion. Although 'Money Out' is variable with high personal impact on players, there are strong reasons to expect that intrinsically very high variability of session-to-session winnings significantly reduces statistical power in detecting effects on this variable.

Table 7.7 Logistic (1) and Tweedie Models predicting Money Out from Session Variables and Demographics

	<i>Dependent variable:</i>	
	Money Out > 0 <i>logistic</i>	Money Out <i>glm: Tweedie</i> <i>link = $\mu^{-0.57}$</i>
	(1)	(2)
Age	0.010 (0.006)	-0.001 (0.001)
Gender	0.131 (0.218)	-0.055 (0.040)
EGM Advert	0.081 (0.287)	-0.021 (0.060)
Bank Advert	-0.067 (0.222)	0.025 (0.043)
PGSI	0.026 (0.027)	0.0004 (0.006)
Jackpots	0.154* (0.088)	-0.008 (0.018)
Priming	-0.009 (0.209)	0.035 (0.041)
Constant	-1.829*** (0.546)	0.364*** (0.109)
Observations	414	414
Log Likelihood	-267.943	
Akaike Inf. Crit.	551.885	
<i>Note:</i>	*p<0.1; **p<0.05; ***p<0.01	

7.15 Discussion

Player shadowing during EGM sessions yields behavioural and game data that cannot be obtained via other (e.g. self-report) means. In contrast to experimental paradigms, the data generated is unarguably ecologically valid; it arises from play with real money, on real EGMs, in a real gambling venue. However, it also presents both methodological and analytic challenges. Despite efforts to encourage participants to behave naturally, the psychological impact of being 'shadowed' is probably significant, and may result in unmeasurable alterations in play behaviour. Session variables such as N. Plays, Money In, Session Time, and Money Out have the valuable property of being direct measures of session characteristics. However, as described above, the behavioural / monetary session variables represent a linked system, that is heavily influenced by Money Won in game. Since the return distribution of EGMs is, by design, highly erratic; this creates a heavy injection of noise that may obscure effects of interest. Experimental designs overcome this issue by artificially creating a return distribution that is constant over sessions, and self-report measures implicitly 'average' gambling outcomes over a large number of sessions within individuals. Session data from real venues is often highly non-normal, demanding the use of sophisticated statistical modelling methods that may be opaque to non-specialists. A final challenge of an observational study is that game characteristics are determined by the marketplace, which is generally geared towards optimisation of gambling intensity and persistence. This may lead to poor sampling of the theoretical range of covariates. For example in the present study, while a reasonable distribution of 'less-jackpot oriented' and 'more jackpot oriented' EGMs were observed, relatively few machines had no jackpots whatsoever.

The present set of studies relied on experiments to investigate some specific structure features of jackpots (e.g., deterministic jackpots), and an observational shadowing study to

explore the motivational influence of jackpots in venue-based settings. Future research could use the big-data gathered by EGMs to explore player behaviour on machines with different types of jackpots, and potentially provide more ecologically valid information on structural features. This would avoid the potential bias introduced by overt observation, and could even yield player-level information with the aid of player tracking technologies (e.g., smart cards).

Despite the methodological hurdles, the present shadowing study yielded some useful results that could not be obtained by other means. PGSI score was not associated with faster switching between EGMs, but high PGSI gamblers were found to spend a longer total time gambling during their visit to the gambling venue. This suggests that extended total gambling time may be an indicator of gambling problems, and is a useful result, considering that this is a behaviour that may be unobtrusively observable by venue staff.

Priming participants reliably influenced the selection of jackpot-oriented machines. The parametric modelling yielded ambivalent results regarding a possible interaction between PGSI and Priming. However, contrasting low-risk ($PGSI < 5$) versus at-risk gamblers ($PGSI > 4$) via non-parametric post-hoc tests indicated that Priming and PGSI status jointly contribute to a greater attraction towards jackpot-oriented machines. These results suggest that jackpots appeal to motivations associated with the anticipated outcomes of play in terms of the life changes a large win might create; and further that at-risk gamblers appear to be more influenced by these cognitions.

Jackpot-oriented machines were reliably associated with a greater spend, which is also consistent with the marketplace offering most EGMs with jackpots. It is plausible that, as with other 'bonus features', these create the psychological perception of greater interest and excitement. A related perspective is that traditional EGM play without jackpots promotes player spend in order to continue to experience the relatively common wins. Jackpots (though almost never realised) adds a qualitatively different extra aspect of 'aspirational'

motivation. This interpretation accords with our findings regarding priming, jackpots, and machine selection.

Although findings from the regression analysis reported in Table 7.6 suggest that jackpots affect spend but not persistence, further investigations built upon the path analytic model suggest this distinction should be treated with caution. When Jackpots are introduced as a predictor of the responses Money In and/or N. Plays, a significant positive association is found (using appropriate robust or bootstrapped standard errors) with one or both of the responses, depending on whether Money Won is included as a feedback variable affecting either or both of the responses. Model fit criteria of the alternative models are not significantly different. We are therefore prevented from deciding upon one of these models as the 'correct' model, as a result of the covariability of N. Plays and Money In, and the strong potential feedback effect of in-game winnings. Our conclusion is therefore that jackpots positively affect player engagement with the game. However, further investigation is required to delineate whether this is reflected in increased spend (and thereby increased play), increased play (independent of spend), or both.

Higher PGSI scores were generally related to fewer plays/spins per EGM session. This may be due to the fact that higher PGSI players tended to gamble using higher credits per play and therefore consumed funds faster. This interpretation is supported by the observation that PGSI was associated with a greater spend per EGM session. Importantly, significant interactions were observed between PGSI and Jackpots, as well as PGSI and Priming. The persistence of higher PGSI players was therefore differentially affected by both experimental and machine factors thought to induce an 'aspirational' cognitive state. Most previous research has indicated that problem gamblers 'know they are not going to win', and are rather thought to be attached to the experience of play itself. Jackpots and Priming do not impact the experience of play itself (except in the very rare case of a Jackpot win), but are instead conceptualized as heightening motivation via aspirational cognitions and emotions.

Therefore, this potential alternate motivational mechanism, that appears to operate differentially for higher PGSI players, is an interesting finding that should be explored further.

A final contribution of this study is to explore the manner in which observable session variables; Money In, N. Plays, Money Won, and Money Out; are related functionally to one another, as shown in Figure 7.1. The fitted model shows that our observations accord with a basic property of gambling known to every casual observer: that further spins increase take-home money through wins, but this is outweighed by the cost of each spin. However it also demonstrates more subtle properties of EGM play. The direct link between Money In and Money Out is not-significant, suggesting that invested funds are almost always entirely consumed through play. Funds left at the end of the session are therefore driven primarily by the random return distribution of re-invested credits. Via model comparison, it was also demonstrated that money won in game motivated further investment of funds. Thus, a player experiencing wins may actually be at risk of losing more money over the longer term, as the 'motivational feedback' effect tends to increase the amount of money put into the machine over the longer term. With these results in mind, it is not surprising that we did not find significant effects of player or machine characteristics predicting Money Out. We suspect this is firstly because it is an indirect measure of player behaviour (directly observable via Money In and N. Plays). Secondly, as demonstrated by the structural model, the effects of these variables on Money Out are mediated by the highly random EGM return distribution, as well as possible feedback loops. Thus, 'Money Out' appears not to be driven by psychological variables, but rather by the intrinsic EGM return distribution, which is known to be highly random with constant mean. One advantage of applying path analysis would be to control for covariances between observable session variables when treating one or more of them as a response in a regression model. This might be accomplished in future work, by either working with residuals of the fitted path model, or alternatively expanding the system to include other observed and latent measures of machine or individual characteristics.

7.16 References

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