RESEARCH REPORT

Literature review of the impact of EGM characteristics on gambling harm

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Executive summary

The purpose of the current literature report was to review literature relating to the design characteristics of electronic gaming machines (EGMs). The aim of the review was to focus on the attitude and behaviours of gamblers with respect to different characteristics and to identify aspects of harm and responsible gambling associated with different characteristics.

OBJECTIVES

The objective of this project was to review recent literature on the design characteristics of EGMs and their impact on gambler behaviour and gambling-related harm to assist the regulator to have the most up-to-date understanding of all relevant research. The literature review updated the 2014 report Impact of Structural Characteristics of Electronic Gaming Machines (Schottler Consulting, 2014), and relevant information in the Gambling Harm Minimisation Report (Blaszczynski et al., 2015). For this reason, the current review focused primarily on identifying new literature published from 2014. A secondary aim was to identify gaps in the evidence base.

Specific project objectives were to:

- Review literature on current and emerging EGM design characteristic and associated harms
- Identify gaps in the current evidence base
- Where the literature allows, identify:
    - Gambler awareness and understanding of EGM design characteristics, and gambler intentions, attitude and behaviour in response to different characteristics (e.g., differential impacts by gambler by Problem Gambling Severity Index (PGSI))
    - Harms that may result from EGM characteristics
    - EGM characteristics that reduce the risk of gambling-related harm.

LITERATURE REVIEW METHODOLOGY

An exhaustive review of peer reviewed and scholarly literature from 2014 to May 2019 on electronic gaming machine structural characteristics was conducted. Search terms including electronic gaming machines, slot machines and gambling were used in a database referencing more than 15,000 journals (deepdyve.com), with results also cross-checked against both other databases and individual journals. In addition, regulatory web sites in major gambling jurisdictions and researcher web sites were reviewed.

In total, 192 papers with relevant content were identified and included in the literature review, with 74 studies with relevant content identified since 2014.

IMPACT OF EGM CHARACTERISTICS - A SUMMARY

This literature review updates a gambling research literature review produced in 2014 (Schottler Consulting, 2014). The review has identified a range of new insights about the impacts of EGM characteristics. As an exhaustive review has been undertaken up to May 2019, evidence on EGM characteristics or features not included in this review is likely to be due to a lack of research in the literature.

This review integrates both earlier and more recent review findings about EGM characteristics and their impacts on gamblers from a gambling harm perspective to allow use by gambling licensing staff.

A summary of key research insights from the review is presented as follows, based on available research evidence.

EGM characteristic	How EGM structural characteristics impact gambling	Strength of evidence
EGM lines, bets and denominations		
Number of lines or pay lines	• Problem gamblers (PGs) find higher line EGMs more exciting • Gamblers may still bet on 80% of lines, due to some fear of 'missing out' on a win. This tendency may also be stronger in PGs • Higher line EGMs may increase gambler immersion in EGM play (even when accounting for bet size)	Emerging evidence
Bet buttons	• PGs bet higher amounts and use multi-credit bet buttons • Higher stakes are associated with poor probability judgements	Very strong evidence
Max bet or Extra bet buttons	• PGs more inclined to use Max Bet or Extra bet buttons • PGs more attracted to Max Bet or Extra bet buttons when linked to features, bonuses or jackpots	Strong evidence
Multiway bets	• Cost of multiway bets is unclear to gamblers	Emerging evidence
Gamble buttons	• Gamble buttons are used slightly more frequently by PGs, but are generally used infrequently • 1 in 2 is more popular than 1 in 4 • Showing outcome of gamble may lead gamblers to believe that they can predict the next outcome	Strong evidence
Display of denominations on EGM	• Gamblers can confuse $1 with 1c EGMs if labelling is small (unclear) • Gamblers not always aware that denominations can change for identically branded EGMs and could get confused in multi-game EGMs (thinking the denomination should continue as it's the same game)	Emerging evidence
Cost per spin for 'unusual denomination' EGMs (e.g., 15c x 25 lines)	• Gamblers anecdotally report that some costs per spin are more difficult to calculate	Emerging evidence
Near misses		
Definition of a near miss	• Near misses before a pay line may have greater impact than those after a pay line, although both still produce effects • Near misses may have a greater impact when players are losing, compared to winning • While a missing symbol in a run of symbols is one type of near miss, many other types are likely to exist (although these are still unknown) • Players may see a near win, when winning symbols on a familiar EGM appear on their machine (without producing a win)	Emerging evidence
Excitement value of near misses	• Near misses are considered closer to a win than a loss by gamblers • Problem gamblers appear to be more stimulated by near misses than non-problem gamblers • Near misses have been found to lead to play persistence in gamblers and have been shown to produce a number of physiological effects that suggest brain circuitry reward	Strong evidence
Probability Accounting Reports (PAR) of EGMs show near miss programming	• While the Australian New Zealand Gaming Machine National Standard (2016) requires that EGMs 'Not be misleading, illusory or deceptive – such as a near miss	N/A

EGM characteristic	How EGM structural characteristics impact gambling	Strength of evidence
(e.g., Left hand reels may have more high value symbols than the last reel)	design', the standard does not define 'near misses', so the prevalence of near misses on NSW EGMs is unclear PAR sheets can be used to identify near miss programming of EGMs	
Losses Disguised as Wins (LDWs)		
Effects of LDWs	Around 18% of Australian EGMs spins are LDWs Multiway EGMs have a similar number of LDWs as regular EGMs Gamblers prefer EGMs with LDWs LDWs contribute to play persistence and higher play excitement – this is particularly true for high risk gamblers LDWs are as rewarding as small wins, based on physiological evidence LDWs are associated with immersion in EGM play and dissociation LDWs generally provide gamblers with more time on EGM play Multi-line EGMs have a high reinforcement rate due to LDWs LDWs give players more time on EGM play, as they reduce the variability in wins and losses Players can be educated about LDWs during EGM play	Strong evidence
Immersion in EGM play	LDWs may increase player immersion dissociation during EGM play	
Visual and auditory aspects of LDWs	Music and audio effects may hide monetary loss of LDWs Adding negative feedback raises gambler awareness that LDWs are in fact losses and not wins	Strong evidence
Ease of keeping track of wins on EGMs	LDWs lead players to over-estimate their real wins	Strong evidence
EGM volatility, RTP and pay schedules		
EGM volatility	Medium volatility EGMs are preferred by gamblers, though the effect of volatility on gambling harm is unknown Standard deviation of wins determines the time players can spend on EGMs Hourly loss rates may be lower, if EGMs have a lower volatility index	Strong evidence
RTP	The relationship between RTP and gambling harm is unclear A recent research assertion, however, is that 100% RTP may minimise harm, as they provide more time on EGMs for a lower average expenditure Higher RTP may be linked to higher betting (although players would need to spend longer on EGMs to lose the same amount) Having EGM games with different RTP has potential to confuse gamblers	Limited available evidence (conflicting effects) – needs research
Payback schedules	All gamblers prefer high reinforcement payback schedules Research is yet to compare Random Number Generator EGMs, with alternative models such as compensators (e.g., on fruit machines in the UK) Large wins produce more neural activation in the brain PAR sheets can reveal significant insights about payback schedules including for features and bonuses.	Strong evidence
EGM spin rates, note acceptors and credit meter limits		

EGM characteristic	How EGM structural characteristics impact gambling	Strength of evidence
Spin rates	• Problem gamblers may play at a faster rate than non-problem gamblers • Faster spin rates are more exciting for both non-problem and problem gamblers • EGMs with higher spin rates may be associated with increased spending, higher bets and impaired recall of wins	Emerging evidence
Note acceptors	• Reducing note acceptor values has been found to reduce gambling expenditure • Problem gamblers tend to use high value notes and load more money on credit meters • Removing or lowering note acceptors may have potential to reduce problem gambling	Very strong evidence
Credit meters/EGM balances	• Display of credits instead of money may have potential to tokenise money on EGMs • EGMs showing higher balances may be associated with more spins and EGM spending	Emerging evidence
EGM payment and pre-commitment methods		
Cashless gaming and TiTo	• Cashless gaming and TiTo appear to not increase harm to gamblers, although further research is required • However, cashless gaming is associated with faster player movement from EGM to EGM • Cashless gaming is generally considered as more convenient for players and requires less time spent waiting for hand-pays	Strong evidence
Pre-commitment systems	• Pre-commitment systems have potential to assist players who are prepared to use the system to set money and time limits. However, players have to be motivated to use the system and to set appropriate limits • System complexity limits the effectiveness of pre-commitment systems • Education about the value of limits may have some potential to assist gamblers including at risk gamblers trying to reduce their expenditure • A trial in South Australia also showed that use of limits assisted at risk gamblers, but had no negative effects on non-problem gamblers • Mandatory pre-commitment won't lower expenditure, as gamblers can still set their own limits (unless an upper limit is set) • Overseas experiences suggest that universal loss limits will reduce EGM expenditure	Strong evidence
EGM branding and marketing		
Sound	• Colourful and exciting sounds may give players the impression that winning on an EGM is more common than losing and may serve to reinforce gambling behaviour • EGM music may increase player confidence, increase arousal, relax players and even lead players to disregard or dissociate from previous EGM losses • Associating sound with symbols leads to player attention to be drawn to symbols • Pairing LDWs with sound, however, may lead gamblers to overestimate wins	Strong evidence
Music and ambience	• Moderate-risk and problem gamblers were found to be over four times more likely to self-select music than were non-problem or low-risk gamblers	Limited available evidence

EGM characteristic	How EGM structural characteristics impact gambling	Strength of evidence
	• Faster tempo music may increase the speed of gambling • Casino environmental sound, lights and music may lead gamblers to spend less time reflecting on and thinking before acting on their gambling losses	
Colour	• Red lighting may be more arousing to EGM players and may increase speed of gambling	Emerging evidence
Reels	• Gamblers spend more time focusing on gaming reels than credit balances	Limited available evidence
Free spins, features and the effect of free spins near wins		
Free spins	• Free spins are associated with gamblers exceeding limits and produce high play excitement • The top three most exciting free spin characteristics were receiving free spins during free spins, win multipliers during free spins (which multiply wins by a number – e.g., 10x) and free spins and winning from free spins	Very strong evidence
Number of free spins	• The greater the number of free spins, the higher play excitement • EGM designs that do not lead to at least a single free spin within a set spending limit may contribute to play persistence • The freeness of the spins may not be the most attractive preference driver for EGMs. Rather, it may be the additional features of EGMs	Strong evidence
Free spins near larger wins	• Obtaining a feature or free spin immediately after a large win is exciting for all gamblers and more exciting for problem gamblers • Problem gamblers increase bets upon receiving a feature near a large win or a free spin near a large win more frequently than non-problem gamblers	Emerging evidence
Win multipliers	• Win multipliers may be associated with high play excitement and have a relatively greater impact on problem gamblers, compared to non-problem gamblers	Emerging evidence
Features	• Receiving a feature during a free spin is exciting for gamblers • One study showed that features that simulated a gambling game are least exciting, while features providing a chance to win a linked jackpot or involved selecting different 'win and spin' options may be more exciting • Three EGM feature characteristics have been found to be more exciting for problem gamblers (A) Features that involved role playing a character (B) Features that gave the impression of a game of skill (C) Features with funny characters Problem gamblers may be attracted to features that are more winning rather than entertainment focused • Reinforcement schedules may be even more important than features in explaining overall EGM game attraction	Very strong evidence
Loot boxes	• Video game research shows that 'within game' loot boxes may have addictive effects - especially if these are exclusive and more attractive than other game features	Not yet available in Australian EGMs
Stop buttons	• Stop buttons may create a perception in EGM players that they can control the game outcome and may lead to the misperception that skill can be used in EGM play	Very strong evidence

EGM characteristic	How EGM structural characteristics impact gambling	Strength of evidence
	• Other features that promote very high player involvement (e.g., collecting items, playing detailed games of chance etc.) may also have potential to harm players	
Impact of jackpots		
Types of jackpots	• There is limited available research on the impact of different types of jackpots • EGM players may bet higher on high jackpot EGMs that are deterministic and non-progressive • Large hidden jackpot prizes, but where winning symbol combinations are known (a non-mystery) may be associated with the fastest bets per minute and strongest play persistence while a player is losing • Mystery jackpots where a winning combination is concealed may not be associated with play persistence	Emerging evidence
Size of jackpot	• Moderate risk and problem gamblers look for EGMs with high jackpots – including linked jackpots • Jackpots over linked networks may not be associated with play persistence – however, problem gamblers have also been found to prefer linked jackpots because of their typical size • Gamblers with large debts may be at risk for persistent gambling if large prizes (as players will bet higher on larger prizes)	Very strong evidence
Jackpot permanence	• Having jackpots expire after a certain time may lead to players ceasing play and may thus minimise losses	Emerging evidence
Win limits	• Win limits – rather than loss limits – have been recently proposed as having potential to reduce gambling harm – a similar effect has also been proposed for prize limits on EGM jackpots	Limited available evidence
Immersive features of gaming		
Immersive features of EGMs	• Examples include - Sound and sound effects, Graphics, Background and settings, Duration of the game, Rate of play or how quickly the player gets absorbed in the game, Advancement rate (how quickly the game advances), Use of humour, Control operations (e.g., choices over settings), Game dynamic (e.g., fulfilling a quest, shooting, Easter eggs etc.), Winning and losing features (e.g., ability to gain bonuses), Character development, Brand assurance (e.g., brand loyalty, celebrity endorsement), Multiplayer features (e.g., being able to play against others, build alliances etc.) and Social features	Limited available evidence
VR and 3D variants of EGM games	• Potential to immerse gamblers and VR may also increase the cognitive load of play (taking attention away from time and money expenditure)	Emerging evidence
Headphones (e.g., playing music)	• Gamblers may use temporal background music and other cues in venue environments to keep track of play duration • While these are not well-researched, there is potential for VR and headphone use to block temporal cues that assist gamblers to self-monitor their play	Emerging evidence

ASSESSING THE STRENGTH OF EVIDENCE OF LITERATURE

Further detail on key findings and an assessment of the strength of evidence on major types of structural characteristics is also presented in the integrated summary of review findings (Refer next section of the report).

A range of practical considerations were made in drawing conclusions about the overall likely impact of different EGM structural characteristics based on studies identified for the current review. There is a relatively limited range of gambling research across the different gaming machine characteristics and features.

The assessment of the overall strength of evidence has been based on the following considerations:

- A general assessment of the total number of studies available on each structural characteristic (i.e., the more studies that conclude similar findings, the higher the likelihood of an effect)
- The availability of behavioural evidence versus only attitudinal evidence relating to characteristics (i.e., laboratory or behavioural studies support the impact of characteristics over attitudinal research alone)
- The extent researchers have attempted to measure or quantify the impact over a reasonably robust sample of gamblers (i.e., a qualitative study involving 10 interviews could be argued to provide less evidence than a larger quantitative study, or a study involving both qualitative and quantitative research)
- The presence of studies that have involved a systematic review with or without meta-analysis of available evidence
- The extent to which research has measured the specific threshold of harm associated with that characteristic (e.g., how many EGM lines, multipliers or free spins are associated with harm, rather than just making general conclusions that those characteristics are harmful).

REFERENCES TO EGM CHARACTERISTICS ON THE NSW GAMING MACHINE PROHIBITED FEATURES REGISTER

While the current review extends further than the NSW Gaming Machine Prohibited Features Register, EGM characteristics contained in the NSW Gaming Machine Prohibited Features Register are identified in the literature review for general reference purposes.

The NSW Gaming Machine Prohibited Features Register was first released in July 2006 to provide general guidance to manufacturers about the types of EGM characteristics that are not permitted in NSW. Updates to the Register are progressively made, with the most recent updates made in November 2011 (Revision F).

Each entry in the Register relates to an EGM characteristic identified by the Authority as having potential to be associated with increased risk of gambling harm for gambling consumers or potentially, for people experiencing gambling problems.

Accordingly, each section that may pertain to a characteristic on the Register is as follows – for example:

The following characteristic/s of relevance to this section is/are on the NSW Gaming Machine Prohibited Features Register:

#2 - EGM games were found to be offering 100 free games with virtually no chance of winning the games. Consequently, a 40 free game limit was introduced.

About this report

This report provides a literature review of Electronic Gaming Machine (EGM) structural characteristics and their effect on EGM players. The literature review updated the 2014 report Impact of Structural Characteristics of Electronic Gaming Machines (Schottler Consulting, 2014) and relevant information in the Gambling Harm Minimisation Report (Blaszczynski et al., 2015).

The literature review is arranged according to ten categories of structural characteristics of EGMs:

1. EGM lines, bets and denominations
2. Near misses during EGM play
3. Losses Disguised as Wins during EGM play (LDW)
4. EGM volatility, RTP and EGM pay schedules
5. EGM spin rates, note acceptors and credit meter limits
6. EGM payment and pre-commitment methods
7. EGM branding and marketing
8. Free spins, features and the effect of free spins near wins
9. jackpots
10. Immersive characteristics of gambling

Key sections of the review are structured as follows:

- Section 1 *Integrated summary of review findings* - provides an accessible overview of findings.
- Section 2 *Introduction and methods* - provides a formal introduction to the literature review and details of the methods, as well as a description of the approach to assessing the strength of the evidence.
- Section 3 *Review of research literature on the impact of EGM characteristics on gamblers* - provides the full review.

All citations are also included in the *Reference*s section.

SECTION 1
Integrated summary of review findings

Integrated summary of review findings

EGM LINES, BETS AND DENOMINATIONS

The following characteristic/s of relevance to this section is/are on the NSW Gaming Machine Prohibited Features Register:

#1 - A non-linear pay table listed a different top prize depending on the amount bet (i.e., Bet 1 credit 5 symbols for $100, bet 2 credits 5 symbols for $300 and bet 3 credits 5 symbols for $500). As it encourages players to increase bet amounts, it was entered into the Register.

#8 - A player was required to bet a minimum of lines (4 lines) as a qualifying bet to win the top prize. As this was inappropriately encouraging higher bets, it was entered into the Register.

#10 - Qualifying ante bets to play feature games were increased from 25 to 35 credits, without a corresponding RTP increase. As players are highly motivated to win features, a corresponding increase in RTP is appropriate. For this reason, the practice was entered in the Register.

A maximum 30-credit bet was set for games that offer an ante bet to win feature style games. The following requirements were set:

- *For a 25-30 credit qualifying bet, the feature RTP must be at least 5%*
- *For a <=25 credit qualifying bet, the feature RTP must be at least 4%*
- *Ante bets on feature games are only permitted on low denominations*

#12 - A $1 Blackjack game could be configured by venues to require a $10 minimum bet per hand (instead of the $1 minimum bet in line with the EGM's denomination).

#9 - A button panel prompted players to increase their bet to play all lines. As this was identified as a responsible gambling issue, it was entered into the Register.

#14 - EGMs played multiple games on-screen such as 4-in-1 games or 2-in-1 games. As venues have a strict allotment of EGMs, multi-game on-screen EGM games circumvent this limit. In addition, multiple game availability would encourage players to play more than a single EGM at once.

7# - A concern was raised that multi-denomination EGMs should not mix 1 cent and $1 games. However, based on a trial that showed limited player migration between such denominations, it was determined acceptable to offer low denominations (e.g., 1c, 2c) and high denominations (50c and $1) on the same EGM.

However, RTP must be increased for higher machine denominations (with a minimum RTP of at least 92% for high denomination EGMs).

Summary of evidence

While EGM lines, bets and denominations have been some of the most well-researched EGM characteristics, there is limited new research in this field since 2014. Possibly the most significant study touching on these characteristics is the Schottler Consulting (2014) study of EGM characteristics for Gambling Research Australia. While replicating some findings from previous research, the study importantly identified that Maximum or Extra bet buttons have potential to excite problem gamblers and that multiway EGMs – such as Reel Power EGMs – are probably not harmful due to their large numbers of 'lines' (or many ways to win). Rather, their popularity may be due to other factors such as multipliers or individual game characteristics.

This study also showed that, while 'gamble' buttons are used more frequently by problem gamblers, overall usage is so infrequent that they are unlikely to be harmful. In addition, findings also showed, that no matters the lines available on an EGM, roughly 80% of available lines were played in an observational study of real EGM players. Such findings clearly highlight that EGMs with high numbers of lines are likely to lead to larger overall bets and higher EGM expenditure.

While there has been limited recent research on EGM lines, bets and denominations (and limited research on EGMs with multiple games that can be selected by players), it is noteworthy that some new findings suggest that lines may be associated with higher levels of player immersion in play (e.g., Dixon et al, 2018; Murch and Clark, 2019). A similar effect was also observed for EGM pay lines. In addition, highlighting the risk of high bets, a further study found that larger bets were associated with impaired probability judgements and increased gambler impulsivity (Parkes et al, 2016). This may highlight potential to investigate whether additional EGM prompts or tools could assist players to remain aware of the probability of winning during high stake EGM play.

The implications of literature review findings and the strength of available evidence in summary are below:

EGM characteristic	How EGM structural characteristics impact gambling	Strength of evidence
EGM lines, bets and denominations		
Number of lines or pay lines	• Problem gamblers (PGs) find higher line EGMs more exciting • Gamblers may still bet on 80% of lines, due to some fear of 'missing out' on a win. This tendency may also be stronger in PGs • Higher line EGMs may increase gambler immersion in EGM play (even when accounting for bet size)	Emerging evidence
Bet buttons	• PGs bet higher amounts and use multi-credit bet buttons • Higher stakes are associated with poor probability judgements	Very strong evidence
Max bet or Extra bet buttons	• PGs more inclined to use Max Bet or Extra bet buttons • PGs more attracted to Max Bet or Extra bet buttons when linked to features, bonuses or jackpots	Strong evidence
Multiway bets	• Cost of multiway bets is unclear to gamblers	Emerging evidence
Gamble buttons	• Gamble buttons are used slightly more frequently by PGs, but are generally used infrequently • 1 in 2 is more popular than 1 in 4 • Showing outcome of gamble may lead gamblers to believe that they can predict the next outcome	Strong evidence
Display of denominations on EGM	• Gamblers can confuse $1 with 1c EGMs if labelling is small (unclear) • Gamblers not always aware that denominations can change for identically branded EGMs and could get confused in multi-game EGMs (thinking the denomination should continue as it's the same game)	Emerging evidence
Cost per spin for 'unusual denomination'	• Gamblers anecdotally report that some costs per spin are more difficult to calculate	Emerging evidence

EGM characteristic	How EGM structural characteristics impact gambling	Strength of evidence
EGMs (e.g., 15c x 25 lines)		

Strength of evidence

- There is very strong evidence that problem gamblers use higher bets and higher denomination EGMs than non-problem gamblers based on the large number of attitudinal and behaviourally-oriented studies that have consistently found this effect in EGM players.
- There is also some emerging evidence that higher line EGMs may be more appealing, however, this is not quite as conclusive, as the literature base is much smaller and still emerging.
- There is also no available evidence on the exact number of EGMs lines that may increase gambling harm, highlighting this as an area for further research (However, a link between lines and harm has been established).

NEAR MISSES DURING EGM PLAY

Summary of evidence

Findings of the review highlight a considerable amount of new research on near misses since 2014. The interest in near misses in part stems from the high reported prevalence of near misses in EGMs in international gaming markets, although it is currently unclear the extent to which near misses occur in Australian EGMs. This is also because the definition of a 'near miss' is currently not well-defined. Indeed, while the definition of a near miss as one or more missing symbols is commonly used to define a near miss, research has shown that the concept may also be far broader. In particular, Schottler Consulting (2014) found many that other EGM effects were reported by gamblers as 'near misses' (e.g., achieving all but one feature objective during a feature).

This highlights the potential for further research on near misses including their effects on both recreational and problem gamblers. The prevalence of near misses in Australian EGMs is similarly unclear, although the Australian/New Zealand National Gaming Machine Standard effectively prohibits 'near miss design', yet does not specifically define a near miss. As near misses were reported by gamblers in the Schottler Consulting (2014) study of EGM players, it is also likely that near misses are generally experienced by gamblers in Australian EGMs.

A range of new studies have been conducted to extend knowledge of the effects of near misses since 2014. Of particular note is that near misses have been found to be associated with longer Post Reinforcement Pauses (PRPs) during EGM play (as compared to a loss), with increasing matching of symbols (e.g., Dixon, 2015). In addition, Dymond et al (2014) found that near misses produce a greater physiological response in the insula region of the brain for problem gamblers and that the effect of gambling was similar to the effects produced for other addictions. Detez (2019) found similar effects and found that heart rate accelerations occurred in response to near misses.

Some new differences in the impact of near misses were also noted. Sharman and Clark (2016) found that near misses before a pay line had increased facial electrodermal activity and increased player motivation to keep playing, while near misses after a pay line were more aversive (than other non-wins). Both types of near misses also increased the desire to play. A similar effect was also obtained by Sharman et al (2015), with near misses before a pay line found to be 'more motivational' than those after a pay line.

A recent systematic review of the effects of near misses also confirmed these findings. In particular, Barton et al (2017) found that near misses do motivate continued play and produce various physiological responses and brain activity that are consistent with reward and reinforcement effects. It was also confirmed that the near misses had an effect due to the psychological experience of a near miss and not merely due to lights, music or sound. This highlights that further research is needed to understand the impact of near misses during EGM play including both the definition of a near miss and the extent that different near miss effects are permitted in gaming machine design (if at all).

The implications of literature review findings and the strength of available evidence in summary are below:

EGM characteristic	How EGM structural characteristics impact gambling	Strength of evidence
Near misses		
Definition of a near miss	• Near misses before a pay line may have greater impact than those after a pay line, although both still produce effects • Near misses may have a greater impact when players are losing, compared to winning • While a missing symbol in a run of symbols is one type of near miss, many other types are likely to exist (although these are still unknown) • Players may see a near win, when winning symbols on a familiar EGM appear on their machine (without producing a win)	Emerging evidence
Excitement value of near misses	• Near misses are considered closer to a win than a loss by gamblers • Problem gamblers appear to be more stimulated by near misses than non-problem gamblers • Near misses have been found to lead to play persistence in gamblers and have been shown to produce a number of physiological effects that suggest brain circuitry reward	Strong evidence
Probability Accounting Reports (PAR) of EGMs show near miss programming	• While the Australian New Zealand Gaming Machine National Standard (2016) requires that EGMs 'Not be misleading, illusory or deceptive – such as a near miss design', the standard does not define 'near misses', so the prevalence of near misses on NSW EGMs is unclear • PAR sheets can be used to identify near miss programming of EGMs	N/A

Strength of evidence

- While the definition of near miss to gamblers is unclear and requires research, the systematic review by Barton et al (2017) of the effects of near misses brings some increased rigour to the conclusion that near misses may contribute to gambling harm.

- There is limited evidence as to the type of near misses that may impact gamblers, other than the recent evidence that near misses before a pay line may have a greater impact than those after a pay line. Upper thresholds of near misses in EGMs that may occur before there is an increase in gambling harm, however, cannot be determined from current available research, highlighting the need for studies in this field.

- Research on PAR sheets is also very limited, with virtually the only significant work in the field being that of Harrigan (e.g., Harrigan, 2009).

LOSSES DISGUISED AS WINS (LDW)

Summary of evidence

Losses Disguised as Wins (LDW) are a further topic that has seen a range of new studies since 2014. Possibly the largest Australian study on the topic, Schottler Consulting (2014) found that LDWs are highly prevalent in Australian EGMs, with around 18% of spins resulting in an amount won that was less than the amount bet (i.e., a LDW). In addition, while real wins most strongly predicted play excitement, LDWs added uniquely to the prediction of excitement over and above Real Wins. Through attitudinal questions, the study also confirmed that winning a higher proportion of an EGM bet was more exciting than winning a lower proportion.

Other recent studies also highlight that gamblers generally recognise LDWs as a characteristic of their preferred EGM (Templeton et al, 2015) and typically categorized LDWs as wins. Harrigan et al (2015) proposed that this preference may be due to the fact that LDWs generally provide gamblers with more time on an EGM. Templeton et al (2015) additionally found that LDWs were perceived as more rewarding than losses and as rewarding as small wins and led gamblers to overestimate their total wins when playing EGMs.

Graydon et al (2018a, 2018b) found similar results and also identified that higher risk players showed stronger play persistence on EGMs with a moderate number of LDWs, compared to low or high LDWs. Similar to findings showing that lines influence player immersion in EGM play, Dixon et al (2018) found that this was the case for LDWs and the effect was stronger for problem gamblers. The author found that LDWs produced a level of arousal in gamblers that was similar to a real win. Dixon et al (2014) also reported that LDWs trigger dissociation in gamblers.

New research on LDWs relates to the Dixon et al (2015) study, where LDWs were paired with sound to appear like losses. Physiological effects demonstrated in this study suggest that pairing negative sound as feedback led gamblers to view LDWs as losses. Other insights about the potential to educate gamblers about LDWs are from the study by Graydon et al (2017). The authors found that education could assist gamblers to correctly identify LDWs as losses rather than wins.

The systemic review of LDWs by Bardon et al (2017) brought together many research findings about LDWs to conclude that LDWs were indeed associated with players overestimating wins and with player excitement generally. They were also found to be triggered through audio-visual elements in EGM design.

Based on recent research on LDWs, this clearly highlights that they have potential to cause gambling harm, although LDWs are also a preferred characteristic of gaming machine play. In addition, players receive longer time on EGMs due to LDWs, as they effectively help extend the duration of gaming machine play. As such, while LDWs pose risk to gamblers, the threshold of harm remains unclear. Accordingly, this highlights the importance of identifying the proportion of LDWs that balance player needs with the potential for LDWs to cause gambling harm.

The implications of literature review findings and the strength of available evidence in summary are below:

EGM characteristic	How EGM structural characteristics impact gambling	Strength of evidence
Losses Disguised as Wins (LDWs)		
Effects of LDWs	• Around 18% of Australian EGMs spins are LDWs • Multiway EGMs have a similar number of LDWs as regular EGMs • Gamblers prefer EGMs with LDWs • LDWs contribute to play persistence and higher play excitement – this is particularly true for high risk gamblers • LDWs are as rewarding as small wins, based on physiological evidence • LDWs are associated with immersion in EGM play and dissociation • LDWs generally provide gamblers with more time on EGM play • Multi-line EGMs have a high reinforcement rate due to LDWs • LDWs give players more time on EGM play, as they reduce the variability in wins and losses • Players can be educated about LDWs during EGM play	Strong evidence
Immersion in EGM play	• LDWs may increase player immersion dissociation during EGM play	
Visual and auditory aspects of LDWs	• Music and audio effects may hide monetary loss of LDWs • Adding negative feedback raises gambler awareness that LDWs are in fact losses and not wins	Strong evidence
Ease of keeping track of wins on EGMs	• LDWs lead players to over-estimate their real wins	Strong evidence

Strength of evidence

- A systematic review of the impact of LDWs (Barton et al, 2017) has extended the strength of evidence in the field by establishing the impact of LDWs on EGM players. In spite of this, the threshold of harm per LDW remains unknown.

- Recent evidence from a 2014 Schottler Consulting study, however, identified that around 18% of a convenience sample Australian EGM games may produce LDWs and found useful behavioural evidence that LDWs may uniquely increase play excitement. Together, these studies provide reasonably strong evidence that LDWs have potential to contribute to gambling harm.

EGM VOLATILITY, RTP AND PAY SCHEDULES

Summary of evidence

The reinforcing nature of EGM play has long been one of the most well-researched topics on EGM harm (e.g., Dickerson et al, 1992). It has been established that EGM players prefer high reinforcement schedules during play (e.g., Delfabbro et al, 2005) and possibly also moderate volatility EGMs (e.g., Freeman and Mitchell, 2010).

A number of new studies have extended our understanding of the influence of EGM payback schedules. In particular, Dixon et al (2014b) found that large wins produce more neural activation than small wins and this was associated with a tendency for gamblers to overestimate their chance of further wins (regardless of whether they were problem or non-problem gamblers).

Other research has also raised the question about whether Return to Player (RTP) may influence problem gambling behaviour. However, different studies have shown varying effects, suggesting that RTP may influence gambling under some conditions, yet not others. An interesting theory has also recently been raised by Rowell and Gyrd-Hansen (2014) that 100% RTP may both lengthen the time gamblers spend on EGMs, whilst reducing their overall losses. In particular, Rowell and Fooken (2019) found through modelling that it would require 33 hours for 25% of EGM players to lose $300 with 100% RTP, while the same loss would take only 2.5 hours with current RTP EGMs.

While only a theoretical assertion, this may highlight the potential to examine whether it is possible to increase RTP in EGMs as a gambling harm minimisation measure. This could, for instance, be applied to certain EGMs to reduce total player losses, or alternatively be offered as a treatment for players experiencing gambling problems. It should also be noted in this context that 100% RTP does not imply a 'free play' EGM, as gamblers would still experience wins and losses on 100% RTP machines. Possibly raising some concern for this, however, is the Leino et al (2015) finding that bet size may be higher in higher RTP gaming (although a limitation is that this study pertained to Norwegian VLTs).

While not a new area of research, more recent research findings also point to the need to examine PAR sheets to better understand EGM payback schedules. Harrigan (2009) has undertaken a comprehensive analysis of PAR sheets obtained under Freedom of Information legislation in Canada. Given new systematic findings highlighting the impacts of LDWs and Near Misses (e.g., Barton et al, 2017), this study highlights the potential to examine Australian EGM PAR sheets to better understand Australian EGM payback schedules.

While it is unclear what findings would emerge for Australian EGMs, Harrigan (2009) reported a range of insights about PARs sheets that highlight the value of such an analysis. For instance, the author identified the potential to mislead gamblers about symbol win probabilities through virtual reel mapping (where physical reel stopping positions don't match virtual reel stopping positions), nudges (e.g., using blanks on reels), clustering to create near misses (i.e., putting a high ratio of blanks next to high paying symbols) and bonus mode probabilities. The analysis also raises the reinforcement schedule of EGMs. For instance, Harrigan (2009) found that the average percentage of spins resulting in wins on the EGMs studied varied according to the lines bet and the presence of scatter symbols. Feature probabilities could also be predicted from PAR sheets.

While findings may not apply to Australian EGMs (as all PAR sheet analyses are specific to individual games), it highlights the value of PAR sheet analysis to understand payback schedules used in EGM play. It similarly highlights the need for greater transparency about EGM PAR sheets, given the potential harm of some types of programming to gamblers. As PAR sheets were not available in Australia, Schottler Consulting (2014) was the first study to record the outcomes of live EGM play across more than 48,000 EGM games nationally. Having access to PAR sheets, however, may help uncover further insights about the programming of payback schedules and potentially identify how different probabilities may lead to gambling harm.

The implications of literature review findings and the strength of available evidence in summary are below:

EGM characteristic	How EGM structural characteristics impact gambling	Strength of evidence
EGM volatility, RTP and pay schedules		
EGM volatility	• Medium volatility EGMs are preferred by gamblers, though the effect of volatility on gambling harm is unknown • Standard deviation of wins determines the time players can spend on EGMs • Hourly loss rates may be lower, if EGMs have a lower volatility index	Strong evidence
RTP	• The relationship between RTP and gambling harm is unclear • A recent research assertion, however, is that 100% RTP may minimise harm, as they provide more time on EGMs for a lower average expenditure • Higher RTP may be linked to higher betting (although players would need to spend longer on EGMs to lose the same amount) • Having EGM games with different RTP has potential to confuse gamblers	Limited available evidence (conflicting effects)
Payback schedules	• Gamblers prefer high reinforcement payback schedules • Research is yet to compare Random Number Generator EGMs, with alternative models such as compensators (e.g., on fruit machines in the UK) • Large wins produce more neural activation in the brain • PAR sheets can reveal significant insights about payback schedules including for features and bonuses.	Strong evidence

Strength of evidence

- There is strong evidence based on the number of available studies (including behavioural, attitudinal and clinical research) that pay back schedules do influence gambling behaviour.

- However, evidence relating to the impact of different levels of reinforcement is still developing and the precise reinforcement schedule associated with maximal gambling harm remains unknown. As research on RTP has produced widely different effects (possibly due to low control for confounds in studies to date), evidence on the impact of RTP should be considered limited and largely unknown.

  As RTP is a fundamental EGM structural characteristic and recent research has highlighted some potential harm minimisation effects of high RTP (i.e., longer time on the EGM before similar loss levels are reached), this may also warrant further research investigation.

EGM SPIN RATES, NOTE ACCEPTORS AND CREDIT METER LIMITS

Summary of evidence

EGM spin rates, note acceptors and credit meter limits have been of interest in gambling research, given their link to EGM expenditure. There is also some research to suggest that faster spin rates and high note acceptors may be associated with higher expenditure and gambling harm and will be used by problem gamblers (e.g. Blaszczynski et al, 2001).

Recent research in the field has also identified a range of new insights about EGM spin rates. Contrary to other research, Worhunsky and Rogers (2017) found that spin rates were very individual and were actually not related to problem gambling status. Harris and Griffiths (2018) also recently summarised research evidence relating to reel spin speed based on 11 studies and found that gamblers preferred games offering a faster rate of play and such games were more exciting to both recreational and problem gamblers. They also found that faster play speed was generally associated with higher bets, longer play and some level of impaired control during gambling.

While no new studies were identified relating to note acceptors on EGMs, Chapman et al (2019) conducted a study examining the display of credit balances on EGMs. This found that gamblers placed higher bets on EGMs with higher balances and higher balance EGMs were associated with longer play and higher expenditure. Accordingly, this may have implications for the total credits displayed on EGMs and also for other players who may feel influenced to spend more on their own machine after viewing high balances.

The implications of literature review findings and the strength of available evidence in summary are below:

EGM characteristic	How EGM structural characteristics impact gambling	Strength of evidence
EGM spin rates, note acceptors and credit meter limits		
Spin rates	• Problem gamblers may play at a faster rate than non-problem gamblers • Faster spin rates are more exciting for both non-problem and problem gamblers • EGMs with higher spin rates may be associated with increased spending, higher bets and impaired recall of wins	Emerging evidence
Note acceptors	• Reducing note acceptor values has been found to reduce gambling expenditure • Problem gamblers tend to use high value notes and load more money on credit meters • Removing or lowering note acceptors may have potential to reduce problem gambling	Very strong evidence
Credit meters/EGM balances	• Display of credits instead of money may have potential to tokenise money on EGMs • EGMs showing higher balances may be associated with more spins and EGM spending	Emerging evidence

Strength of evidence

- There is only moderate available evidence on the impact of spin rates and credit meter limits on gambling harm.

- There is very strong evidence that higher note acceptors may be associated with increased gambling harm and/or possibly higher gambling expenditure. However, the harm associated with increasing or decreasing note acceptors could benefit from further research to quantify or assess its value as a gambling harm minimisation policy (e.g., it is likely to affect gambling expenditure, but further research could help quantify by how much, so the impact of possible policy changes could be measured).

EGM PAYMENT AND PRE-COMMITMENT METHODS

The following characteristic/s of relevance to this section is/are on the NSW Gaming Machine Prohibited Features Register:

#11 - An outcome of the TITO harm minimisation trial was that cashback terminals equipped with display screens should use the on-screen displays to display problem gambling notice information. Larger screens require ongoing display of information, while small screens require periodic display.

Cashless and TiTo (*Ticket in, Ticket out*) payment technology is currently quite prevalent across NSW EGMs. While many payment devices are peripherals to EGM design, they are fundamental to the EGM play experience and should thus be viewed as a structural characteristic of EGM design.

Card based gaming trials of Schottler Consulting (e.g., 2005-2010) also highlight that most EGM players at least perceive that cashless gaming is no more harmful than cash-based gambling. However, while these trials were largely to evaluate pre-commitment systems rather than pure cashless gaming, there is undoubtedly scope for further research into the potential for cashless gaming to be associated with gambling harm. A more recent paper by Drawson et al (2017) also highlights this potential. The authors reviewed evidence in the field and concluded that overall evidence was rather limited.

Pre-commitment methods are also worthy of future research. While the many trials conducted by Schottler Consulting (e.g., 2005-2008, 2012) highlight some value of player pre-commitment tools, the overall findings of this research is that players need to be motivated to use such tools to benefit. They must be able to select reasonable and affordable limits and be open to using system feedback when limits are reached. This reflects the general understanding that pre-commitment is essentially no more than a psychological contract that gamblers have with themselves. In their review of recent literature, Drawson et al (2017) concluded that players who set time limits gambled for a shorter time and that while problem gamblers were more likely to set monetary limits on their gambling, they were also more likely to exceed limits.

Similar findings also emerged from the Schottler Consulting trial of pre-commitment in South Australia (Schottler Consulting, 2010), as recently reported by Rintoul and Thomas (2017). However, while limits may be useful to some gamblers, the complexity of system use was also found to limit the value of pre-commitment. In this respect, research by Delfabbro (2012) also found that not only few gamblers set limits, but many became confused over the limits they set due to poor system usability. While such findings may highlight some limitations associated with pre-commitment systems, there needs to be more research dedicated to encouraging gamblers to improve their use of limits and limit reminders. Accordingly, this forms an important future research topic with potential to support harm minimisation during EGM play.

The implications of literature review findings and the strength of available evidence in summary are below:

EGM characteristic	How EGM structural characteristics impact gambling	Strength of evidence
EGM payment and pre-commitment methods		
Cashless gaming and TiTo	• Cashless gaming and TiTo appear to not increase harm to gamblers, although further research is required • However, cashless gaming is associated with faster player movement from EGM to EGM • Cashless gaming is generally considered as more convenient for players and requires less time spent waiting for hand-pays	Strong evidence
Pre-commitment systems	• Pre-commitment systems have potential to assist players who are prepared to use the system to set money and time limits. However, players have to be motivated to use the system and to set appropriate limits • System complexity limits the effectiveness of pre-commitment systems • Education about the value of limits may have some potential to assist gamblers including at risk gamblers trying to reduce their expenditure • A trial in South Australia also showed that use of limits assisted at risk gamblers, but had no negative effects on non-problem gamblers • Mandatory pre-commitment won't lower expenditure, as gamblers can still set their own limits • Overseas experiences suggest that universal loss limits will reduce EGM expenditure	Strong evidence

Strength of evidence

- There is strong evidence from Australian behavioural trials that pre-commitment is not likely to be taken up by gamblers, unless gamblers are actively promoted the benefits of pre-commitment.
- For gamblers taking up pre-commitment, there is also reasonably strong evidence that pre-commitment tools can be useful IF a gambler is motivated to reduce or better control their gambling (especially moderate risk and problem gamblers). However, as venues trialing pre-commitment systems have often struggled to promote benefits, there is a need for more robust trials of pre-commitment marketing approaches to identify more effective models of driving uptake.
- As cashless gaming and TiTo have primarily been qualitatively assessed as not being harmful to gamblers, quantitative studies to establish this over a wide range of gaming venues may strengthen the likelihood of this conclusion.

EGM BRANDING AND MARKETING

The following characteristic/s of relevance to this section is/are on the NSW Gaming Machine Prohibited Features Register:

#3 - An image of real Australian money was displayed on an EGM. As this was considered a potential player inducement, display of real money on an EGM or as part of an EGM theme was entered into the Register.

#4 - An EGM was branded with a 'Big Money' theme. This was considered inconsistent with responsible gambling, so was entered into the Register.

#5 - Verbal player inducement messages were prompted to players in the event they didn't win a feature ('try again' and 'have another go'). These were considered inducements to play and were entered in the Register.

#6 - The top prize of an EGM was prominently displayed in EGM game rules, in spite of the prize not being attainable without use of the maximum bet (i.e., Win up to $3,000, $5,000 or $10,000 – However, the $10,000 prize only applied if the maximum bet was used). This was considered an advertising inducement and was entered into the Register.

Summary of evidence

While it is against regulations to promote gaming machines in NSW, as a product the branding, appearance and game dynamics of EGMs are essentially a type of product marketing that drives the success of machines in the gaming market. Research has also shown that gaming machine sounds, colours and lights play a major role in attracting gamblers to play an EGM (e.g., Griffiths and Parke, 2003). Past research in particular suggests that red colour and fast tempo music may make a machine more arousing to gamblers (Spenwyn et al, 2010).

While there is limited recent research relating to EGM branding and marketing, Brevera et al (2015) simulated a casino environment while gamblers were playing EGMs and found that such environments may lead gamblers to spend less time reflecting on and thinking before acting on their gambling losses. This also highlights how a gaming atmosphere may be part of the reason gamblers become attracted to certain venues and EGMs. Bramley et al (2018) interestingly also investigated the effect of background music on gambling behaviour and found that moderate-risk and problem gamblers were over four times more likely to self-select music for their gambling (when given an option to do so) than were non-problem or low-risk gamblers. This further highlights the potential role of ambience in attracting consumers towards a venue or EGM.

Dixon et al (2017) additionally demonstrated how gamblers can be conditioned to like or dislike certain slot machines through conditional discrimination training. Rodgers et al (2017) similarly revealed insights about where gamblers look on EGMs and found that most of the gambler's gaze was directed to reels while placing bets and this was even higher when reels were spinning. In comparison, fixations on credit balances were only a small percentage of total fixations when betting and an even lower percentage during reel spins. Accordingly, this may highlight that gamblers pay limited attention to credit balances during reel spinning and that the visual appearance of reels (e.g., colour, lights, sound and music) are significant parts of the visual appearance of a gaming machine.

While it is clear that some games are very popular in the market, however, it is currently unclear what makes a game popular and attractive to gamblers. In this respect, this is also a difficult area of research, as many of the visual aspects of gaming machine pay are intertwined with the wins, losses and other dynamic features of game play. In addition, potentially thousands of different variables and combinations of variables are at play. This itself makes it difficult to identify colours, lights or sounds that may contribute to gambling harm.

Accordingly, EGM branding and marketing will undoubtedly continue to benefit from qualitative research studies to identify the aspects of game appearance that contribute to the overall appeal of a gaming machine. Further research of this nature may also arguably help develop some type of conceptual models to explain why different game presentation and brandings may be more appealing to gamblers.

The implications of literature review findings and the strength of available evidence in summary are below:

EGM characteristic	How EGM structural characteristics impact gambling	Strength of evidence
EGM branding and marketing		
Sound	• Colourful and exciting sounds may give players the impression that winning on an EGM is more common than losing and may serve to reinforce gambling behaviour • EGM music may increase player confidence, increase arousal, relax players and even lead players to disregard or dissociate from previous EGM losses • Associating sound with symbols leads to player attention to be drawn to symbols • Pairing LDWs with sound, however, may lead gamblers to overestimate wins	Strong evidence
Music and ambience	• Moderate-risk and problem gamblers were found to be over four times more likely to self-select music than were non-problem or low-risk gamblers • Faster tempo music may increase the speed of gambling • Casino environmental sound, lights and music may lead gamblers to spend less time reflecting on and thinking before acting on their gambling losses	Limited available evidence
Colour	• Red lighting may be more arousing to EGM players and may increase speed of gambling	Emerging evidence
Reels	• Gamblers spend more time focusing on gaming reels than credit balances	Limited available evidence

Strength of evidence

- There is only mostly emerging evidence on how EGM branding and marketing approaches impact gambling behaviour, including some basic evidence relating to the colour red in lighting and music/sound generally is likely to impact gambling behaviour.

- However, the impact of specific EGM branding characteristics remain unknown, highlighting relatively limited overall evidence in this area.

FREE SPINS, FEATURES AND THE EFFECT OF FREE SPINS NEAR WINS

The following characteristic/s of relevance to this section is/are on the NSW Gaming Machine Prohibited Features Register:

#2 - EGM games were found to be offering 100 free games with virtually no chance of winning the games. Consequently, a 40 free game limit was introduced.

Summary of evidence

Free spins and features are amongst the most desired features of gaming machine play. In particular, Schottler Consulting (2014) found that the most exciting free spin characteristics involved obtaining free spins during free spins, obtaining win multipliers during free spins (which multiply wins by a number – e.g., 10x) and winning free spins from free spins. This same research also showed that problem gamblers are prepared to spend a significantly higher amount on EGM play to obtain a free spin (e.g, an average of $23.79 versus an average of $16 for all risk segments), implying that EGM designs that don't deliver free spins have potential to contribute to play persistence.

Similar to free spins, gaming machine features represent a further desirable attribute of gaming machines. Similar to free spins, not receiving any feature during a gaming session has been found to be associated with play persistence (e.g., Schottler Consulting, 2014) and problem gamblers have also been found to be prepared to spend far more than non-problem gamblers to win a feature ($23.93 versus $16.38). This research similarly showed that features that provide a chance to win a linked jackpot or those that involved selecting different 'win and spin' options were the most exciting for gamblers.

Three EGM feature characteristics were also found to be more exciting for problem gamblers compared to non-problem gamblers: (A) Features that involved role playing a character (problem gamblers (PGs) mean=3.4, non-problem gamblers (NPGs) mean=2.4), (B) Features that gave the impression of a game of skill (PG mean=3.0, NPG mean=2.3) and (C) Features with funny characters (PG mean=3.4, NPG mean=2.5). It was then suggested that this may provide some evidence that such feature characteristics could pose some level of harm to problem gamblers.

While some more recent studies have examined free spins and features, few new insights have been revealed. Goodie (2015) also recently concluded that while temporal characteristics such as speed and duration of games have received the most research attention, other nuanced characteristics of features (e.g., feature characteristics such as skill elements in games and other characteristics) have not been well researched. Belisle et al (2017), for instance, conducted a study to conclude that dense win schedules were probably even more important than features, however adding 'bonus rounds' can increase gambling. In addition, Taylor et al (2016) stated that additional characteristics of EGM play were more important preference drivers than features (e.g., animations, buttons, music etc.).

Some research has started to examine EGM like games of chance in the context of video gaming (e.g., Loot boxes), games of skill in the context of EGM play are yet to emerge as a topic of research. King and Delfabbro (2018), however, more recently advocated how safe guards could be put into place in the context of video games to prevent such games harming players from their gambling like characteristics.

While not a game of skill, use of stop buttons during gaming has also been found to create perceptions of games of skill. Early research has also shown gamblers believe that use of such buttons gives the perceptions of control over gaming outcomes (e.g., Ladouceur and Sévigny, 2005). Dixon et al (2017) also more recently examined the use of stop buttons and found that near misses and stop buttons made players feel in control of the EGM and fostered cognitive biases. Accordingly, such findings further reiterate that features with stop buttons that give gamblers the perception of control over gambling may raise the potential for gambling harm. This also highlights that limited progress has been made in understanding the impact of feature characteristics and as highlighted by Goodie (2015) nuanced characteristics of features are a critically important future topic of research.

The implications of literature review findings and the strength of available evidence in summary are below:

EGM characteristic	How EGM structural characteristics impact gambling	Strength of evidence
Free spins, features and the effect of free spins near wins		
Free spins	• Free spins are associated with gamblers exceeding limits and produce high play excitement • The top three most exciting free spin characteristics were receiving free spins during free spins, win multipliers during free spins (which multiply wins by a number – e.g., 10x) and free spins and winning from free spins	Very strong evidence
Number of free spins	• The greater the number of free spins, the higher play excitement • EGM designs that do not lead to at least a single free spin within a set spending limit may contribute to play persistence • The freeness of the spins may not be the most attractive preference driver for EGMs. Rather, it may be the additional features of EGMs	Strong evidence
Free spins near larger wins	• Obtaining a feature or free spin immediately after a large win is exciting for all gamblers and more exciting for problem gamblers • Problem gamblers increase bets upon receiving a feature near a large win or a free spin near a large win more frequently than non-problem gamblers	Emerging evidence
Win multipliers	• Win multipliers may be associated with high play excitement and have a relatively greater impact on problem gamblers, compared to non-problem gamblers	Emerging evidence
Features	• Receiving a feature during a free spin is exciting for gamblers • One study showed that features that simulated a gambling game are least exciting, while features providing a chance to win a linked jackpot or involved selecting different 'win and spin' options may be more exciting • Three EGM feature characteristics have been found to be more exciting for problem gamblers (A) Features that involved role playing a character (B) Features that gave the impression of a game of skill (C) Features with funny characters Problem gamblers may be attracted to features that are more winning rather than entertainment focused • Reinforcement schedules may be even more important than features in explaining overall EGM game attraction	Very strong evidence
Loot boxes	• Video game research shows that 'within game' loot boxes may have addictive effects - especially if these are exclusive and more attractive than other game features	Not yet available in Australian EGMs
Stop buttons	• Stop buttons may create a perception in EGM players that they can control the game outcome and may lead to the misperception that skill can be used in EGM play • Other features that promote very high player involvement (e.g., collecting items, playing detailed games of chance etc.) may also have potential to harm players	Very strong evidence

Strength of evidence

- There is strong evidence based on the number attitudinal and behavioural studies that free spins and features are likely to be associated with increased excitement during gambling (and particularly for PGs). However, there is not yet available evidence on the number of free spins or features, or even feature characteristics, most associated with increases in gambling harm.

- Recent evidence from the 2014 Schottler Consulting study examining multipliers in a real gambling environment also provides some reasonably strong emerging behavioural evidence that large multipliers may be harmful. However, exact numbers of multipliers associated with harm cannot yet be determined from available research.

- Reasonably strong evidence from several studies – including attitudinal and behavioural studies - also supports the potential for stop buttons to create an illusion of control over gambling.

IMPACT OF JACKPOTS

Summary of evidence

While research highlights that jackpots are desired by problem gamblers, still very little is known about jackpots. Schottler Consulting (2010) also found evidence that both moderate risk and problem gamblers were inclined to select EGMs with high jackpots or linked jackpots and using their methodology, Rockloff et al (2014) recently conducted a study to find that messages about 'jackpot expiry' may lead players to quit gambling (i.e., a message telling the gambler that a jackpot was no longer available). Such results may highlight that permanent jackpots may be harmful and that there is merit in offering jackpots on a limited basis and of a limited size to prevent gambling harm. The authors also found that hidden jackpots (a concealed prize) may contribute to intense gambling, however, mystery jackpots (where a winning combination was concealed) did not.

Li et al (2015) also more recently conducted an experimental study comparing Deterministic and Progressive jackpots and found that players bet highest on large jackpot EGMs that were represented as deterministic and non-progressive.

The idea of restrictions on winning of jackpots was also recently introduced by Walker et al (2015). The authors highlighted in a paper the notion of win limits as a Responsible Gambling (RG) measure. Quilty et al (2016) also investigated limits on jackpot prizes as a gambling harm minimisation strategy and found that self-reported gambling increased with monetary pay outs. Accordingly, such results further highlight that there may be some harm minimisation value in keeping jackpots and generally, wins from gambling low in size.

The implications of literature review findings and the strength of available evidence in summary are below:

EGM characteristic	How EGM structural characteristics impact gambling	Strength of evidence
Impact of jackpots		
Types of jackpots	• There is limited available research on the impact of different types of jackpots • EGM players may bet higher on high jackpot EGMs that are deterministic and non-progressive • Large hidden jackpot prizes, but where winning symbol combinations are known (a non-mystery) may be associated with the fastest bets per minute and strongest play persistence while a player is losing • Mystery jackpots where a winning combination is concealed may not be associated with play persistence	Emerging evidence
Size of jackpot	• Moderate risk and problem gamblers look for EGMs with high jackpots – including linked jackpots • Jackpots over linked networks may not be associated with play persistence – however, problem gamblers have also been found to prefer linked jackpots because of their typical size • Gamblers with large debts may be at risk for persistent gambling if large prizes (as players will bet higher on larger prizes)	Very strong evidence
Jackpot permanence	• Having jackpots expire after a certain time may lead to players ceasing play and may thus minimise losses	Emerging evidence
Win limits	• Win limits – rather than loss limits – have been recently proposed as having potential to reduce gambling harm – a similar effect has also been proposed for prize limits on EGM jackpots	Limited available evidence

Strength of evidence

- There is very strong evidence from a number of attitudinal and behavioural studies that high jackpots are very attractive to and are highly coveted by PGs.

- Some reasonably strong emerging evidence by Rockloff highlights some possible effects for different types of jackpot on gambling harm, this complex area requires further research to fully understand if and why some types of jackpots are more or less harmful. In addition, the threshold for jackpot harm also needs investigation to provide regulators with some clear guidance on the upper thresholds of harm associated with different jackpot levels. There is a distinct absence of behavioural studies in this area.

IMMERSIVE CHARACTERISTICS OF GAMING

The following characteristic/s of relevance to this section is/are on the NSW Gaming Machine Prohibited Features Register:

#13 - A number of jurisdictions expressed objection to the proposed operation of EGMs with headphones. As EGM players have potential to immerse themselves in gaming with the use of headphones, it was entered into the Register.

Summary of evidence

While gaming machine play is anecdotally considered immersive, there is still much to be learned about the effects of more immersive features of gaming machine play. It is also the case that many immersive features are yet to be developed and implemented in spite of existing in video games and many other consumer products. These may include surround sound, 3D effects, virtual reality, USB chargers for phones, skill-based games in EGM and the like.

Some games like EGMs also have potential to use avatars and other features used in video game play (e.g., Loot boxes). Other immersive aspects of EGM design also intersect with gaming machines and include features such as quests, shooting, 'Easter Eggs', vibration effects (like on racing cars), headphones and multi-play characteristics, allowing 'competition' between adjacent or remote gamblers. However, in spite of such features being core to many video games, most are yet to be widely implemented in EGMs. Nevertheless, it is useful to consider possible effects to ensure that harms can be anticipated prior to gaming machine approvals.

While there is limited to no research in this area, some interesting conceptual frameworks have been identified by King et al (2009) and more recently by Calleja (2014) and Tanskanen (2018). While such models do not explain immersive effects, they use video gaming to provide a framework for identifying and potentially assessing the potential characteristics of immersive features of EGMs.

A recent study by Roettl and Terlutter (2018) also highlight how Virtual Reality (VR) in particular can be a powerful way to achieve immersion in play. This study showed the superiority of Head-Mounted Display (HMD) VR in immersing players of a video game and demonstrated its superiority to other versions of the game (e.g, conventional 3D, 2D video). It is also noteworthy that cognitive load was higher in this condition, highlighting the potential for further player immersion and involvement in play. Accordingly, such features have potential to take player concentration away from important design features – such as the credit meter – and direct player attention to the game play dynamics.

The implications of literature review findings and the strength of available evidence in summary are below:

EGM characteristic	How EGM structural characteristics impact gambling	Strength of evidence
Immersive features of gaming		
Immersive features of EGMs	Examples include - Sound and sound effects, Graphics, Background and settings, Duration of the game, Rate of play or how quickly the player gets absorbed in the game, Advancement rate (how quickly the game advances), Use of humour, Control operations (e.g., choices over settings), Game dynamic (e.g., fulfilling a quest, shooting, Easter eggs etc.), Winning and losing features (e.g., ability to gain bonuses), Character development, Brand assurance (e.g., brand loyalty, celebrity endorsement), Multiplayer features (e.g., being able to play against others, build alliances etc.) and Social features	Limited available evidence
VR and 3D variants of EGM games	Potential to immerse gamblers and VR may also increase the cognitive load of play (taking attention away from time and money expenditure)	Emerging evidence
Headphones (e.g., playing music)	Gamblers may use temporal background music and other cues in venue environments to keep track of play duration While these are not well-researched, there is potential for VR and headphone use to block temporal cues that assist gamblers to self-monitor their play	Emerging evidence

Strength of evidence

- There is very limited research on immersive characteristics of gaming. While some frameworks for considering game impacts are available in other disciplines (e.g., video gaming research), there is very limited available evidence in this area related to EGMs and gambling harm. Given that immersive characteristics are a fundamental part of EGM play, this highlights a dire need for further work in this area.

SECTION 2
Introduction and methods

Introduction

PURPOSE

The purpose of the current literature report was to review literature relating to the design characteristics of electronic gaming machines (EGMs).The aim of the review was to focus on the attitude and behaviours of gamblers with respect to different characteristics and to identify aspects of harm and responsible gambling associated with different characteristics.

OBJECTIVES

The current review was commissioned to support the NSW gaming machine approvals process by assisting Liquor & Gaming NSW to develop policies and guidelines to guide the development of EGMs by manufacturers.

The objective of the review was to update literature reviewed as part of the 2014 research commissioned by Gambling Research Australia (Impact of Structural Characteristics of Electronic Gaming Machines, Schottler Consulting, 2014). For this reason, the current review focused primarily on identifying new literature published in 2014 and beyond. A secondary aim was to identify future areas for research on EGM characteristics.

Specific project objectives were to:

- Review literature on current and emerging EGM design characteristic and associated harms
- Identify gaps in the current evidence base
- Where the literature allows, identify:
    - Gambler awareness and understanding of EGM design characteristics, and gambler intentions, attitude and behaviour in response to different characteristics (e.g., differential impacts by gambler PGSI)
    - Harms that may result from EGM characteristics
    - EGM characteristics that reduce the risk of gambling-related harm.

EGM DESIGN CHARACTERISTICS OF FOCUS OF THE LITERATURE REVIEW

EGM design characteristics identified as particularly of interest in the review included the following. It should, however, also be noted that if in-depth literature is not presented in the literature review, this is simply because extensive or no literature was available. As such, the following characteristics were considered key points of focus for the review, if research evidence was available.

<table>
<tr><th>General EGM characteristics</th><th>Features and free spins</th><th>Jackpots</th></tr>
<tr><td>Lines and bets
• Multi line games
• Bet size and limits (min and max)

Max bet buttons
• 'Max Bet' button
• Extra credit buttons

Denominations
• Multi-denomination games

LDWs and near misses
• Losses Disguised as Wins
• Near-misses

Wins and payback schedules
• High and low volatility pay tables
• Weighting tables

Spin rates and cash input limits
• Reel spin rates
• Cash input limits

Payment and pre-commitment methods
• Methods of payment
• Pre-commitment methods

EGM physical presentation
• Artwork
• Music and lights
• Congratulatory messages</td><td>• Presence
• Frequency
• Free spins
• Gamble
• Multipliers
• Ante bets</td><td>• No. of jackpot levels
• Linked progressive vs. stand-alone
• Deterministic vs. non-deterministic
• Size of jackpot
• Display of jackpot history</td></tr>
<tr><th colspan="3">Immersive design characteristics</th></tr>
<tr><td colspan="3">For instance, these may include:
• Headphones
• Surround sound
• 3D and 4D
• Virtual reality
• Skill-based features
• Games of skill
• Multi-player competitive games</td></tr>
</table>

CHARACTERISTICS RELEVANT TO THE NSW GAMING MACHINE PROHIBITED FEATURES REGISTER

The NSW Gaming Machine Prohibited Features Register was first released in July 2006 to provide general guidance to manufacturers about the types of EGM characteristics that are not permitted in NSW. Updates are progressively made with the most recent Register update in November 2011 (Revision F).

Each entry in the Register relates to an EGM characteristic that ILGA identified as having potential to be associated with increased risk of gambling harm for gambling consumers or potentially, for people experiencing gambling problems.

The Register was originally developed based on potentially harmful EGM characteristics identified by the former Independent Liquor and Gaming Authority (ILGA) (as part of regulatory EGM and game approvals) as part of its statutory role. The NSW Gaming Machines Act 2001 No 127 required ILGA to pay due regard to harm minimisation considerations in exercising its regulatory functions under legislation.

Specific entries in the current NSW Gaming Machine Prohibited Features Register (Version F – 28 November 2011) are summarised in Table 1. Official entry numbers of items in the NSW Gaming Machine Prohibited Features Register are also provided in the left-hand column for reference.

Accordingly, each section of the literature review that either directly or indirectly relates to a characteristic on the Register is as follows – For example:

The following characteristic/s of relevance to this section is/are on the NSW Gaming Machine Prohibited Features Register:

#2 - EGM games were found to be offering 100 free games with virtually no chance of winning the games. Consequently, a 40 free game limit was introduced.

Table 1. Overview of prohibited features in the NSW Prohibited Features Register (Version F – 28 November 2011)

Official Register number	Research literature reviewed	Current Register Entries	EGM characteristics present in the NSW Gaming Machine Prohibited Features Register (Version F – 28 November, 2011)
Free spins			
#2	Research literature on the effects of free games on EGM play	Maximum of 40 free games	EGM games were found to be offering 100 free games with virtually no chance of winning the games. Consequently, a 40 free game limit was introduced in the Prohibited Features Register revision F.
Advertising and branding of EGMs			
#3	Research literature relating to the effects of gambling advertising	Display of legal tender	An image of real Australian money was displayed on an EGM. As this was considered a potential player inducement, display of real money on an EGM or as part of an EGM theme was entered into the Prohibited Features Register revision F.
#4		Game name, for example display of 'Big Money' theme	An EGM was branded with a 'Big Money' theme. This was considered inconsistent with responsible gambling, so was entered into the Prohibited Features Register revision F.
#5		Player inducement messages	Verbal player inducement messages were prompted to players in the event they didn't win a feature ('try again' and 'have another go'). These were considered inducements to play and were entered in the Prohibited Features Register revision F.
#6		Inappropriately advertising the top prize, for example advertising top prizes without information that a maximum bet was required	The top prize of an EGM was prominently displayed in EGM game rules, in spite of the prize not being attainable without use of the maximum bet (i.e., Win up to $3,000, $5,000 or $10,000 – However, the $10,000 prize only applied if the maximum bet was used). This was considered an advertising inducement and was entered into the Prohibited Features Register revision F.
EGM characteristics that encourage greater spending			
#1	Research literature relating to EGM characteristics that may encourage greater spending on EGMs	Non-linear pay table game	A non-linear pay table listed a different top prize depending on the amount bet (i.e., Bet 1 credit 5 symbols for $100, bet 2 credits 5 symbols for $300 and bet 3 credits 5 symbols for $500). As it encourages players to increase bet amounts, it was entered into the Prohibited Features Register revision F.
#8		Qualifying bet required to win top or jackpot prize	A player was required to bet a minimum of lines (4 lines) as a qualifying bet to win the top prize. As this was inappropriately encouraging higher bets, it was entered into the Prohibited Features Register revision F.
#10		Qualifying ante bet increase on feature games	Qualifying ante bets to play feature games were increased from 25 to 35 credits, without a corresponding RTP increase. As players are highly motivated to win features, a corresponding increase in RTP is appropriate. For this reason, the practice was entered in the Prohibited Features Register revision F. A maximum 30-credit bet was set for games that offer an ante bet to win feature style games. The following requirements were set: • For a 25-30 credit qualifying bet, the feature RTP must be at least 5% • For a <=25 credit qualifying bet, the feature RTP must be at least 4% • Ante bets on feature games are only permitted on

Official Register number	Research literature reviewed	Current Register Entries	EGM characteristics present in the NSW Gaming Machine Prohibited Features Register (Version F – 28 November, 2011)
#12			low denominations
#9		A $1 game that could be configured with a minimum $10 bet	A $1 Blackjack game could be configured by venues to require a $10 minimum bet per hand (instead of the $1 minimum bet in line with the EGM's denomination). It was entered into the Prohibited Features Register revision F.
#14		A large 'bash' button that prompted players to play all lines	A button panel prompted players to increase their bet to play all lines. As this was identified as a responsible gambling issue, it was entered into the Prohibited Features Register revision F.
		Simultaneous multi-game on-screen games on EGMs	EGMs played multiple games on-screen such as 4-in-1 games or 2-in-1 games. As venues have a strict allotment of EGMs, multi-game on-screen EGM games circumvent this limit. In addition, multiple game availability would encourage players to play more than a single EGM at once. It was entered into the Prohibited Features Register revision F.
Display of problem gambling notices on cashback terminals			
#11	Research literature relating to the display of problem gambling notices on cashback terminals	Cashback terminals should display problem gambling notice information	An outcome of the TITO harm minimisation trial was that cashback terminals equipped with display screens should use the on-screen displays to display problem gambling notice information. Larger screens require ongoing display of information, while small screens require periodic display. It was entered into the Prohibited Features Register revision F.
Mixing of machine denominations			
#7	Research literature relating to how EGM players use different machine denominations	Mixing of machine denominations on the same EGM	A concern was raised that multi-denomination EGMs should not mix 1 cent and $1 games. However, based on a trial that showed limited player migration between such denominations, it was determined acceptable to offer low denominations (e.g., 1c, 2c) and high denominations (50c and $1) on the same EGM. However, RTP must be increased for higher machine denominations (with a minimum RTP of at least 92% for high denomination EGMs). Mixing high and low denominations on gaming machines was entered into the Prohibited Features Register revision F.
Headphone use			
#13	Research literature relating to the potential effects of headphone use on EGM play	Use of headphones during EGM play	A number of jurisdictions expressed objection to the proposed operation of EGMs with headphones. As EGM players have potential to immerse themselves in gaming with the use of headphones, it was entered into the Prohibited Features Register revision F.

Literature review methodology

SEARCHES OF JOURNALS

The methodology used for the review included searches of a scholarly journal subscription service containing access to over 15,000 peer review journals (www.deepdyve.com). Searches involved the following search terms since 2014:

- Gaming machine (yielded 1365 results)
- Electronic gaming machine (yielded 267 results)
- Slot machine (yielded 665 results)
- Poker machine (yielded 42 results) and;
- Gambling (yielded 5467 results)

Broad search terms were used to ensure that every possible paper of relevance could be identified and included in the review, where relevant.

Abstracts of papers were reviewed for relevant content on the impact of EGM structural characteristics and where relevant content was identified, full papers were reviewed. As most searches had significant overlap, it was not possible to determine the number of relevant papers retrieved from each search. As such, the overall objective was primarily to exhaustively identify all papers of relevance to EGM structural characteristics, with a particular emphasis on new papers or reports since 2014.

To ensure a comprehensive review, additional searches were also made on web sites associated with other scholarly databases. This was primarily a cross-check to ensure that all relevant papers had been identified. In some cases, new content earlier than 2014 was also incorporated to extend the scope of the literature review.

Key additional databases reviewed as part of the cross checking using the same search terms are shown in the box below.

• PsychINFO • CinahlPlus • Informit • Ovid	• Medline • Proquest • PubMed • ScienceDirect

As a further cross check to ensure that all possible papers were identified, major research journals since 2014 known to produce quality research on gaming and gambling were also identified and journal content headings examined page by page since 2014. This included journals such as Gambling Research, Addiction, International Gambling Studies and Journal of Gambling Studies.

Other general searches were also conducted on Google scholar to exhaustively identify other journal papers of relevance to the research. Following this stage, as papers retrieved in the search had already been identified through previous searching, the literature searching was considered complete and exhaustive.

In total, 192 papers with relevant content were identified and included in the literature review, with 74 studies with relevant content identified since 2014.

A breakdown of the number of papers in scholarly journals or other high-quality peer reviewed research reports is below. Given that many papers before 2014 have contributed significantly to the body of research on EGM structural characteristics, these too were included in the review.

Year	Papers identified (N)	Year	Papers identified (N)
Pre-2010	86	2015	16
2010	13	2016	8
2011	5	2017	9
2012	6	2018	17
2013	8	2019	4
2014	20		

SEARCHES OF GREY LITERATURE

In addition to reviewing peer reviewed journals, searches of grey literature were also undertaken to identify quality reports and papers on EGM characteristics of relevance to the review. The search for grey literature focused on both general internet searches and searches of major jurisdictions known to produce useful reports on gambling harm.

This included reviews of web sites regulators in all Australian states, the UK, New Zealand, South Africa, Canadian provinces, Singapore, Hong Kong and the US. Other repositories of research were also reviewed such as GREO (the Gambling Research Exchange Ontario), the Victorian Responsible Gambling Foundation research web site and the Gambling Research Australia web site. Web sites of prominent researchers in the field were also searched (e.g., Harrigan, Parkes).

Results of the searches of grey literature, however, only identified papers that were already captured in the previous review of scholarly peer review journals. This highlighted that the search for papers on EGM structural characteristics was likely to be exhaustive, as no further papers were identified.

Assessing the strength of available literature review evidence on EGM structural characteristics

APPROACH

Research on the impact of Electronic Gaming Machine structural characteristics is still very much in its infancy. For this reason, all 192 papers have been referenced in the review, where some level of possible insight about the impact of EGM structural characteristics was available.

While 192 papers may sound like a large body of research, in reality, these are studies spread over an extensive range of different EGM structural characteristics. As such, the total available papers on individual characteristics is still relatively small. It should also be noted in this context that this is not the complete body of all papers on EGM structural characteristics ever, as the review was primarily to update a 2014 literature review with new research evidence.

Given that EGM structural characteristics research is still in its infancy, there is benefit in learning what we can from available studies, rather than excluding studies due to small methodological issues or other factors (e.g., laboratory studies, smaller than optimal sample sizes etc.).

However, some confidence in the overall value of studies reviewed is apparent, in that all studies identified were from peer reviewed journals or related sources with peer review or a similar scholarly review process. Accordingly, this provides some validation of the value of studies reviewed in spite of some possible research limitations.

The small number of papers available in the field is also likely in part to be due to the many challenges and difficulties experienced by researchers in studying EGM structural characteristics. These include difficulty gaining access to EGMs and players, challenges associated with measuring cognitive/psychological phenomena during live EGM play and difficulties associated with measuring effects of structural characteristics in complex environments (e.g., there are many potential confounding variables and complex measurement approaches are often required to understand the effects of individual characteristics).

KEY CONSIDERATIONS IN ASSESSING THE STRENGTH OF EVIDENCE

A range of practical considerations were thus made in drawing conclusions about the overall likely impact of different EGM structural characteristics based on studies presented in the current review. As a qualitative general desktop review, rather than meta-analysis, these were qualitative in nature and included:

- A general assessment of the total number of studies available on each structural characteristic (i.e., the more studies that conclude similar findings, the higher the likelihood of an effect)
- The availability of behavioural evidence versus only attitudinal evidence relating to characteristics (i.e., laboratory or behavioural studies support the impact of characteristics over attitudinal research alone)
- The extent researchers have attempted to measure or quantify the impact over a reasonably robust sample of gamblers (i.e., a qualitative study involving 10 interviews could be argued to provide less evidence than a larger quantitative study, or a study involving both qualitative and quantitative research)
- The presence of studies that have involved a systematic or meta-analytical review of available evidence (i.e., any studies attempting to conduct a more systematic review may often also attempt to evaluate individual study methodologies and/or attempt to estimate effect sizes)
- The extent research has not only identified a characteristic as harmful, but has also attempted to measure the specific threshold of harm associated with that characteristic (e.g., how many EGM lines, multipliers or free spins are associated with harm, rather than just making general conclusions that those characteristics are harmful).

The strength of evidence for each major type of EGM structural characteristic (i.e., the amount of evidence on the potential of each EGM characteristic to be associated with harm) are in the integrated summary of findings. This contains a discussion of major findings and highlights future directions for research based on conclusions drawn.

Once again, this assessment is qualitative in nature, as it was outside the scope of the current review to conduct a meta-analysis or systematic review of individual studies by characteristic, nor to analyse pooled effect sizes. An analysis of effect sizes by characteristic, however, may be a project for future consideration, once a larger range of studies becomes available for particular EGM structural characteristics.

SECTION 3
Review of research literature on the impact of EGM characteristics on gamblers

EGM lines, bets and denominations

The following characteristic/s of relevance to this section is/are on the NSW Gaming Machine Prohibited Features Register:

#1 - A non-linear pay table listed a different top prize depending on the amount bet (i.e., Bet 1 credit 5 symbols for $100, bet 2 credits 5 symbols for $300 and bet 3 credits 5 symbols for $500). As it encourages players to increase bet amounts, it was entered into the Register.

#8 - A player was required to bet a minimum of lines (4 lines) as a qualifying bet to win the top prize. As this was inappropriately encouraging higher bets, it was entered into the Register.

#10 - Qualifying ante bets to play feature games were increased from 25 to 35 credits, without a corresponding RTP increase. As players are highly motivated to win features, a corresponding increase in RTP is appropriate. For this reason, the practice was entered in the Register.

A maximum 30-credit bet was set for games that offer an ante bet to win feature style games. The following requirements were set:

- *For a 25-30 credit qualifying bet, the feature RTP must be at least 5%*
- *For a <=25 credit qualifying bet, the feature RTP must be at least 4%*
- *Ante bets on feature games are only permitted on low denominations*

#12 - A $1 Blackjack game could be configured by venues to require a $10 miqnimum bet per hand (instead of the $1 minimum bet in line with the EGM's denomination).

#9 - A button panel prompted players to increase their bet to play all lines. As this was identified as a responsible gambling issue, it was entered into the Register.

#14 - EGMs played multiple games on-screen such as 4-in-1 games or 2-in-1 games. As venues have a strict allotment of EGMs, multi-game on-screen EGM games circumvent this limit. In addition, multiple game availability would encourage players to play more than a single EGM at once.

7# - A concern was raised that multi-denomination EGMs should not mix 1 cent and $1 games. However, based on a trial that showed limited player migration between such denominations, it was determined acceptable to offer low denominations (e.g., 1c, 2c) and high denominations (50c and $1) on the same EGM.

However, RTP must be increased for higher machine denominations (with a minimum RTP of at least 92% for high denomination EGMs).

IMPACT OF EGM LINES AND BETS

EGM lines and bets are possibly the three most salient structural characteristics of EGMs. Gambler choice of bet size (credits per line) and the number of lines are also some of the most well-researched gambler behaviours. This is largely because the choice of bets and lines is fundamental to EGM play.

Early research has identified that most gamblers will bet on more than a single line when playing EGMs. McMillen et al (2003), for instance, identified in a Victorian study that 86% of EGM players gambled on more than a single line. Livingstone and Woolley (2008) found in a telephone survey that most gamblers preferred to make minimum bets on multiple or maximum lines.

Williamson and Walker (2001) observed 220 players in the NSW Casino to monitor and record their betting patterns. Based on the study, the authors coined the term 'Maximin' to describe the common strategy (in 45% of players) to bet maximum lines with the minimum bet (i.e., 1 credit for 20 lines). Results of this study were interestingly also confirmed in a laboratory experiment by Delfabbro, Falzon, and Ingram (2005).

Walker (2003) explored gambler reasons for use of the 'Maximin' strategy. Reported reasons were (1) To avoid missing out on wins associated with lines not being selected, (2) To ensure that players could capitalise on scatter symbols (which can trigger free spins/features and can be anywhere to produce a win) and (3) To increase the perceived chance of winning a bonus feature.

A further observational study of EGM players by Schottler Consulting (2014) confirms this trend. Problem gamblers were significantly more likely to think that they had to play all pay lines to avoid missing wins (mean=4.3), compared to non-problem gamblers (compared to mean=3.7 for non-problem gamblers). In addition, problem gamblers rated EGMs with more lines (50 and 243 lines) as more exciting than non-problem gamblers. In addition, around 77% of the 222 players observed during live EGM play chose to bet on all lines on their EGM (including 84% of problem gamblers and 76% of non-problem gamblers) and there was a general tendency for gamblers to bet on a similar percentage of total lines, no matter the lines available on the machine. In addition, Templeton et al (2015) found that, during free play of two EGMs, players opted to play on the maximum number of lines on over 70% of spins (71.4% on one EGM and 72.3% on the other EGM).

While there has been a noted gambler tendency to bet multiple lines with minimum bets, some variations in behaviour have been observed in problem and at-risk gamblers. In particular, there is reasonably strong evidence that problem gamblers use higher credit bets when playing EGMs. Livingstone and Woolley (2008), for instance, found that problem gamblers were less likely to make minimum bets on multiple lines and were disproportionately over-represented in the group making medium bets on multiple or maximum lines.

This was similarly confirmed in an observational study of EGM players by Schottler Consulting (2010). Moderate and problem gamblers used a higher number of multi-credit bets during gambling, compared to lower risk gamblers. It was similarly found that use of multi-credit bets added the prediction of play excitement, over and above a range of other factors (e.g., Problem Gambling Severity Index (PGSI), play involvement, venue promotions/prizes, loyalty points and incentives, dreaming about winning, staff friendliness and total free spins received during play). Reasons for players using multi-credit bets were reported to include a perception that one could 'win more money' (45%) and to 'increase the chance of winning' (17%), which may indicate a misperception that large credits may change the machine payback schedule (or RTP).

Other studies have similarly identified a link between multiple credit bets and problem gambling at a population level. The Australian Productivity Commission (1999), in particular, found that 70% of problem gamblers reported betting multiple credits (compared to only 36% of non-problem gamblers) and 27% of problem gamblers reported betting 'often or always' on more than a single line per spin (compared to only 16% of non-problem gamblers).

INCREASING LINES MAY INCREASE PLAYER IMMERSION

While the above studies confirm the EGM gambling patterns of gamblers, more recent research has identified a further possible impact of EGMs with higher numbers of lines. In particular, Murch and Clark (2019) found that higher line machines may have an 'immersion' effect on gamblers. The authors conducted an experimental study examining the impact of multiline play and bet size on cardiac activity and gambler immersion in play.

Seventy-six male undergraduate students were asked to play an authentic computer-based EGM simulation game. Play lines and bet multipliers were varied across four conditions. Findings revealed that immersion was greater in players, if pay lines and bet size were high. In addition, increasing pay lines was associated with increased levels of player immersion. Results were considered by the authors to imply that player immersion may be amplified by multi-line play and that some limits may need to be placed on EGM lines for harm minimisation. A study by Dixon et al (2014) also reiterates this finding. Dixon et al (2014) compared single line to multiple line EGMs and found that there was greater immersion in the multiple line condition.

A further recent study by Dixon et al (2018) similarly found a link between multiple line EGM design and risk for problem gambling, even when bet size was statistically controlled. The authors compared gambler behaviour when betting 20 lines at 1 credit (1 cent per line) to betting 1 line at 4 credits (5 cents per line). As the bet size was effectively the same across the two conditions (each was 20 cents), the study allowed changes in gambler immersion to be measured, whilst controlling for total bet size. Interestingly, findings showed that multiple lines predicted risk for problem gambling and immersion was greater in the condition with multiple lines.

HIGH BET SIZE MAY BE ASSOCIATED WITH POOR PROBABILITY JUDGEMENTS

A recent study by Parkes et al (2016) also explored the relationship between impulsivity during gambling and stake size (effectively bet size). A total of 32 frequent adult non-problem gamblers took part in an experiment betting on three different stake sizes (£20, £2 and no stake per bet) on a simulated gambling task. Findings showed that participants' ability to make probability judgements was impaired after gambling at higher stakes, when compared to lower stakes. This was taken to imply increased reflection impulsivity. Accordingly, findings may imply the need for harm minimisation measures to prevent loss chasing in larger stake betting. Indeed, large bets may present some vulnerabilities to players.

MULTILINE BETTING PURCHASED TO INCREASE REINFORCEMENT

Harrigan et al (2014) proposed that being able to bet on multiple lines actually provides gamblers with a chance to purchase a higher frequency of winning and larger prizes, despite no change in the payback percentage of the game. This is also reported to be favoured by gamblers, as players prefer frequent wins (Templeton et al, 2015). In this respect, players were reported to be aware that the frequency of wins can be effectively 'increased' following adjustments to lines (i.e., they see wins more often).

DOUBLE-UP OR GAMBLE BUTTONS

Also relating to betting behaviour is the extent gamblers are prepared to stake their wins using the 'gamble' button. While not as much research has been undertaken on player use of double-up, a few studies provide some evidence about its use and effects during EGM play.

Double-up games typically provide an opportunity for players to 'double their winnings' during EGM play. It is also commonly referred to as the 'gamble' button on the EGM. In some games, players must pick 1 of 2 cards to double their money and in other games, they pick other combinations such as 1 of 4 cards (to quadruple their money). Matching the correct card suit then leads to a win and money is either doubled or quadrupled depending on the game. In some machines, half gambles are also permitted allowing a part of the win to be staked.

Walker (2003) summarised the results of several studies examining double-up in gaming machine players. The overall observation from this paper was that EGM players can be somewhat reluctant to use double-up and particularly when they have obtained a large win. One analysis of player use of double-up on Aristocrat EGMs at a Sydney venue showed that just under 6% of players' wins were doubled-up. A further study showed that 71% of players never doubled-up and 67% believed it was too risky.

This is also somewhat ironic, given that the odds associated with double-up games are typically better than EGM odds generally. The reason for not using double-up was also explained as an attempt to avoid regret in line with Kahneman & Tversky (1984) prospect theory.

In spite of the limited use of double-up, Schottler Consulting Pty Ltd (2010) found in an observational study of EGM players that problem gamblers (and higher-risk segments more generally) used double-up more frequently than non-problem gamblers. This was also seen to indicate that higher-risk segments of gamblers may show a predisposition towards risking winnings for the prospect of a large return. Accordingly, this may provide some evidence that double-up could present harm to higher risk segments of gamblers.

A further more recent observational study of 222 EGM players by Schottler Consulting (2014) also showed that gamble buttons are used infrequently by gamblers. In their study, the gamble button doubling up was only used 8.2% of the time across all EGM sessions and the one in four gamble function was used only in 1.8% across all sessions. Possibly highlighting some potential for harm, however, the button was found to be used more often by problem gamblers (it was used by 14.5% of problem gamblers and 5.6% of non-problem gamblers). Some user issues were also apparent with some players unaware that the 1 in 2 gamble function can be changed to 1 in 4 on most EGMs. In addition, having dual function buttons was reported to lead some players to accidentally use double up, when they had not intended to gamble their winnings (although this was not frequent overall).

Gamble buttons were similarly only used for small EGM wins. The average maximum win all EGM players reported being prepared to double up was $12.18. Based on attitudinal ratings, the 1 in 2 gamble function was most preferred of the two types available (71.6% of all gamblers). Presentation of prior gamble game outcomes on EGM screens was also described to lead to players believing they can predict the outcome of gamble games.

IMPACT OF MULTIWAY BETTING

Multiway EGMs – including Reel Power EGMs - are unique types of EGMs that require betting on reels (typically up to 5) rather than lines. They are unique because they have extremely large numbers of effective pay lines. The observational study of EGM players by Schottler Consulting (2014) is one of the only studies to examine multiway machines in depth. Findings of a survey of players highlighted that only 46.4% of EGM players had definitely heard the name Reel Power or Multiway on gaming machines and a further 20.5% indicated some level of 'vague' recognition of the machines (implying that 66.9% of all players had some level of awareness).

Some interesting trends relating to PGSI risk status were also apparent. Problem gamblers reported playing Reel Power and Multiway EGMs (88.1% reporting definite or possible play) more often than non-problem gamblers (58.6% reporting definite or possible play).

While offering a distinctive way of betting, most players did not see that multiway machines had very distinctive characteristics, compared to regular EGMs. In particular, the many 'ways' to win and the purchasing of reels rather than lines were not especially salient to players (44% of players could not think of any differences from regular EGMs) and some players were confused over the cost per spin for such machines. However, the top characteristics of Reel Power and Multiway EGMs were seen to include win multipliers (43% of EGM players), larger wins (33.3% of EGM players) and greater play excitement (33.1% of EGM players) (possibly due to multipliers).
One concerning aspect of Reel Power EGMs raised by EGM players related to a reported player tendency to use 'extra credits' button to qualify for free spins and features (e.g., Buttons with 25 + 5 credits – although note this is a characteristic that is not exclusive to Reel Power).

While the large number of lines may raise concern about high LDWs for multiway EGMs, Schottler Consulting (2014) found that multiway EGMs in the study actually had the lowest proportion of spins resulting in Losses Disguised as Wins (LDWs) (only 13.8% of spins), Reel Power EGMs had the second lowest (16.7% of spins) and regular line based EGMs had the highest (18.5% of spins). One limitation of interpreting these differences, however, is of course the potential for sampling error (i.e., it is not possible to know if the distribution of win outcomes actually matched the Probability Accounting Reports, as these are not publicly available).

Analysis of spins across all multiway machines also showed that:

- Total win multipliers applied during free spins were somewhat higher for Reel Power EGMs (mean=3.5), compared to Multiway (mean=1.7) and regular line-based EGMs (mean=2.5) (as noted during qualitative research – although the above result was not statistically significant)

- Reel Power machines had significantly higher top jackpot prizes (mean=$6,846) compared to line based EGMs (mean=$4,059) - The difference in jackpot prizes between Reel Power and Multiway EGMs combined (mean=$6,291) versus regular line based EGMs (mean=$4,059) was tending towards significance (so this latter result should be interpreted with caution)

MAXIMUM BET AND EXTRA BET BUTTONS

Related to bet size, some EGMs have 'Maximum bet' buttons that allow gamblers to use maximum bets by pressing a single button (i.e., instead of pressing maximum lines and maximum credits). The recent study by Schottler Consulting (2014) is one of very few studies that have investigated the impact of maximum bet buttons in an observational study of EGM players. Findings revealed a range of insights about max bet buttons on gambling behaviour. In particular, findings identified max bet buttons as a potential EGM characteristic that may harm problem gamblers.

Specific findings highlighted that:

- Problem gamblers rated Max Bet buttons as more exciting than non-problem gamblers and used such buttons more frequently

- Problem gamblers were more likely than non-problem gamblers to hold a cognition during EGM play to bet high to ensure that the size of their wins would be maximised

- Maximum bet buttons were considered harmful to EGM players when gambling while intoxicated (as the button could be pressed with a low level of informed consent about the cost of each spin).

A further finding related to the presence of '+5 extra credits' bet buttons on multiway EGMs. These effectively allowed gamblers who were betting on all five reels to 'up their bet' by 5 credits (over and above the maximum bet). Players reported that such buttons were harmful, given that they had to be used to qualify for particular bonus features in a game.

Accordingly, evidence from the study highlighted that maximum bet buttons may be harmful to intoxicated gamblers and particularly harmful to problem gamblers. In addition, buttons adding extra credits were also deemed harmful if linked to bonus features.

EGM DENOMINATIONS

There has been limited research to examine the relationship between EGM denominations and line and bet patterns. However, it is generally accepted that problem gamblers tend to play higher denomination EGMs. A Victorian study, for instance, found that, relative to non-problem gamblers, problem gamblers were more likely to play $1 machines and the denominations preferred by most problem gamblers were two cent (26.80%) and five cent machines (26.48%) (Hare, 2009). This has also been a consistent finding over time, with the original Australian Productivity Commission study (1999) also suggesting that problem gamblers are more likely to play $1 denomination machines than other gambling risk segments.

The interaction between EGM denomination and lines was also recently investigated in an observational study of EGM players by Schottler Consulting (2014). In the study, while EGM players reported playing different numbers of lines on different denomination machines, it was interesting to note that roughly 80% of all available lines would still be played.

Specifically, EGM players reported playing an average of 21.6 lines on 1 cent EGMs (or 80% of available lines), 22.6 lines on 2 cent EGMs (or 77% of available lines) and 15.5 lines on 5 cent EGMs (or 82.5% of available lines). The mean bet size per spin for different denomination EGMs was also as follows - 1 cent EGMs (mean=42 cents), 2 cent EGMs (54 cents) and 5 cent EGMs ($1.20 per spin) (only 1c, 2c and 5c machines were used during observations).

This may suggest that higher numbers of lines on higher denomination EGMs (which typically have fewer lines) may still result in roughly 80% of available lines being played. Accordingly, this raises the need to consider upper limits on high denomination machines to limit maximum bet size.

Some other notable qualitative insights relating to machine denomination also emerged in this study. In particular, players reported occasional use of an incorrect denomination EGM due to poor labelling of denominations on EGM screens (e.g, mixing up $1 with 1 cent EGMs) and advocated that EGM denominations should not be changed in multi-game EGMs, as this could lead players to choosing an incorrect denomination game. This was in part a reflection on many current EGMs having multiple denomination variants of the same EGM game.

In addition, some players similarly reported to find it more difficult to mentally calculate the total cost of an EGM game for some machine denominations. For instance, while it was reported as relatively easy to work out the cost per spin of 1 cent EGM with 20 lines (20c), it was considered more difficult to calculate the cost of a spin on higher denomination EGMs (e.g, 5 cent machines which may only have 15 lines). It should be noted that these were only qualitative observations anecdotally reported by players in the study. However, findings highlight the need for clarity of machine denomination in multi-game EGMs and clarity over the cost of play for EGMs generally (and especially for higher denomination EGMs).

EGM LINES, BETS AND DENOMINATIONS – SUMMARY INSIGHTS

EGM lines

- Most players bet on all lines to avoid missing wins
- Minimum bets on maximum lines is generally the betting pattern used by most non-problem gamblers
- Problem gamblers find higher line EGMs more exciting than those with fewer lines
- No matter the denomination of EGM, gamblers may still bet on roughly 80% of lines
- Higher line EGMs may increase gambler immersion in play, even when accounting for bet size

EGM bets and bet size

- Problem gamblers bet higher amounts than non-problem gamblers
- Problem gamblers *may* choose multiple line EGMs, even when the bet size available is the same
- Problem gamblers have higher use of maximum bet and 'extra bet' buttons and find such buttons more exciting than non-problem gamblers
- Larger bets may be associated with poorer probability judgements by gamblers
- The cost per bet for multiway bets (on multiple reels) can be unclear to gamblers

Gamble buttons

- While gamblers have very low use of gamble buttons, gamble may be more frequently used by problem gamblers (though use is still relatively limited)
- The 1 in 2 gamble button is more popular than other variants (e.g., 1 in 4)
- Showing the outcomes of gamble may lead to gamblers to erroneously believe that they can predict the outcome of the next gamble game

Multiway betting

- While multiway EGMs offer huge numbers of lines, other factors may explain their attraction to gamblers (e.g., multipliers, larger jackpots)

Special features of betting buttons

- Linking bonus features to maximum or extra bet buttons was considered harmful to gamblers, as such features would be purchased by problem gamblers
- Maximum bet buttons may be harmful to EGM players who are intoxicated

Informed consent

- Gamblers sometimes confuse $1 and 1c EGMs due to unclear fonts on EGM screens
- Gamblers are not always aware that denominations and RTP can changed in multi-game EGMs (and thus may play an EGM on occasion thinking it is identical to other EGMs of the same brand)
- The cost per spin on higher denomination EGMs may be more difficult to mentally calculate, than on lower denomination EGMs (e.g., 5c per line for 15 lines is more difficult than 1c per line for 20 lines)

Near misses during EGM play

GENERAL IMPACTS OF NEAR MISSES

Near misses include EGM events where a player is led to believe that they have 'nearly' won. This may involve a player obtaining two symbols when three are required for a win. While there is still much to be learned about the impact of near misses, a range of past studies provide evidence that near misses may impact gambling behaviour.

Clark et al (2009), for instance, found in an experimental study of recreational gamblers that, while not as exciting as real wins, near misses recruit the same 'reward circuitry' of the brain as real wins. Chase and Clark (2010) also conducted an experiment to examine how near miss effects were moderated by at risk gambling behaviour. Findings showed that increasing problem gambling risk was associated with a greater response to near misses in a simulated gambling task.

Slightly different effects of near misses, however, have been found by Dixon et al (2011). This study examined the psychophysical responses of 65 subjects to wins, losses and near misses while playing a slot machine simulator. The authors found that skin conductance responses and heart deceleration were larger for near misses (than for either wins or losses). However, there was no moderation effect for a gambler's risk status.

In addition to possible impacts on brain reward circuitry, other research highlights a possible impact of near misses on gambling persistence. Cote et al (2003), for instance, conducted an experiment using a video lottery terminal game. In an experimental group, subjects were either exposed to a condition where 25% of losses were near misses or to a control group that was not exposed. Interestingly, subjects in the near miss condition played more games than the control group (33% more overall), highlighting a possible motivational impact of near misses.

Other studies have also historically highlighted that near misses may be harmful. For instance:

- Billieux et all (2011) – found that gamblers with a high illusion of control showed strong persistency in gambling after near misses than gamblers with a lower illusion of control (highlighting that near misses may increase the perceived illusion of control during gambling)
- Dixon et al (2013) - conducted an experiment to examine how near misses affected the timing of initiation of the next spin (in other words, how quickly subjects pressed the spin button). This was coined the Post-Reinforcement Pause (PRP) and was measured along with a measure of skin conductance response (SCR). Results showed that near misses with jackpot symbols (landing on the first two reels) produced larger SCRs than regular losses and other types of near misses. In addition, PRPs in this near miss scenario were smaller than for all wins and for all regular losses. The pattern of large SCRs and small PRPs was also described as extending gambling behaviour, on the basis that near misses were 'frustrating'
- Dixon and Schreiber (2004) - found some support for the theory that gamblers see near misses as 'nearly winning', when subjects in an experiment rated near misses as being 'closer to a win' than to a total loss

EGM MANUFACTURERS PROGRAM NEAR MISS EFFECTS

Harrigan (2008 and 2007) also identified that some EGM manufacturers design machines to maximise near misses:

- Harrigan (2008) showed that some manufacturers use a technique called 'award symbol ratio' to program machines to display near misses (a) above and below the pay line and (b) on the pay line at a higher rate than at random
- Harrigan (2007) reported that a technique called 'clustering' is used by manufacturers in the US to create a high number of near misses. Under clustering, the probabilities of symbols on the reel map associated with the Random Number Generator do not match the probabilities of the symbols associated with the physical reels displayed to gamblers. This implies that symbols shown may occur at a higher probability and have potential to influence player perceptions of the overall probability of a win
- Harrigan (2007) also argued that use of virtual reels and clustering with blanks adjacent to high paying symbols can lead to the perception of 'near misses' (above and below the pay line). EGMs could, however, be created without clustering by having a requirement that on the virtual reel there be only a single blank adjacent to each paying symbol. The author similarly proposed that mismatches between physical and virtual reel probabilities may lead to gamblers misrepresenting underlying win probabilities.

Accordingly, such insights raise concerns about EGM games being programmed to display a high proportion of near misses. Falkiner and Horbay (2006) highlight there is no requirement for symmetrical or balanced reels in the Australian EGM standard (or in other words, a requirement for each type of symbol to appear at the same frequency on each reel). However, asymmetric weighting of symbols – as opposed to asymmetric reels – is prohibited in Australian jurisdictions. The authors also advocate that unbalanced reels may create gambling harm and that EGM manufacturers should submit for government approval balanced reels and provide this information to gamblers on EGMs (showing balanced reels with numbers of each symbol per reel and the size of reels).

Livingstone and Woolley (2008) similarly advocate that elimination or reduction of near-miss effects has potential to reduce excessive gambling. Strong opponents of near miss EGM programming such as Harrigan (2008) have also attempted to document that many gaming machines in the US are purposely programmed to deliver more near miss outcomes than would occur with random sampling alone.

PHYSIOLOGICAL AND NEUROLOGICAL RESPONSES TO NEAR MISSES

Given that much is still to be learned about the impacts of near misses, a number of more recent studies have studied near misses impacts using a range of different and new approaches. This has interestingly included a number of studies demonstrating the physiological and neurological responses to near misses in gambling.

Using a similar technique to Dixon et al (2013), Belisle and Dixon (2015) examined the impact of a near miss on Post Reinforcement Pauses (PRPs) following display of EGM game outcomes. The authors interestingly found longer pauses for near miss events, relative to a loss and of new interest, the effect was found to strengthen with an increasing number of matching symbols.

Dymond et al (2014) measured the physiological impact of near misses using Functional Magnetic Resonance Imaging (fMRI). Using fMRI, the authors examined effects of near misses on both non-problem and problem gamblers and their effects on brain circuitry. The relationship of near misses to cognitive distortions was also investigated. A number of notable findings were apparent from this study.

Findings showed that increased responses to near misses in the insula region of the brain were strongly associated with problem gambling severity. In addition, near misses produced a similar effect in the brain as evident during winning and were associated with measured cognitive distortions about gambling. Such findings were then used by the authors to conclude that the insula region of the brain may respond to near misses in gambling in a similar way to other addictions and that such effects may be more pronounced for problem gamblers.

Detez et al (2019) also extended insights by examining heart rate responses in near misses in a virtual reality casino bar. Subjects were allowed to select their preferred EGM and changes in physiological arousal were measured in adults with no history of problem gambling. Final analysis was conducted on 50 participants. Findings showed that significant heart rate acceleration occurred for near misses and losses compared to wins. Findings also showed that both types of losses were also associated with longer Post Reinforcement Pauses (PRPs). It was proposed by the authors that losses may encourage gambling, as subjects experience more immediate heart rate acceleration and initiate faster responses.

COGNITIVE RESPONSES TO NEAR MISSES

Schottler Consulting (2014) examined player perceptions of near misses in an observational study of 222 EGM players. EGM players reported seeing near miss events quite frequently and problem gamblers were significantly more likely to report thinking they had nearly won due to near misses, compared to non-problem gamblers. In addition, problem gamblers were significantly more likely to be triggered to play on through near miss events than non-problem gamblers. Near misses involving a greater number of symbols appeared to have a larger effect on players - For instance, receiving four symbols when five were required for a win was the most exciting type of near miss event, while winning two symbols when three was required was less exciting.

Qualitative feedback also highlighted that near misses could be auditory in nature and generally corresponded to a diverse range of different machine events. This highlights a need for more research in this area and raises the issue that simple near misses – such as where a pay line misses a symbol – may not adequately capture the full range of near miss events.

Further study insights about different methods of winning also provide some indirect insight into why gamblers view certain symbol combinations as near misses. In particular, findings showed that winning more symbols in a row was more exciting than winning fewer symbols in a row (e.g., Mean excitement for winning were as follows - Five symbols in a row – 4.6, four symbols in a row – 3.7, three symbols in a row – 3.0).

Players also reported some 'symbol confusion' when card symbols had greatly different values across EGMs. Analysis of the top and mid-range 15 NSW EGMs also illustrated these differences (e.g., King is 40 credits on one EGM and 100 credits on another). Some EGM players also believed that win credits and credits for common card symbols should be standardised across EGMs to avoid player symbol confusion and to avoid misleading players. Possibly highlighting the need to do this for harm minimisation, problem gamblers reported a greater frequency of being confused after seeing winning symbols on one EGM (mean=2.9) that were not winning symbols on another, compared to non-problem gamblers (mean=2.2).

NEAR MISSES AND STOP BUTTONS ON EGMS

Dixon et al (2017) conducted a study examining how near misses and use of a stop button in multiline machines influenced erroneous cognitions about gambling. This follows the assertion by Wits et al (2015) that features like stop buttons may lead to a sense of agency in players and contribute to erroneous beliefs in gamblers that they can influence the outcome of a win.

The objective of Dixon et al (2017) was to examine how frequently erroneous cognitions occurred relating to near miss outcomes and the extent to which a stop button influenced perceptions of winning, losing and near misses. A total of 132 gamblers were recruited from a Canadian Casino. Two different types of simulated slot machines were played - One with and one without a stop button.

The authors measured player arousal, based on Skin Conductance Responses (SCRs), button pressure and Post-Reinforcement Pauses (PRPs) following a spin. This was based on previous research showing that PRPs are typically longer for wins and near misses (Belisle and Dixon, 2016).

Findings showed that 13.6% of players held erroneous cognitions about the ability of the stop button to influence play outcomes. Players also used more force when playing the next spin after use of the stop button and SCRs were larger when the stop button was used. This was inferred to suggest the presence of higher player arousal or use of a 'strategy' to stop reels in a winning combination (i.e., highlighting an illusion of control over play).

In addition:

- Near misses triggered greater SCRs and more force on the next spin in both the stop button and no-stop button condition (caused more 'frustration' than regular losses)
- PRPs however suggested that players were NOT interpreting near misses as wins – The authors purported that this may be because players were attempting to use 'skill' in pressing the stop button (or that near misses were being used as performance feedback)

The authors then concluded that near misses may lead to player frustration and arousal and that use of a stop button creates an illusion of skill that impacts player behaviour.

A further recent study examining the impact of stop buttons on EGMs was a study by Chu et al (2018). This study examined the impact of stop buttons in a casino laboratory experiment in 30 student and 31 EGM player participants. The study was unique in that it explored the mechanisms underlying why players may use stopping devices. These were proposed to include for enhanced 'illusory control' over gambling and for 'faster game speed'. Participants were given 20 minutes to play the EGM as often as they wished.

Findings showed that participants did not differ in their use of the stop button, regardless of their beliefs about the impact of the stop button. However, it was also found that use of the stop button produced faster spin initiation latencies after wins that involved the use of the stopping device. The authors then speculated that the stop button may produce a level of operant conditioning of respondents (i.e., they presumably press the stop button more often because they believe it is having some impact on play outcomes).

NEAR MISSES BEFORE AND AFTER A PAYLINE

A further recent study by Sharman and Clark (2016) examined the difference between near misses, depending on whether they were 'above' or 'below' a pay line. The authors conducted a study using facial electromyography (at the brow and cheek), along with measures of general electrodermal activity (EDA). A total of 77 student participants were screened with the PGSI and played an EGM simulator.

Consistent with expected results, near misses before the pay line were associated with increased facial Electrodermal Activity (EDA) and increased player motivation to continue playing. In comparison, near misses after the pay line were rated as more 'aversive' than other non-wins and were associated with increased EDA at the brow and zygomaticus activity (at the cheek). This highlighted physiological and psychological differences in the type of near miss effect. Authors also reported that, even when both types of near miss were combined, near misses still increased the desire to continue play. A similar effect was also confirmed by Sharman et al (2015). Near-misses before the pay line were more motivational than near-misses after the pay line and near misses after the pay line were found to be more aversive than near misses before the pay line.

NEAR MISSES IN THE CONTEXT OF WINNING AND LOSING ON EGMS

Banks et al (2018) further examined the value of near misses in terms of player perceptions. This was examined in both winning and losing contexts involving an experiment with 192 undergraduates. Findings of the study indicated different results depending on whether a participant was winning or losing. When participants were losing, the near miss was more positively valued than full losses. However, when the participant was winning, near misses were more negatively valued than losses.

When participants selected a machine with a high expectation of winning, near misses thus violated the expectation of a win and were viewed more negatively than a 'regular' loss. In comparison, when participants chose a losing machine, near misses were viewed more positively than losses. Such findings may have implications for how players view EGMs considered to be 'hot' or 'cold' machines.

OTHER TYPES OF NEAR MISS EFFECTS

Schottler Consulting (2014) examined the different types of near miss effects in an observational study of EGM players. Of particular note was that a range of different types of near miss effects may occur during EGM play. While further research is needed to fully identify and understand these effects, they included the following types of machine events:

- Matching symbols appearing on the pay line without the right number of symbols (e.g., getting 3 with the 4th symbol missing)
- Getting a screen full of winning symbols but lacking one or more to trigger a win
- During a feature, achieving all but one of the feature objectives to trigger a win
- Use of sounds or visual effects that highlight a likely win (also creating anticipation of the win) (e.g., hearing the Pink Panther theme sound, made players think the jackpot feature was close)
- Symbol nudging reel effects (where a symbol stops then falls just above or below the pay line or starts spinning very slowly on the pay line)
- Non-coverage of pay lines required to trigger a win (e.g., symbols fall on a pay line not bet on)
- Machines lighting up or playing sound after a loss or win less than bet size
- Getting symbols required for a win on one EGM that were not winning symbols on another
- Getting a free spin with a lower free spin or win multiplier when a higher was desired
- Getting several near misses (any type) in a row
- Getting two symbols on free spin then the required third on the next free spin

RECENT SYSTEMATIC REVIEW OF IMPACT OF NEAR MISSES

Of relevance to both near misses and LDWs, Barton et al (2017) conducted a systematic review of the effects of near misses and LDWs in research literature. Fifty-one experimental peer-reviewed studies were examined in the systemic review between 1991 and 2015.

Findings of the systematic review showed that near misses motivate continued play and can have varied effects on the betting behaviour and emotional state of EGM players. Near misses were found to produce heightened Skin Conductance Responses (SCRs) and diffuse brain activity in areas of the brain most commonly associated with reward and reinforcement.

Interestingly, the experience of a near miss was not due to lights or music on EGMs, rather was attributed to the psychological state of experiencing the miss. Accordingly, findings support the conclusion that near misses may contribute to potential gambling harm. This highlights the need to consider how near misses are perceived by gamblers in terms of EGM design.

NEAR MISSES DURING EGM PLAY - SUMMARY INSIGHTS

Nature of near miss events

- While near misses are generally visual, they may also be auditory in nature. They are also diverse. Further research is needed to identify near miss events and their impacts
- Receiving close to a large number of symbols (e.g., four or five symbols) is considered a more exciting type of near miss event, than receiving close to a smaller number of symbols

Cognitive impacts of near misses

- Near misses are considered by gamblers to be closer to a win than a loss
- Near misses are associated with cognitive distortions during gambling
- Near misses may lead to increased play persistence in gamblers with a high illusion of control over their gambling – such as problem gamblers
- Problem gamblers may see near miss events more frequently than non-problem gamblers during play
- Problem gamblers are more triggered to continue play following near misses than non-problem gamblers
- The experience of a near miss is not primarily due to lights or music on EGMs, rather is due to the psychological state of experiencing the miss (Note that this is not to state that audiovisual effects can increase the effect)

Near miss locations relative to pay lines and winning

- Near misses before a pay line may have a greater impact than those after a pay line, although both still produce near miss effects
- Near misses may have a greater impact when players are losing during EGM play versus winning

Stop buttons and near misses

- Stop buttons may be associated with higher player arousal and lead players to perceive an illusion of control over EGM play

Physiological effects of near misses

- Near misses have been shown to produce a number of physiological effects and effects are more pronounced in problem gamblers – These include increased activity in the insula region of the brain and increased heart rate acceleration (physiological arousal)

Symbol confusion

- Players report 'symbol confusion' when symbols have different values or winning effects across EGMs - Players also advocate that card symbols should be standardised across EGMs to avoid this

Near misses are programmed into EGMs by manufacturers

- A review of Probability Accounting Report (PAR) sheets highlight that EGM manufacturers program near misses to occur above and below pay lines
- A technique called clustering has also been found to be used to create high numbers of near misses (where probabilities are mapped on reels to occur more frequently)
- Blanks adjacent to high paying symbols are programmed by EGM manufacturers to create near misses
- Falkiner and Horbay (2006) highlight there is no requirement for symmetrical or balanced reels in the Australian EGM standard. However, asymmetric weighting of symbols – as opposed to asymmetric reels – is prohibited in Australian jurisdictions

Losses Disguised as Wins (LDW) during EGM play

NATURE OF LDWS DURING EGM PLAY

Apart from the possibility of 'near misses' during gambling, gamblers are exposed to many events during gambling, where amounts won are actually less than amounts bet. This has been termed by Dixon, Harrigan, Sandhu, Collins, and Fugelsang (2010) as a 'Loss Disguised as a Win' (LDW), or as 'fake wins' by Wilkes, Gonsalvez, and Blaszczynski (2010).

A number of early studies have investigated the effects of LDWs. Harrigan and Dixon (2009) identified that many multiline games produce a high frequency of LDWs. This study involved a computer simulation of Lobstermania, a popular type of Canadian slot machine. By playing an average of 15 lines, the authors found that players would receive a win on 33.52% of spins and of these, 60.73% involved LDWs (producing ~20.4% LDWs overall). In comparison, a gambler betting on a single line and bet would only receive wins on 5.25% of spins. It was noted that only multiline games would be associated with LDWs, as single line games would produce wins greater than the bet.

Other studies have also historically highlighted a number of important effects of LDWs. In particular:

- Harrigan et. al (2012) - examined LDWs in a slot machine called Money Storm and found that the reinforcement rate from LDWs on a 20-line game was actually much higher than even real wins for a single line game. It was found that 29.7% of spins on the 20-line game were LDWs, while 15.4% of spins were winning hits (real wins) on the one-line game.

- Dixon et al. (2010) - examined whether subjects who were 'novice' slot machine players would respond to LDWs in the same way as regular gamblers. Based on recording of skin conductance responses following wins, LDWs and regular losses on a 15-line machine, results showed significantly greater responses to LDWs in all subjects relative to regular losses

- Jensen et al (2013) - conducted an experimental study examining Lobstermania LDWs. Participants in a six-line group estimated that they won on significantly more spins than those in the three-line group, even though wins were balanced across the games. Authors also asserted that music and visual effects played during LDWs may hide monetary loss and lead players to believe they are winning when they are not.

Supporting the importance of considering LDWs in the context of gambling harm minimisation, Myles et al (2018) also highlighted that there is limited neuroscientific evidence to explain the effect of LDWs on the brain and that such studies may help to inform the development of public policies to minimise gambling harm.

LDWS IN AUSTRALIAN EGMS

While LDWs are a major part of EGM play in Australia, there has been very limited research to investigate LDWs on Australian EGMs. The largest Australian study by Schottler Consulting (2014) provides recent evidence on the prevalence of LDWs in Australian EGMs. Around 48,920 EGM spins/games were coded during the 2014 study following live EGM play observations (Total spins recorded included spins for both regular line-based EGMs and Multiway EGMs). EGMs were selected by gamblers based on the machine they elected to play (with only an observation conducted of their play). Spin outcomes across machines were coded as LDWs, Losses, Bets only Won (where only the bet size was won) and Real Wins (where the wins were greater than the bet size).

EGM player exposure to different spin outcomes (based on 38,764 spins for the regular line-based machines only) showed that, around 64.6% of spins were losses, 2.2% won only the bet, 14.7% were real wins and 18.5% were LDWs. LDWs were generally also found to have a stimulation effect for all EGM players. This implied that roughly one in three spins in total provided players with some level of reinforcement during play (based on sum of the percentages of LDWs, RWs and BOWs).

Some interesting differences were also noted in player choice of EGMs. While all risk segments play EGMs with fairly similar pay back characteristics, problem gamblers used machines with a slightly higher proportion of Real Wins (14.6% of all spins), compared to non-problem gamblers (only 13.3% of all spins) – the same trend applied to all at-risk gamblers. It should of course be noted, however, that it is not possible to know whether this difference is due to the 'randomness' of the EGM distribution of game outcomes (i.e., random sampling error), or whether it may represent a true player preference (especially given that a wide range of machines were played). It would probably take months of play on any given EGM to see a distribution that is identical to its Probability Accounting Report) (which were not available for this study).

Based on live EGM play data, all 'win' events (Real wins, BOWs and LDWs) contributed positively to overall EGM play excitement and the urge to continue play (the more of each, the greater the excitement and urge to continue) (when measured as counts). In addition, while Real Wins were a better predictor of overall play excitement (with higher Real Wins producing greater play excitement), LDWs were found to uniquely add to the prediction of play excitement. This was reported to suggest that Real wins are mostly responsible for play excitement and increased urges to continue, but lower losses associated with LDWs also uniquely influence play excitement.

Findings interestingly also showed that:

- Winning a higher proportion of an EGM bet was more exciting than winning a lower proportion of bet
- Players believed that EGMs displaying visual effects or sounds during LDWs or Bets only Won (BOWs) may contribute to players believing that each are a type of 'win'
- While gamblers were only somewhat likely to believe that LDWs implied that a win must be close, this cognition was higher in problem gamblers, compared to non-problem gamblers
- Reel power EGMs examined in the study (a multiway EGM with 5 reels and large numbers of pay lines) had a similar proportion of LDWs as regular machines (Reel Power machines had 16.7% LDWs, compared to 18.5% on regular line-based EGMs) (Though once again, it is not possible to know whether this is due to a difference in win outcomes or rather just due to random sampling error)

It is also noteworthy that Dixon et al (2014) found in their study that Post Reinforcement Pauses were longer during EGM play when players won 10-19 credits of a 20 credit wager, than when players won only 2 credits of a 20 credit wager) (possible highlighting that pauses may be longer for LDWs, as players are winning a large proportion of a bet).

LDWS PREDICT PLAYER EGM PREFERENCES

Given that multiline EGMs are associated with LDWs, Templeton et al (2015) assessed the EGM play of 83 subjects on two EGMs with different rates of LDWs. Players were asked to play two EGMs with different percentages of LDWs (one producing a moderate number – 18% - and another producing a high number – 30%). Findings showed that a subset of players preferred EGMs with high rates of celebratory feedback. The high rate of celebratory feedback was achieved by presenting a very high rate of LDWs (the 30% LDW condition). Consistent with other research (e.g., Jensen et al, 2013), players also miscategorised LDWs as wins.

Some other notable findings were also observed relating to Post Reinforcement Pauses (PRPs) measured in the study. Players found LDWs more rewarding than losses and as rewarding as small wins. The authors additionally found that players tended to overestimate their wins due to LDWs. Study results were then used to re-affirm that multiline EGMs offer a higher rate of reinforcement than single line EGMs (i.e., as single line EGMs have no LDWs). It was similarly concluded that EGMs with high celebratory feedback (e.g., via LDWs) are important in determining EGM player machine preferences.

Graydon et al (2018a) similarly identified that players prefer EGMs with LDWs. Thirty-three university students played four simulated EGMs including two with 115% RTP and two with 85%. Interestingly, most subjects preferred the high RTP machine with LDWs and it was proposed that both characteristics may impact play choice of EGMs.

A further study by Graydon et al (2018b) examined the relationship between LDWs and gambling persistence in a sample of 132 gamblers using an experimental EGM simulator. A total of 100 spins were played on games with low, moderate or high LDWs. After 100 spins, participants were allowed to continue play, though all spins would result in only losses. Findings showed that higher risk status gamblers persisted long on EGMs with a moderate number of LDWs, compared to EGMs with low or high LDWs. The authors then took findings to suggest that moderate numbers of LDWs may encourage problem gamblers to continue play in spite of losing money.

LDWS TRIGGERING 'DARK FLOW' AND WIN AROUSAL

Dixon et al (2018) proposed that LDWs produce a state called 'Dark Flow', i.e., a state where gamblers become effectively entranced by their EGM play. To investigate the impact of LDWs on different segments of gamblers, they conducted an experiment involving a force transducer, to measure player arousal or how hard players hit the spin button following different game outcomes.

Dixon et al (2015 and 2017) previously established that players will initiate spins with greater force if EGM wins are highly salient. However, if losses occur, buttons are pressed with far less force. In Dixon et al (2017), there was similarly evidence that the larger the win, the greater the overall force of the button press.

Players in the Dixon et al (2018) study were recruited from a casino and played a simulated EGM. The authors installed the force transducer under real EGM buttons to provide a realistic measure of player arousal. A total of 150 participants took part in the study. Subjects completed a Depression, Anxiety and Stress scale called the DASS21 (Lovibond and Lovibond, 1995), the PGSI, the Games Experience Questionnaire (which contained 5 items measuring player 'flow') and a number of other questions as part of their session.

Findings showed that LDWs were treated similar to small wins and multiline games were preferred over single line games. Players exhibited a similar level of force for small wins and LDWs and a large amount of force following large wins. This was supported the conclusion that players do interpret LDWs as wins.

In addition, player feedback showed a strong preference for 20-line EGMs over 1-line EGMs, in spite of the fact that bets and payback were held constant across both EGMs. This is also interesting in view of the fact that the average size of wins in the single line game was greater ($3.55) than the multiline game ($1.23).

PGSI score also interestingly predicted the level of 'dark flow' experienced by players and a link between gambler depression and dark flow was observed. In addition, the association was far stronger for the multiline game. The result relating to dark flow was attributed to some problem gamblers playing EGMs to alleviate depressive symptoms. Accordingly, such findings highlight that LDW effects may potentially be amplified for problem gamblers and may be considered similar to small wins by all players.

LDWS TRIGGERING DISSOCIATION

Dixon et al (2014) found evidence that LDWs may trigger some level of dissociation in players. The authors conducted an experiment that required players to play two EGMs - One with a single line and the other with 20 lines. The multiline game effectively allowed LDWs, as wins could occur on some lines and not others. Credits bet on the one credit machine (20 credits per spin) were maintained with the 20-credit machine (1 credit per line for also 20 credits per spin).

Two hundred and fifty spins were played on each EGM and players were asked to estimate their total spins and to estimate the times they won more than bet. It was expected that pauses should be equivalent for small wins on the one-line game and LDWs on the 20-line game, if players misconstrue LDWs as wins.

Findings showed that, while players lost more money with multiple line play, multiple line EGMs were still more preferred than single line EGMs. Multiple line games were also described as triggering 'dissociation' effects in at-risk and problem gamblers. There was also a tendency for all gamblers and particularly, at-risk and problem gamblers, to attribute their success to skill in the 20-line games.

Player estimations of wins on the 20-line game also suggested that they mixed up LDWs with real wins (by a factor of 15). However, for single line games, player recall of actual wins was more accurate. Post reinforcement pauses, or pauses in play after a 'win', were also interestingly similar, with 2 credit LDWs producing a similar effect to 2 credit 'real wins'.

In addition, the largest increases in pauses were where there was a full loss then a two-credit gain on both EGMs. This is interesting in view of the fact that, even when LDWs implied a loss on the 20-line EGM, players still showed the same level of pause in play. The pattern of results relating to pauses after 'wins' was also identified as suggesting that LDWs are quite reinforcing, in spite of being effectively losses.

LDWS IMPLY THAT PLAYERS CAN PLAY FOR LONGER

Harrigan et al (2015) undertook an experimental study using a multiline slot machine simulator based on a commercial EGM called 'Money Storm'. A number of simulations were run on the machine to demonstrate player losses and wins under different numbers of lines.

Findings also showed considerable differences in outcomes when players played a single line versus multiple lines on the EGM. After a specified time (e.g., 1hr or 50h), on the single line EGM, a few players won a lot, while others lost far more than average. In comparison, when playing 20 lines, there were fewer big winners and fewer players losing a large percentage of their total stake. The authors also simulated the Gambler's Ruin, whereby players started with $100 and bet $1 per spin until broke.

This showed a large reduction in the variability amongst players as the number of lines increased. Fewer players lost their stake quickly and fewer also experienced large wins. Accordingly, this may highlight that players prefer multiline machines simply because most players can continue to play for a longer time due to LDWs.

MAKING LDWS SOUND LIKE A LOSS

While LDWs are often considered 'wins', Dixon et al (2015) recently examined the impact of making LDWs sound like a loss. An experiment was conducted using negative sounds as a means of player feedback. A total of 157 participants were allocated to one of three experimental conditions. These were (1) A standard sound condition which paired LDWs with positive music and lights, (2) A silent condition, where LDWs were silent and (3) A negative sound condition where LDWs and regular losses were both accompanied by a negative sound.

After completing 300 spins, participants were asked to indicate if they had won or lost after being shown 20 different spin outcomes. Findings showed that skin conductance responses (SCRs) were similar for both LDWs and losses and these were both smaller than real wins. Heart rate deceleration, however, was steeper for both LDWs and wins, relative to losses.

Different results were also obtained depending on the experimental condition. In the Standard Condition (1), most participants miscategorized LDWs as wins, and overestimated how often they won. Interestingly, however, supporting the author's experimental aims, in the negative sound condition (3), the opposite occurred and participants correctly guessed that LDWs were losses. The authors then proposed that LDWs with positive reward music create an impression of a win and that sounds 'unmask' the fact that they are actually losses.

Contrary to findings of other studies, Sagoe et al (2018) conducted a recent study of 92 undergraduates and found that there was no relationship between LDWs (called 'negative wins' in the paper) and total bet size, bet size variation or attitudes. They concluded that LDWs do not reinforce gambling intensity and beliefs about gambling. However, this study used short rather than long gambling sessions. This approach was selected on the basis of a view that gamblers generally play sessions of short duration.

EDUCATING GAMBLERS ABOUT LDWS

Graydon et al (2017) examined the role of sound and LDWs in an experimental study of EGM players. Reflecting on past research showing that LDWs lead players to over-estimate their wins (termed the 'LDW-triggered win overestimation effect'), the authors used a brief animation to teach gamblers to distinguish a real win from an LDW (by looking at the bet and pay out counters on an EGM). This was also compared to a general control condition, which did not have the educational information on LDWs. As expected, the educational resource had a positive effect in helping gamblers identify LDWs as losses. Accordingly, this study illustrates how a brief animation can be useful in helping educate gamblers about LDWs. The need for greater regulation of LDWs was also identified in the report by Blaszczynski et al (2015), which recommended that LDWs become part of the NSW Gaming Machine Prohibited Features Register (However, as the proportion of LDWs presenting harm to EGM players is unclear, this is currently somewhat complex to implement, as the topic needs much further research).

OTHER PRODUCTS THAT GENERATE LDWS

While EGMs are the main product that raises policy concern about LDWs, Harrigan et al (2015) recently reported that other 'EGM like' games may also now require harm minimisation considerations. This paper was triggered by the emergence of electronic bingo games in Ontario charitable gaming centres in Canada. Research by MacLaren et al (2015) also highlights that instant lottery ticket machines are also now available in this environment. Bingo works similar to Ticket-in-Ticket-out (TiTo) machines, where players play by placing a ticket in an electronic bingo machine (with a voucher number and password entered for each session of play).

Play on Demand (PoD) bingo games were reported by Harrigan et al (2015) to have characteristics similar to EGMs. Some games, for instance, were reported to have continuous characteristics (e.g., results after 2 seconds), have multiple patterns for achieving wins and to display LDWs (e.g., you have won $1, when the bet was $4). One of the payback game percentages was also very close to EGMs (e.g., Lucky Clover game paid back an overall play return 91.94% over thousands of games). Frequency of wins can also be increased by purchasing multiple cards for play (e.g., one card produced 16.44% hits, while four produced 51.34% hits). Celebratory music was also played during play. Accordingly, LDWs may also warrant policy attention in the context of other 'EGM like' games.

RECENT SYSTEMATIC REVIEW OF IMPACT OF LDWS

Of relevance to both near misses and LDWs, Barton et al (2017) conducted a systematic review of the effects of near misses and LDW in research literature. Fifty-one experimental peer-reviewed studies were examined in the systemic review between 1991 and 2015.

Findings showed that LDWs were associated with players overestimating wins and general player excitement. LDW impacts were also interestingly found to be triggered by audio-visual elements, as typically occurring after a real win (where a win is higher than the bet).

Accordingly, findings support the conclusion that LDWs may contribute to potential gambling harm. In addition, LDWs can be triggered through audio-visual elements in EGM design. This highlights the need to consider LDW design from a harm minimisation perspective.

LDWS DURING EGM PLAY - SUMMARY INSIGHTS

Prevalence of LDWs

- Around 1 in 3 spins provide some level of reinforcement effect on Australian EGMs (based on sum of the percentages of LDWs, RWs and BOWs). A recent Australian study also showed that 18% of spins were LDWs
- While Multiway EGMs have more lines, one Australian study found that they had a similar number of LDWs as regular line-based EGMs

Player preferences for LDWs

- Research shows that EGM players prefer EGM with LDWs – especially those with high celebratory feedback
- Higher risk status gamblers have been found to persist longer on EGMs with a moderate number of LDWs, compared to EGMs with low or high LDWs

Effect of multiline games on LDWs

- The reinforcement rate of multiline EGM games may be roughly around 2-2.5 times of single line games due to LDWs
- LDWs in multiline games reduce the variability in 'winning and losing' amongst EGM players – This has also been found to further reduce, as the number of lines increase (i.e., fewer players lose their stake quickly and fewer experience large wins)

Auditory and visual effects associated with LDWs

- Music and visual effects played during LDWs may hide monetary loss and lead players to believe they are winning – A recent systematic review also highlights that LDW effects are triggered by audiovisual elements
- Sounds during LDWs have been found to 'unmask' the fact that LDWs are actually losses

Cognitive effects of LDWs

- LDWs uniquely add to the prediction of play excitement during EGM play
- Players may find LDWs more rewarding than losses and as rewarding as small wins
- Players tended to overestimate their wins due to LDWs
- Winning a higher proportion of an EGM bet is more exciting than winning a lower proportion
- Problem gamblers are somewhat more likely to believe a win is close due to LDWs

- LDW effects may potentially be amplified for problem gamblers and may be considered similar to small wins by all players.

Physiological effects of LDWs

- When force transducers under EGM buttons are used, players exert a similar level of force for small wins and LDWs and a large amount of force following large wins. This provides evidence that players interpret LDWs as wins
- LDWs are also associated with higher Skin Conductance Responses (SCR), when compared to losses
- Post reinforcement pauses, or pauses in play after a 'win', have been found to be similar for 'real wins' and LDWs

Psychological effects of LDWs

- LDWs have been found to lead to dissociation by gamblers or a state of 'dark flow'
- Dark flow and dissociation is higher in multiline games and also stronger for problem gamblers and potentially other players experiencing depressive states

Gambler education about LDWs

- A brief animation about LDWs can be useful in helping educate gamblers about their effects

Alternative electronic gambling products that may have LDWs

- Other 'EGM like' electronic games – such as electronic bingo and lotto games – have also been found to produce LDWs

EGM volatility, RTP and EGM pay schedules

Skinner (1953) was one of the first authors to identify that reinforcement schedules can shape human behaviour. This became the well-known and now accepted theory of operant conditioning. As reinforcement schedules are a fundamental part of EGM play, they remain a key topic of research interest. However, still very little is known about how different EGM reinforcement and payback schedules (including prize schedules) influence gambling behaviour.

The tendency of gamblers to prefer high reinforcement schedules has also been demonstrated by Delfabbro et al (2005). The authors conducted experimental research by manipulating reinforcement schedules and other variables including lighting, speed of play and bets. Players showed preferences for any factors that had potential to increase reinforcement. This was argued to explain why people would often place minimum bets on maximum lines. Players were wanting to extend the number of wins that provide reinforcement.

Delfabbro & LeCouteur (2003) additionally argued that Random Ratio (RR) schedules are effective in maintaining gambling behaviour, given that gamblers learn the value of 'waiting for wins' (i.e., that eventually they will win something). In addition, Dickerson et al (1992) and Delfabbro & Winefield (1999) found that, following small wins, gamblers increased their play rate and following large wins, play rates were slowed.

IMPACT OF EGM VOLATILITY ON GAMBLING

EGM volatility is the way an EGM game delivers its pay outs. Pay outs can be either highly variable and volatile (e.g. a small number of large wins) or more frequent (e.g., a large number of small wins).

A few studies provide early insight into possible effects of machine volatility on gambling behaviour. Freeman and Mitchell (2010) identified the pay out characteristics or volatility of EGMs in NSW. Several different concepts were said to influence a machine's pay out characteristics. This included the volatility of the game, the standard deviation of pay outs and the Return to Player (RTP). The authors noted that different EGMs can have similar standard deviations and some will pay more frequently, while others pay more erratically. In addition, the volatility of a game was said to affect RTP, as the expected minimum and maximum RTP range (its tolerance) can be affected.

Based on their analysis, Freeman and Mitchell (2010) argued that there was an overall market preference for moderate volatility games in NSW. When using the Taylor Fry method to categorise games by skewness and volatility (using a game's standard deviation), the authors concluded that there was no type of specific reinforcement schedule that made a game popular. Accordingly, there was not found to be any specific payback 'schedule' which created popular games. However, there was a noted preference for moderate volatility EGMs.

It is also noteworthy that Lucas, Singh, and Gewali (2007) examined the impact of variations in Standard Deviation (SD) of wins in relation to the time players spend gambling. The authors found that SD was a key determinant of the amount of time a player could spend on an EGM. They specifically found that the higher the SD, the lower the Pulls per Losing Player (their proxy for time on device), implying that increases in SD were associated with decreases in the time spend on EGM play). This is also supported by Kilby et al (2005). In addition, Coates and Blasczcynski (2013) found that payback percentage and volatility strongly influenced EGM preference where multiple line bets were not available.

On a related note, Lucas and Roehl (2002) similarly found that floor location can influence the performance of video poker machines. Machines attributed with superior access and higher traffic volumes were found to perform better than EGMs situated in perimeter locations, along with cabinet style, house advantage, and game program (a variable which represented different pay tables).

IMPLICATIONS OF EGM VOLATILITY FOR GAMBLING LOSSES

Harrigan (2009) advocated that hourly rates of loss for gaming machines could be decreased if all games had a lower volatility index. As problems gamblers typically incur very high losses, this finding is of interest. Low volatility was said to be best achieved by lowering jackpot prize amounts and keeping games with the same payback percentage (thus permitting a greater number of smaller prizes). A regulation or a standard for machine volatility was also suggested (e.g., a regulation such as - EGMs must have a standard deviation of 10 maximum) or a regulation that states that, for a certain number of games (e.g., 1200), the 90% confidence interval of return to player should be within a certain range.

At present, many Australian EGMs have much longer range pay back schedules based on theoretical RTPs that only occur after hundreds of thousands of games (or extremely large numbers). In this context, it is of note that fruit machines in the UK have different payback schedules to Australian EGMs, as they are based on a compensator, rather than a Random Number Generator (RNG). However, research to date has not compared the relative harm minimisation benefits of these different approaches.

NEUROLOGICAL EFFECTS OF WINS

A number of more recent studies have examined various topics relating to EGM payback schedules. A recent study by Dixon et al (2014b), for instance, examined the neurological correlates of small and big wins on EGMs in pathological gamblers (using functional MRIs). Twenty-two subjects were exposed to different sized wins, along with losses on a computer EGM simulator.

A 'dose effect' was observed for pathological gamblers. Large wins produced more neural activation in the dopaminergic pathway, compared to small wins. This was likened to the effect of substance use. It was also noteworthy that large wins led both pathological and non-pathological gamblers to estimate their chance of a further win higher, than a small win or a loss trial.

IMPACT OF RTP ON GAMBLING BEHAVIOUR

A number of recent studies have also identified the need to consider the impact of Return-to-Player (RTP) on gambler behaviour. This is a generally very under-researched topic, in spite of RTP being fundamental to EGM play.

A small number of studies have investigated RTP impacts to identify some level of conflicting results. In particular:

- Coates and Blaszczynski (2014) - found that players played more on an EGM with lower RTP. However, the opposite was also found by Coates and Blaszczynski (2013) (a higher RTP machine was preferred)
- Taylor et al (2016) - found in an experimental study that RTP had no effect on preferences for free spin EGMs across two experiments. However, in a third experiment, preferences for machines with bonus features depended on whether the machine had a high RTP
- Haw (2008) - found that changes to RTP did not affect player preferences
- Brandt and Pietras (2008) and Weatherly and Brandt (2004) - Found that changing RTP did not affect player betting patterns
- Harrigan and Dixon (2010) - accessed the RTPs and pay schedule PAR sheets and ran simulations based on a fictitous player starting with $100 and the assumption of 85% and 98% RTP. The simulation exercise showed that, while median expenditure didn't vary across players, players playing the 98% RTP machine played a greater number of total spins, winning spins, bonus rounds and hand pays (where a win was more than $125)

Such findings highlight that RTP may affect player behaviour under some conditions and not others, although the exact mechanism behind this is unclear. One limitation of most RTP research, however, is that actual player returns may not always be equal to theoretical machine RTP.

Accordingly, such factors should be taken into consideration in future research exploring the impact of RTP on player behaviour. Taylor et al (2016) also recently concluded that future research is needed to clarify under which conditions RTP affects player behaviour.

Current methods of presenting RTP were also critiqued by Blaszczynski et al (2015). Current RTP on EGMs was reported to be typically positively framed (e.g., 87%, 90% etc). However, if RTP was expressed as a return on investment and negatively framed, the same figure could be displayed as -10% or -14%. This was described as having potential to magnify the risk for loss.

100% RTP AS A METHOD FOR GAMBLING HARM MINIMISATION

Rowell and Gyrd-Hansen (2014) recently explored the concept of 100% RTP as a method of gambling harm minimisation. This was coined as an 'Actuarially-Fair EGM'. The authors proposed that EGMs with 100% return to player may help minimise gambling harm, given that problem gamblers would effectively have a much longer time to gamble before losing their stake.

It should be noted that 100% Return to Player does not imply a 'free play' EGM, as wins and losses would still occur, though over a much longer time than current EGMs (which may have a RTP of 85-90% in Australia) (Rowell and Gyrd-Hansen, 2014).

This concept was demonstrated through economic analysis and modelling. Rowell and Fooken (2019) also simulated, that using an 'Actuarially Fair EGM' (with 100% Return to Player), instead of taking 2.3 hours for 25% of EGM players to lose $300 (as in a 'regular EGM'), it would require a total 33 hours for 25% of EGM players to lose the same amount if RTP was set to 100%.

This highlights the need to consider whether adjustments to RTP could be used to minimise gambling harm. However, in spite of Return to Player being a fundamental structural characteristic of EGM design, there has been very limited research into the impact of RTP.

In their observational study of 222 EGM players during live EGM play, Schottler Consulting (2014) interestingly found that problem gamblers showed a slight tendency to choose EGMs with higher proportions of 'real wins' (where the win was more than the bet). In particular, problem gamblers used machines with 14.6% of spins resulting in a real win, compared to 13.3% for non-problem gamblers. Whilst speculative, this may also indicate that problem gamblers have some potential to discriminate machines producing a higher RTP.

BETTING MAY BE RELATED TO RTP

Leino et al (2015) explored the impact of a wide range of EGM structural characteristics on VLT terminals in Norway. Data was supplied by Norsk Tipping, the state-owned Norwegian gambling company. Differences in bets made were observed across gamblers, while the impact of a range of independent variables was assessed. These included payback percentages, hit frequency, size of winnings, size of jackpots and range of betting options. Age and gender were controlled to avoid confounding effects.

Of relevance to RTP, findings showed that bets made were positively related to payback percentage, and negatively related to win size. Analysis also showed that reward characteristics (payback percentage, hit frequency, size of winnings and size of jackpot) and betting options respectively explained 27% and 15% of the variance in bets made. It was also noteworthy that games with a higher payback percentage predicted the total bets made.

The author then inferred the implications of findings for design of harm minimisation measures on EGMs. In particular, as higher payback percentages were found to be associated with total bets made, this was inferred to suggest that payback percentage may influence the time spent gambling and may develop and sustain gambling behaviours. It was also concluded that gambler losses could potentially be reduced by increasing the payback percentage of games in line with the proposal by Weatherly and Brandt (2004).

Possibly highlighting a potential unintended consequence of different EGM denominations and RTPs on identical machines, Frahn et al (2015) recently examined the effects of different RTPs in free-to-play casino EGMs in an experimental study. A total of 128 players were randomly allocated to different conditions to practise gaming prior to playing on a simulator involving real money. The conditions included a control play group (no differences from the 'real' EGM), standard 90% RTP, inflated return and inflated return with a pop-up message.

Findings showed that players exposed to the mode offering inflated returns tended to wager more money on the real EGM, compared to other conditions. The authors then concluded that inflated RTP EGMs – especially those that offer inflated wins during demonstration modes – may lead EGM players to short term increases in risk taking.

As many EGMs are now programmed with different RTPs and win probabilities (e.g., Indian Dreaming can have different configurations depending on the venue), this also highlights the potential for players to be confused over the likely return of a given EGM in the marketplace. This may highlight the need for improved clarity about how EGMs of the same branding also differ in RTP when presented across different venues.

CHARACTERISTICS OF EGM PAR SHEETS

While there has been no specific research on the effect of different reel configurations on EGM play, Harrigan (2009) conducted an analysis of a range of EGMs in Ontario Canada. Probability Accounting Reports (PAR) sheets were obtained under Freedom of Information and Protection of Privacy Act in Canada for this analysis. Analysis of PAR sheets was used to conclude that multiple reinforcement schedules are at play in gaming machines. The author commented that understanding pay schedules of EGMs has been notoriously difficult in Canada, as PAR sheets are not readily available to researchers.

The author found that machines used both physical and virtual reels, with some games mapping virtual reel positions onto physical reels. As an example, the EGM Double Diamond Deluxe, had 72 stopping positions on the virtual reel, which was far greater than the estimated 22 on a physical reel. This implied that the number of potential outcomes was over 373,000 on the virtual reel, compared to only 10,648 on the physical reel.

The 72 stops on the virtual reel were found to be mapped using 'weighted mapping' to each of the 22 stops on the physical reel (e.g., virtual stops 5 to 9 are mapped to physical stop 3). Due to the weighting, Harrigan (2009) noted that each stop on the physical reel did not have an equal probability of occurring on the pay line. For instance, it was noted that the blank on stop 1 had a probability of 3/72, the 7 on physical stop had a probability of 1/72 and the blank on stop 3 had a probability of 5/72.

Nudges where a reel moves up or down just after a spin (to make it look like the combination was nearly achieved) were also programmed into the EGM. This highlights that many of the effects designed by manufacturers are far from 'random' and are specifically programmed into games. As an example, Harrigan (2009) found that, if the virtual stopping position is 10, 11, or 12, then Reel 1 will stop with Physical Stop 4 on the pay line (one bar) and there will be no nudge. However, if the virtual stopping position was between 13 and 19, then physical stop 5 (a blank) will stop on the pay line after approximately 5 seconds (a nudge). The game probabilities were also unaffected by this, as the final stopping position determined the pay schedule.

A further technique called 'clustering' was also identified from an analysis of PAR sheets. This involves putting a high ratio of blanks next to high paying symbols in the virtual reel. This was described to create near misses in that players see high winning symbols more frequently than in non-winning positions.

Asymmetric reels were also described as creating another type of near miss. This occurred when high paying symbols occurred on a single line multiple times, in spite of it being a non-winning combination. Losses disguised as Wins (LDWs) were also seen in the PAR sheets. When players bet on all 15 lines, a 'win' occurred in roughly 33% of spins and of these 'wins', nearly 61% were less than the amount bet.

PAR sheets also showed that the hit frequency per line for the 92.5% version of Lobstermania was only around ~5% (i.e., only 5% of spins produce a payout of some kind). With 15 lines, this increased to around 33%. Comparing the ~5% win rate from single line EGMs to the 33% win rate for 15 line EGMs also highlights how additional EGM lines produce a very different gaming experience due to the dramatic increase in winning games (and it should also be remembered in this context that 60.73% of the winning hits on multi-line EGMs were LDWs).

If there were no scatter symbols and the 15 lines were independent, a player betting on 15 lines with a 5.25% hit frequency would win something on 55.5% of total spins. However, the 33% rate of winning was accounted for by the fact that scatters only occurred once per spin (irrespective of the lines bet on) and the fact that the 15 lines were not independent of each other (i.e., a reel position on one-line affected positions on other lines). Hand pays were also calculated. With a maximum bet on all 15 lines, a hand pay would occur every 399 spins.

Bonus mode wins were also observed by looking at the EGM features during play, as these were not observable from PAR sheets. The authors thus effectively had to work out how the bonus features correlated with the probabilities of machine events through observation. This highlights that conducting harm minimisation research faces many barriers, as PAR sheets are currently not provided by manufacturers to gambling regulators.

Bonus modes occurred once every 1729 spins. In relation to features, it was also noteworthy that lookup tables highlighted that feature game outcomes were weighted. As an example, in one part of a feature, a prize of 12 occurred 10 times out of 322, while a prize of 250 occurs 5 times out of 322.

Harrigan (2009) summarised the key findings as a percentage of total hits and total pays (Table 2). This also highlights how the reinforcement schedule of an EGM can be determined. While this was not evaluated with players in the study (only machine events were observed), this highlights the potential to determine the impact of different machine events and pay back schedules on non-problem and problem gamblers.

As also proposed by Schottler Consulting (2014), Harrigan (2009) argued that having different EGMs branded identically, yet with different pay characteristics has potential to confuse gamblers. In addition, as Ontario venues can change RTP of a single machine, it was purported that it may be not fair to players, if they are not aware of this practice (Harrigan, 2009).

Similar to Harrigan (2009), Barboianu (2014) also recently advocated the need for EGM manufacturers to be more transparent in the publishing of PAR sheets for EGMs. These were also described as effectively 'kept secret' by EGM manufacturers.

Table 2. How EGM PAR sheet analysis can reveal insights about EGM pay out characteristics (Source: Harrigan, 2009)

EGM machine events	Total hits		Total pays	
	Hits	%	Pays	%
Lobstermania				
Line wins	9,382,500	63.46	162,889,616	67.86
Scatter wins	4,126,464	27.91	27,617,760	11.51
Combinations to initiate Lobster Buoy Bonus	150,000	1.01	-	0.00
Lobster Buoy Bonus wins	1,125,000	7.61	49,524,000	21.63
All wins	14,783,964	100.00	240,031,376	100.00
Money Storm				
Line wins	5,164,600	55.42	26,351,150	54.79
Scatter wins	3,238,803	34.76	7,564,140	15.73
Weather 'Beakon' Bonus wins (base)	294,000	3.15	983,920	2.05
Weather 'Beakon' Bonus wins (bonus mode)	1,851	0.02	371,766	0.77
Combos to initiate Free Storm Scatter Bonus	36,750	0.39	1,094,250	2.28
Free Storm Scatter Bonus wins	582,891	6.25	11,733,233	24.39
All wins	9,318,895	100.00	48,098,459	100.00

EGM VOLATILITY, RTP AND EGM PAY SCHEDULES - SUMMARY INSIGHTS

Gambler preferences

- Gamblers generally prefer high reinforcement schedules and moderate volatility EGM games

EGM volatility

- Standard deviation of wins has been found to be a determinant of the amount of time a player is able to spend on an EGM (higher SD, less time on device)
- Research suggests that hourly rates of loss for EGMs may be decreased if EGMs have a lower volatility index (i.e., by lowering jackpot prize size, small prizes and similar RPT in games)

RTP in EGMs

- While RPT is a fundamental EGM characteristic, the impact of changes to RTP on gambling harm is unclear, with some studies producing opposing findings
- 100% RTP has been proposed as having potential to minimise harm, on the basis it may take much more time for a gambler to lose their original stake
- While increased betting has been found to be related to higher EGM payback percentages, other research shows that gambler losses may also potentially be reduced by increasing RTP
- Having different EGMs branded identically, yet with different RTP has potential to confuse gamblers
- Players exposed to a different EGM return on a demonstration mode game are likely to believe that the same return will apply to the main game (highlighting the potential harm of high RTP demo modes)

RNG versus compensators

- Research has not compared the relative harm minimisation benefits of Fruit machine compensators versus Random Number Generators in terms of gambling harm – Conceivably, however, compensators may be less harmful as they compensate for any major variations from RTP

Impact of winning

- Large wins produce more neural activation in the dopaminergic pathway of the brain, compared to small wins and the effect of winning is stronger for problem gamblers

PAR sheets

- Analysis of PAR sheets highlights that multiple reinforcement schedules are at play in EGMs
- Some EGM games create probabilities or machine events that do not match reality – While these have potential to distort player perceptions of winning, exact effects remain unknown.

For instance, PAR sheets provide insight into effects such as:

- Reel positions can be mapped onto physical reels using 'weighted mapping' – This means that each physical reel stopping position does not match that of the virtual reel
- Nudges - where a reel moves up or down after a spin - (i.e., where a combination is 'nearly achieved') are also programmed into EGM PAR sheets
- 'Clustering' – where a high ratio of blanks is placed next to high paying symbols in a virtual reel to create near misses (i.e., players see high winning symbols more frequently than in non-winning positions)
- Asymmetric reels – where high paying symbols fall on a single line multiple times, in spite of it being a non-winning combination
- Losses disguised as Wins (LDWs) – where probabilities dictate how frequently players win less than their bet
- Bonus mode probabilities - lookup tables can weight feature game outcomes and dictate during which parts of features players win

EGM spin rates, note acceptors and credit meter limits

SPIN RATES OF EGMS

Spin rates of EGMs have been a topic of some interest in the gambling research literature. Blaszczynski et al (2001) examined modifications to EGMs (relative to unmodified EGMs) in NSW. The modified machines had changes to spin rates (from 3.5 to 5 seconds), note acceptors ($20 maximum notes with $50 and $100 notes removed) and had a maximum bet size of $1 (reduced from $10). Unsurprisingly, a higher percentage of problem gamblers not only used higher denomination notes, but also played at a faster rate of play (higher than 5 seconds per spin). In addition, a higher percentage of problem gamblers placed bets over $1 and the greater the preference for large bets, the more severe the gambling problems.

In a further paper based on the Blaszczynski et al. (2001) study, it was also concluded that a lower bet size may help reduce gambling harm and may itself be the best strategy for problem gamblers (Sharpe et al, 2005). However, reducing spin rate was not seen to have the same utility in being able to reduce harmful gambling. Although it was acknowledged that problem gamblers do play faster than non-problem gamblers.

Yet another paper by Blaszczynski et al (2005) explored whether slower spin rates affected gambler enjoyment and satisfaction with gambling. The authors' hypotheses were confirmed. However, slower spin rates did not deter gamblers from gambling, rather just affected their satisfaction and enjoyment from the experience.

Ladouceur and Sévigny (2006) identified that increased EGM play speed was associated with larger monetary risks and lower awareness of the number of EGM games played by gamblers. Interestingly, however, slowing down play speed did not negatively impact gambler motivation, nor affected the control gamblers had over the time and money spent on play.

While some past research has identified that fast spin rates may be used by problem gamblers and be associated with greater gambling expenditure, there is still much to be learned about the optimal spin rate that balances player satisfaction with gambling harm. However, this remains unknown and has had little research in the past five years.

SPEED OF EGM PLAY MAY BE UNRELATED TO GAMBLING SEVERITY

One recent study that relates to EGM spin rates, is the study by Worhunsky and Rogers (2017). The authors conducted an experiment to examine Individual Rate of Play during simulated EGM gambling. Players were informed they would win an amount commensurate with their total amount won during simulated EGM play. Measures of arousal or gambling intensity included bet size and inter-play reaction times.

EGM players had their individual preferred Rate of Play assessed during the simulations. Findings interestingly showed that male problem gamblers had a widely ranging preferred Rate of Play from half a second to over seven seconds per game. Individual Rates of Play were additionally not found to be statistically related to problem gambling severity, compulsiveness or gambling cognitive distortions.

A further experimental condition then introduced EGMs with either faster or slower Rates of Play. EGMs offering faster rates of play were associated with increased spending during an optional play period, greater underestimations of the amount spent and impaired recall of the number of winning outcomes. In comparison, play on slow machines was associated with longer inter-play reaction times, less spending during continued play and improved recall of total spending and winning outcomes. However, there was no relationship between Rate of Play and bet size nor duration of continued play.

A recent attempt to summarise the body of evidence relating to reel spin speed was by Harris and Griffiths (2018). Their review examined past evidence from studies relating to reel speed with a view to exploring what they may imply for gambling harm minimisation. A total of eleven studies were identified for review based on inclusion criteria including nine experimental studies and two qualitative studies (from 1991 to 2016). All studies were subject to peer review.

Findings from the review consistently showed that games offering faster speed of play were preferred and more exciting to gamblers including both recreational and at-risk gamblers. However, there was also a frequently consistent finding that problem gamblers preferred games with a fast speed of play. In addition, such games tended to be associated with higher bets, longer play and were frequently associated with some level of impaired control over gambling. The Authors also concluded that research examining speed of play was in its relative infancy. There was similarly an assertion that slowing down games may result in gamblers making higher bets and may also be associated with lower levels of play enjoyment. In this regard, there was seen to be potential for harm-minmisation tools to be developed to assist gamblers to improve self-control over their gambling.

EGM NOTE ACCEPTORS AND CASH LIMITS

While there has been limited recent research on the impacts of EGM credit limits, several studies have previously verified some effects of changing EGM note acceptors in EGMs. Brodie, Honeyfield, and Whitehead (2003), for instance, examined how EGM expenditure changed following the introduction of $20 maximum note acceptors on EGMs. A survey of 359 EGM players showed that 61% approved of the limit and a further 28% also supported additional note acceptor reductions. Following the introduction of $20 note acceptors, up to 20% of surveyed EGM players reported reducing their expenditure. Moreover, this trend was found to be much higher in problem gamblers with up to 40% reducing their expenditure and gambling less frequently. This result is similarly supported by findings of a study by Haw (2000), which identified a link between EGM note acceptors and overall machine turnover.

The study by Schottler Consulting Pty Ltd (2010) observed that problem gamblers showed a tendency to use both high value notes in note acceptors, relative to non-problem gamblers. When notes used for gaming were analysed, results showed that most players fed in $20 (55% of players) or $10 amounts at a time (41% of players) prior to commencing play. However, problem and moderate risk gamblers fed in far larger amounts such as $50 before commencing play (respectively 25% and 27% of each segment). In addition, even when coins were used, 9% of total coin feeds of problem gamblers were $20 or higher (before money was drawn down) and this again was higher compared to non-problem gamblers (where 1% of total coin feeds were $20 or higher).

A study examining the impact of removal of note acceptors in Norwegian slot machines was conducted by Hansen and Rossow (2010). This study explored how the gambling behaviour of adolescents changed longitudinally across three points in time. Total samples comprised 20,000 students at each wave. Key findings showed no changes in problem gambling prior to changes to note acceptors. After note acceptors were removed, however, rates of problem gambling dropped by 20%. Gambling frequency also reduced 20% and the proportion of adolescents gambling frequently decreased by 26%.

The Responsible Gambling Council of Ontario (2006) held an expert forum to identify views on the modifications to EGMs that would have the greatest impact on problem gambling. This was conducted on behalf of the Saskatchewan Liquor and Gaming Authority. Based on expert views, fast speed of play, direct electronic fund transfers (which allow patrons to access bank or credit card funds directly while sitting at an EGM – not available in Australia), the appearance of near-misses and bill acceptors were the key structural characteristics identified as most important contributors to problem gambling. Eliminating direct transfers and bill acceptors were also identified as key changes thought to have potential to reduce problem gambling.

DISPLAY OF CASH RATHER THAN CREDITS ON EGMS

After players insert notes or coins into a machine, they typically receive a screen display indicating the amount of credits or money (in dollars and cents) they have inserted into the machine. For instance, $10 may be converted to 1,000 credits or be shown as $10.00 on the credit meter. Some studies have asserted that converting money into credits may contribute to faster EGM play rate, given that it may create a perception that gamblers have a running credit on the machine or contribute to the perceived 'tokenisation' of money (Griffiths, 1993).

A number of important insights are available from past research relating to the display of EGM credit limits. Schellinck and Schrans (2001) conducted a study to explore possible changes to gaming machines that may assist with problem gambling. Interestingly, one result of their study was that, when the credit meter on a machine was changed to display cash rather than credits, it attracted the highest awareness level of all other features changed (with 94-100% of participating players noticing the display change).

The cash display was also the second most preferred responsible gambling feature of EGM players (liked by 58% of regular players), following the availability of an on-screen clock. Displaying the credit meter in cash - rather than credits - was also seen as the most effective responsible gambling feature in assisting money management (a view held by 46% of players). Though respondents who liked the display of cash (rather than credits) did not appear to change their gambling behaviour.

A number of new insights about credit limits are also available from a study by Chapman et al (2019). The authors conducted a 2x2 experiment to examine whether EGM player preferences were affected by display of a credit balance on an EGM (balance v no balance) and the availability of free spins (free spins v no free spins). Dependent variables were the proportion of spins and proportion of the total bet allocated to the first machine played.

The study had 80 undergraduate students as participants. To explore the effects of machine balance, participants were also allocated to two sub-conditions – Either a machine with a higher balance ($50) or a machine with a lower balance ($27). The first and second machines played were similarly allocated to either a condition with free spins or a condition without free spins.

In the final phase, players were offered an opportunity to choose a machine to play, providing the potential to assess their machine preference. The number of bets placed on each machine was then used as an indicator of preference.

Results of the experiments highlighted that three EGM characteristics impacted player preferences - The balance when they first encountered the EGM, whether free spins were available and whether they encountered it first or after another machine. Participants were also found to make riskier bets on an EGM with a higher balance. In particular, higher balance machines attracted a higher proportion of spins and the amount players spent on that machine.

The tendency for players to make riskier choices on high balance machines was attributed to the 'house-money' effect. This research highlights that riskier choices are made when people receive money immediately before making a choice (e.g., in investments, as demonstrated by Hsu and Chow, 2013).

Accordingly, this may have implications for the amount of money displayed on credit meters, along with the availability of free spins. The authors also pointed out that this may have implications for credit meter displays in gaming venues to players gambling on other EGMs (i.e., it may have a facilitation effect).

EGM SPIN RATES, NOTE ACCEPTORS CREDIT METER LIMITS - SUMMARY INSIGHTS

Spin rates

- Problem gamblers may play at a faster rate, although a recent study has found no difference for problem gamblers
- EGMs offering faster rates of play were associated with increased spending during an optional play period, greater underestimations of the amount spent and impaired recall of the number of winning outcomes
- EGMs offering faster speed of play were preferred and more exciting to gamblers including both recreational and at-risk gamblers.
- Problem gamblers prefer games with a fast speed of play
- EGMs with fast play tend to be associated with higher bets, longer play and higher impaired control over gambling

EGM note acceptors

- Reducing note acceptor amounts has been found to reduce gambling expenditure
- Problem gamblers may show a tendency to use high value notes in note acceptors or even load on higher amounts of coins, relative to non-problem gamblers
- An expert forum in Canada identified that note acceptors were amongst the key EGM structural characteristics that may contribute to problem gamblers – eliminating note acceptors was similarly reported as having potential to reduce problem gambling

EGM credit meters/EGM balances

- Display of credits may - instead of money - may have potential to 'tokenise' money on EGMs
- A recent study found that gamblers may prefer EGMs showing high balances and may make riskier bets on EGMs with higher balances. Higher balance machines may attract a higher proportion of spins and machine spending

EGM payment and pre-commitment methods

EGM PAYMENT METHODS

EGM payment methods present a further type of structural characteristic in Australian EGMs. Current payment methods include cash and coins, Ticket-in Ticket-out (TiTo) technology and smart cards or magnetic stripe gaming cards (typically associated with cashless gaming accounts). Some EGMs also provide associated pre-commitment and loyalty systems.

While little research is available to inform the impact of different EGM payment methods, some past research has examined both TiTo technology and use of cashless cards for gaming. Nisbet (2005), for instance, found that cashless gaming allowed quicker movement of players from EGM to EGM and was also found to be very convenient by EGM players. Carr-Gregg (2013), in a paper on Ticket-in Ticket-out gambling, also concluded that there was some evidence that Ticket-in Ticket-out technology was helpful to both problem gamblers and potential problem gamblers.

An early trial of card-based gaming by the Queensland Government additionally supported this conclusion (Queensland Office of Gaming, Liquor and Racing, 2005) (Conducted by Schottler Consulting), as players using card-based gaming were found to play a higher number of machines compared to those not on cashless gaming. Feedback from this study suggested that cashless gaming was seen to be very convenient for players.

A further study examining pre-commitment at an RSL Club in Queensland showed that players reported less waiting for hand-pays with cashless gaming and enjoyed the convenience of being able to leave gaming machine venues without having to drawn down on small amounts on the credit meter (as such amounts could be easily transferred back to the gaming card) (Schottler Consulting Pty Ltd, 2009).

Parke et al (2008) conducted a comprehensive review of cashless gaming for the UK Gambling Commission. Based on the common feature of cashless gaming systems to be able to provide cash accounts, the authors concluded that gamblers will typically underestimate monetary expenditure on gaming machines and advocated that expenditure statements would help in expenditure monitoring. The authors also cited evidence from research by Nisbet (2005) that 67% of respondents found account summaries useful and from Schellinck and Schrans (2007), that over two-thirds of gamblers looked at their account summaries at least once over a six-month period.

The Australian Productivity Commission (2010) also concluded that there was a strong argument to display expenditure over a longer term to players if cashless accounts were used - *This provides strong grounds for the screen display of player transaction records that inform people about the total cost of play they have experienced over the last year, not just the cost of the current session (Section 11.8).* Accordingly, cashless gaming, TiTo and cash based payment methods may conceivably affect both gambling and problem gambling. However, further research is needed to fully understand these effects.

A more recent study by Nisbet et al (2015) also examined the impact of cashless gaming in NSW gaming venues. The authors describe the key aims of cashless gaming as marketing, cashless play and pre-commitment. The authors qualitatively explored player experiences in adopting cashless gaming technology and reported that players interviewed claimed that it did not affect player expenditure, machine choice, session length or breaks in play, relative to regular gaming. In this respect, the cashless system of play was not found to contribute to gambling harm. The authors also highlighted the value of future studies comparing cashless, ticketed and cash-based gaming as payment technologies to assess their contribution to gambling harm.

A more recent study by Drawson et al (2017) reviewed evidence relating to cashless gaming and highlighted that the evidence base was very limited. This study reviewed previous research by a number of authors including Nisbet (2005). Other research of interest included a finding by Omnifacts (2005) that 80% of gamblers believed that cashless would support responsible gambling and Schottler Consulting (2009), which found that EGM players were largely satisfied with the functionality of card-based gambling. As research cited is more than a decade old, this highlights the need for more contemporary research in this area.

EGM TIME AND MONEY PRE-COMMITMENT

The recent study by Drawson et al (2017) also reviewed EGM time and money pre-commitment features of EGMs. Research was cited to conclude that players who set time limits gambled for a shorter time (Kim et al, 2014) and that setting time limits was a common strategy of gamblers (and especially problem gamblers) (e.g., Woods and Griffith, 2014). A recent study by Kim et al (2014) also highlighted that pop-up messages appear to increase the likelihood of players setting a time limit.

In relation to monetary limits, Drawson et al (2017) concluded that between 54 and 92% of all gamblers set monetary limits (Woods and Griffith, 2014; Wynne and Stinchfield, 2004). In addition, problem gamblers generally set limits more frequently than non-problem gamblers (e.g., Moore et al, 2012) and problem gamblers were more likely to exceed money limits they set including bet limits (e.g., Blaszczynski et al, 2014).

Rintoul and Thomas (2017) also summarised evidence relating to the impact of pre-commitment in EGMs. The authors cited evidence from two South Australian trials of pre-commitment to highlight some harm minimisation benefits. In particular, a trial of the Worldsmart card-based pre-commitment system found a reduction in EGM turnover for players electing to use the card, with most reductions in spending noted for high-risk gamblers (Schottler Consulting, 2010).

However, an evaluation of the Maxetag pre-commitment tag at two South Australian venues showed limited efficacy in player use of the system. Of particular note was that very few players set a monetary limit, more than half exceeded their limits and when limits were exceeded, most failed to use the feature again (Delfabbro, 2012). Confusion over the limits were also observed across both trials, highlighting some complexity in encouraging EGM players to set and keep to limits.

Other evaluation of monetary based pre-commitment found that:

- Schottler Consulting (2005-2008) - Trials of cashless gambling systems offering pre-commitment limits were conducted in Queensland across three venues. While players reported some positive benefits of pre-commitment systems, few took up promoted systems and there was frequent confusion over the limits set and many players exceeded set limits
- Lund (2009) – Losses fell following introduction of a nationwide pre-commitment system on Video Lottery Terminals (VLTs) in Norway, which involved universal loss limits
- Schellinck & Schrans (2010) – Gamblers who used the features of the system found them to be beneficial. However, the system was disabled in 2014 following declining use of the system

OTHER HARM MINIMISATION FEATURES OF EGMS

While a comprehensive review of Responsible Gaming Features was outside the scope of this analysis (as many are peripheral devices that attach to EGMs and are distinct from betting and EGM game play), one recent study by Blaszczynski et al (2014) evaluated the effectiveness of five responsible gaming features for EGM play.

These were - responsible gaming messaging, a bank meter quarantining winnings until termination of play, an alarm clock allowing time-reminders to be set, a demonstration mode allowing play without money; and a charity donation feature (where residual credit amounts could be given to charity, as opposed to being played to zero credits). Ten machines were placed across five gaming venues as part of a trial of these features.

A total of 300 participants completed a structured interview to provide feedback on the features. Findings showed that a quarter of participants saw the features as having potential to contribute to preventing recreational gamblers from developing gambling problems. In addition, a large proportion indicated that they saw these potential features to have at least a moderate or significant effect in this regard.

While responsible gambling features have been traditionally designed as peripheral devices that can be optionally 'attached' to EGMs, if such features have proven benefits, this may highlight their potential to become integral structural characteristics of gaming machines. Accordingly, prescription of such features could also be considered as part of future EGM licensing requirements to minimise harm to players.

EGM PAYMENT AND PRE-COMMITMENT METHODS - SUMMARY INSIGHTS

Cashless gaming

- Cashless gaming is associated with quicker movement of EGM players from EGM to EGM
- Cashless gaming is associated with lower use of hand-pays and higher player convenience
- Qualitative research shows that EGM players believe that cashless gaming does not affect player expenditure, machine choice, session length or breaks in play, relative to regular gaming

Expenditure statements

- Expenditure statements may improve player monitoring of EGM expenditure

Time and money pre-commitment features of EGMs

- Players who set time limits are likely to gamble for a shorter time
- Pop-up messages may remind players to set time limits on their EGM play
- Problem gamblers are more likely to set time, money and even bet limits, but also exceed them more frequently, than non-problem gamblers
- A pre-commitment trial in South Australia found that use of limits was associated with an EGM expenditure reduction for high risk gamblers, but had little effect on non-problem gamblers
- Most pre-commitment trials to date have shown that systems can confuse players (leading to players setting erroneous limits) and update of pre-commitment tools by EGM players is low
- Universal loss limits may lead to EGM expenditure reductions based on overseas experiences

EGM branding and marketing

The following characteristic/s of relevance to this section is/are on the NSW Gaming Machine Prohibited Features Register:

#3 - An image of real Australian money was displayed on an EGM. As this was considered a potential player inducement, display of real money on an EGM or as part of an EGM theme was entered into the Register.

#4 - An EGM was branded with a 'Big Money' theme. This was considered inconsistent with responsible gambling, so was entered into the Register.

#5 - Verbal player inducement messages were prompted to players in the event they didn't win a feature ('try again' and 'have another go'). These were considered inducements to play and were entered in the Register.

#6 - The top prize of an EGM was prominently displayed in EGM game rules, in spite of the prize not being attainable without use of the maximum bet (i.e., Win up to $3,000, $5,000 or $10,000 – However, the $10,000 prize only applied if the maximum bet was used). This was considered an advertising inducement and was entered into the Register.

MACHINE BRANDING, SOUNDS, LIGHTING AND ADVERTISING

The overall branding or appearance of gaming machines can be considered a key type of structural characteristic. Parke and Griffiths (2006) advocated that machine branding may influence players to the extent that it increases player familiarity with machines and increases the overall attractiveness of a machine. The power of familiarity is also supported by research by Griffiths & Dunbar (1997).

The authors used common examples of machine branding to explain how these may influence behaviour. Common techniques used in branding were described to include celebrity association, use of trusted brands (which may lead players to assume they are unlikely to lose a lot of money as a machine is 'trustworthy'), use of TV show branding (which may lead players familiar with the TV show to assume they can use skill as they 'know' the show and characters) and fun (some machines are novel and interesting to play due to sound effects and game dynamics).

Gaming machine sounds have similarly been found to affect EGM play. Griffiths & Parke (2003) suggest that colourful or exciting sounds may give players the impression that winning is more common than losing and may serve to reinforce gambling behaviour. Other sound effects have also been noted on machines. For instance, Parke and Griffiths (2006) identified that UK fruit machines have a sound that increases in pitch and speed to encourage players to make quick decisions. Edworthy, Loxley, & Dennis (1991) were also noted to call this the 'perceived urgency' effect. Background music was also described by Griffiths and Parke (2005) as a key area for future research, given the possibility that music may increase player confidence, increase arousal, relax players or even lead players to disregard previous EGM losses.

Similar to Australian EGMs, EGMs in the UK are noted by Griffiths & Parke (2003) to use verbal or written reinforcers to encourage players during play (e.g., Words such as 'Well done' shown after each spin resulting in a win). Words noted as common in the UK included phrases such as 'You're cool', 'You're genius' and 'Thank you. Come again'. However, apart from noting such phrasing, there is no specific research available on these in the gambling research literature.

IMPACT OF COLOUR ON EGMS

The colour of machine lights is similarly a characteristic with potential to influence EGM play. Papers by authors such as Griffiths and Swift (1992) and Stark, Saunders, & Wookey (1982) provide evidence that use of red lighting may be more arousing to EGM players. However, this is a very under-researched field. A study by Spenwyn et al (2010) involved experimental manipulation of light and music speed for roulette gambling in four separate experimental conditions - (1) gambling with fast tempo music under white light, (2) gambling with fast tempo music under red light, (3) gambling with slow tempo music under white light and (4) gambling with slow tempo music under red light. Key findings suggested that music tempo influenced betting speed, but the same effect was not found for light. In addition, fast tempo music under red light was found to be associated with faster gambling.

A further study by Bramley (2012) cites evidence on the effects of music from other areas of research. Fast tempo music was found to increase the speed of eating (Roballey et al., 1985), drinking (McElrea & Standing, 1992), moving through a supermarket (Milliman, 1982) and even activities such as reading (Kallinen, 2002). In the field of exercise, music tempo was also found to influence the speed of pedalling (Waterhouse, Hudson & Edwards, 2010) and faster treadmill speeds (Edworthy and Waring, 2006). A meta-analysis of eight studies was also quoted as concluding that there was an association between faster music tempo and faster behaviour (Kämpfe, Sedlmeier & Renkewitz, 2011). Accordingly, it is likely that the same affects may apply to EGM gambling.

A further recent study investigated the role of colour in EGM play. Brevers et al (2015) highlighted that casino environmental characteristics may influence gambling in a casino environment and examined this through an experiment. The authors postulated that casino venues are often characterised by warm colours, people and reward-related sounds and that such factors may facilitate gambling.

In an experiment, eighty non-gamblers took part in one of four conditions that varied sound, light and people using the Iowa Gambling Task (IGT). The IGT is a computerised task involving card selections used to assess decision making (Bechara et al., 1994). Decks vary in the cards that result in lost money, with two advantageous and two disadvantageous decks. Subject learn from the card selection process by working out how to minimise the disadvantageous deck selections and how to maximise the advantageous deck selections.

The four experimental conditions in the study were (1) IGT without casino-related sound and under normal (white) light (the control), (2) IGT with casino-related sound and red light (casino alone), (3) IGT with combined casino-related sound, red light and in front of another participant (casino competition—implicit), and (4) IGT with combined casino-related sound, red light and against another participant (casino competition—explicit).

The authors found that in the casino conditions, participants did not show slower reaction time after losses than rewards. In the two 'competition' conditions, participants, however, showed slower reaction time after losses and rewards. The authors then postulated that casino environments may lead gamblers to spend less time reflecting on and thinking before acting on their gambling losses.

IMPACT OF SOUND

A more recent study has also found that sound played during EGM play has physiological effects. Dixon et al (2014) conducted a study of 96 gamblers to investigate the impact of sound incorporating measures of skin conductance and heart rate. A simulator was used in the study with and without sound being paired with reinforcement. Participants played two different multiline EGM simulators. One was a machine with sounds played during wins and LDWs (the sound on EGM), while the other had sounds turned off, with only visual celebratory feedback (the sound off EGM). Players were asked which machine they preferred at the end of play and each player was asked to estimate their number of wins.

Findings showed that sound influenced player behaviour and also preferences for the EGM playing sound. SCRs were larger on the machine with sound and the sound on EGM was rated as more arousing. In addition, due to sounds being played, gamblers overestimated their number of wins. Players estimated 33 wins in the sound off EGM, when they were only exposed to 28 wins (a 15% over-estimation). However, for the sound on EGM, over-estimation was much higher at 24% (i.e., players estimated they had won 36 times). Accordingly, this supports the idea that sounds during LDWs may help sustain gambling behaviour. The authors then proposed that sound should not be played during LDWs to reduce the likelihood that gamblers over-estimate their wins.

USE OF SOUND IN GAME DESIGN

While not a study about EGMs, Bramley and Gainsbury (2014) examined the role of sounds and play characteristics of 'free to play' slot themed social media casino games. Auditory features of games were studied using an exploratory case study approach. Sounds in the social casino games were found to serve a number of purposes including setting the scene for gaming, creating an image, demarcating space, interacting with visual features, prompting players to act, communicating achievements, providing reinforcements and heightening player emotions. It was also proposed that use of different sounds at different stages of play communicate to players and may help migrate players to paid games.

As there is potential to develop games that work with player loyalty systems in Australia (i.e., where different music could be potentially played at different points for individual players, as they progress through sessions of play), such findings may highlight a need for caution in ensuring that new products are not developed with such characteristics. It also raises the related issue that, if migration between free play pokies and real pokies is possible, free play poker machine like games – including apps - should also potentially be subject to regulatory control to protect players.

To examine its relevance to the field of game design, Collins et al (2012) discussed the existing research relating to sound and its application to EGMs. Possibly the most interesting conclusion was that sound reinforces the idea of winning, even in spite of a player losing. It was also concluded that much more research is needed to investigate the impact of sound during EGM play, including research to examine if gambling is affected when EGM sounds mix and compete with other background music, sounds and noise.

Further research examining the impact of sound was conducted by Collins et al (2013). This included four separate studies examining psychological and physiological impacts of sound in EGMs. Unsurprisingly, sound was found as critical to the overall experience of playing EGMs and results showed that manipulating sound impacted the player response and experience. In particular, in a sound on versus off condition, sound impacted player arousal and enjoyment and contributed to the overestimation of wins.

The second study examined the role of sound in LDWs and found that sound was more important than visual indicators. In the third study, results showed that associating sound with particular symbols draws attention to those symbols and may thus be involved in creating perceptions of near misses during EGM play. The fourth study used eye tracking glasses to show that players fail to notice credit subtractions when they spin EGM reels, highlighting the potential to make this more salient during EGM play.

IMPACT OF BACKGROUND MUSIC IN GAMBLING

A more recent study by Bramley et al (2018) investigated the effect of background music on gambling behaviour. A survey was used to measure the effect of music on gamblers from a cognitive, emotional and behavioural perspective. Respondents included staff and students at a university in the UK.

Just over half the sample reported hearing music in gambling environments in the past 12 months. However, most respondents generally indicated that they did not believe music to have an effect on their gambling behaviour (including their speed of betting or expenditure). In addition, over a third self-selected music to accompany their gambling (e.g., when gambling online at home) and moderate-risk and problem gamblers were over four times more likely to self-select music than were non-problem or low-risk gamblers. In addition, both gambler selected and operator selected music was deemed by respondents to set an optimal atmosphere for gambling. This may highlight that background music is important to at-risk gamblers, however, further research is needed to better understand these effects.

HOW EGM PLAYER PREFERENCES CAN BE MANIPULATED

Zlomke and Dixon (2006) originally demonstrated how EGM player preferences for a particular machine can be manipulated in a venue. Even though payouts of both machines in an experiment were identical, the authors experimentally manipulated an association between the EGM's yellow colour and other positive characteristics.

A more recent study by Dixon et al (2017) also conducted a similar experimental manipulation on computer simulated EGMs. While EGMs had an identical payback schedule, positive and negative associations were formed between certain slot machines, which allowed the authors to test whether this could be transferred to simulated casino EGMs.

Participants were trained during the experiment on how to conditionally discriminate machines on the basis of positive words and colours (e.g., Win, pleasure, orange; Lose death red). Findings showed that preferences were effectively able to be altered based on the conditional discrimination training provided to participants. This highlights how EGM marketing and branding has potential to create associations between EGMs and certain characteristics (e.g., colours, emotive words that trigger greater confidence in the EGM to produce a win etc.).

A further experiment by Wilson and Dixon (2014) also recently applied conditional discrimination training to EGMs players playing an EGM simulator with different types of coins (red or silver). While only based on six participants, following a baseline gambling stage, participants were trained to establish a rule that either the red or silver coins were somehow 'better'. A survey was then conducted to test participant's knowledge and then following a further stage on the EGM simulator, five of the six participants altered their use of coins based on the conditional discrimination training they had received.

A recent study by Rodgers et al (2017) additionally investigated where slot players looked when gambling. Eye tracking glasses were used in the study. Findings showed that reels accounted for 53.6% of the gambler's visual fixations while placing bets and this was 91.7% when the reels were spinning. In comparison, fixations on credit balances were around 14% of total fixations when betting, but only 5.1% during reel spins. Accordingly, this may highlight that gamblers pay less attention to credit balances during reel spinning and that the reels take gambler's gaze away from betting.

COGNITIVE ASPECTS OF PROBLEM GAMBLING THAT MAY INFLUENCE RESPONSE TO ADVERTISING

While branding is a critically important part of the success of EGMs, there is also a need to ensure that advertising does not mislead consumers or negatively impact people experiencing problem gambling. It is also important to consider the vulnerabilities of people with gambling problems to understand possible impacts of advertising. Research provides some evidence on possible vulnerabilities of problem gamblers from a cognitive perspective.

Some studies in particular have identified that problem gamblers hold false cognitions about gambling and may make cognitive errors in decisions. Grant et. al (2011), for instance, studied the decision making of gamblers in a simulated gambling task and found that people at risk for problem gambling gambled more of their available points, made less rational decisions under conditions of ambiguity and were more likely to continue play until bankruptcy.

Results suggested that problem gamblers had a pre-disposition to risk taking and impulsivity and an inability to make logical decisions when presented with information. In addition, drawing on literature suggesting that problem gamblers hold a higher belief in luck, Wohl and Enzle (2002) found that gamblers who felt 'lucky' were more likely to continue gambling, compared to people who were not feeling 'lucky'. Accordingly, such studies highlight the need for manufacturers to be cautious in designing EGM advertising and branding approaches.

A study by Hewig et. al (2010) similarly identified that problem gamblers are likely to make risky decisions during gambling. This study examined neurological responses of problem gamblers to losses and rewards in another simulated gambling task. Problem gamblers were hyper sensitive to reward and this explained their tendency to make risky decisions about gambling. Such research may thus provide some evidence that problem gamblers are vulnerable to advertising inducements promoting possible rewards.

In a study examining the marketing and advertising of gambling (Schottler Consulting Pty Ltd, 2012), several studies were reviewed to draw conclusions about the theoretical impacts of gambling advertising, given known cognitive vulnerabilities of problem gamblers. It was concluded that problem gamblers may:

- Have difficulty processing unclear advertising information and may be more likely to engage in risk taking due to advertising
- Be influenced by advertising offering the potential for high rewards (e.g., free money, inducements or similar benefits)
- Be influenced by advertising that encourages 'escapism' (e.g., dreaming about winning)
- Problem gamblers may be more influenced by advertising promoting 'luck', superstitions or good fortune

While the impact of imagery of money or use of words in advertising such as 'Big Money' has not been specifically researched, together such studies highlight the potential for images or slogans to be harmful to problem gamblers. In particular, images of money and slogans referencing 'Big Money' may have potential to lead problem gamblers to see an EGM as being able to alleviate financial stress (encouraging escapism) or believe that the EGM will provide a better payout (reinforcing superstitions). This latter assertion would similarly be supported by research showing that problem gamblers are generally attracted to EGMs offering high jackpots and will play more intensively on such machines (e.g., Rockloff et. al, 2014).

RESEARCH HIGHLIGHTING POSSIBLE EFFECTS OF GAMBLING ADVERTISING

A range of evidence from other studies about advertising also supports such conclusions. This includes research on the role of advertising stimuli in triggering addictive behaviour. Wolfling et. al (2011), for instance, found that gambling related stimuli were perceived as significantly more 'arousing' by pathological gamblers (compared to controls) in a study of the effect of 'cue' exposure on gambling 'cravings'. Authors concluded that gambling addiction is maintained through addiction-associated stimuli (money could also be argued as a possible addiction-associated stimulus).

Such findings are similarly supported in a smoking study by Conklin (2006). The study found that pictures of environments associated with smoking evoked urges to smoke in abstinent smokers. Such findings thus further raise the possibility that cues suggesting or showing pictures of money or gambling associated stimuli (e.g., or words such as 'Big Money' or even showing gambling activities – like card games) may impact problem gamblers.

A further more recent study by McGrath et al (2018) also reinforces these results. These authors examined the attentional biases of gamblers through an eye tracking study. Three groups of participants were included in the study - Poker players, Video lottery terminal/slot machine players and non-gambling controls. Each group then participated in a test session where they viewed 25 sets of four images. Images were about poker, VLTs/slot machines, bingo, and board games. Results of eye tracking gaze analysis showed that players attended to their primary form of gambling, while controls were more fixated on the non-gambling stimulus (board games). Accordingly, this may highlight that EGMs with advertising or branding showing gambling related themes may appeal more strongly to problem gamblers (who are probably very fixed on gambling related imagery).

Other supporting research is available from lottery advertising. Landman and Petty (2000) examined counterfactual thinking as relating to lottery promotions. Counterfactual thinking involves how people compare their current situation with the prospect of 'what may occur' if they win. Advertising was proposed to increase the tendency for counterfactual thinking. The greater the extent this occurs, the more consumers will be inclined to spend. This was also described as harmful to low socioeconomic groups, given the large difference between their (financial) situation and a lottery win. Accordingly, this raises the potential for terms relating to the potential to win large sums of money to encourage counterfactual thinking in financially vulnerable problem gamblers and encourage vulnerable segments to increase EGM expenditure.

Pike and Quinn (1997) also studied the impact of casino inducements. Inducements provided by casinos to video poker players were found to lead players to gamble longer and more often than they had planned. It is also noteworthy that Hing, Cherney et al (2014) purported that free bets offered by sports betting companies particularly tempt problem gamblers and reinforce problematic gambling behaviours.

Schottler Consulting (2014) examined the impact of visual EGM celebration and encouragement messages (termed 'motivational messages' in the study report) in a broader study examining the impact of EGM structural characteristics. Using qualitative research, the study reported that most EGM players were aware of such messages as part of EGM play, but did not consider the messages to be stimulating in nature or contributing to extended EGM play. However, a very limited range of messages was identified.

ADVERTISING RELATING TO THE DISPLAY OF PRIZE INFORMATION

Research has also examined how advertising of prize information may affect gamblers. This is particularly relevant to the display of prize information in game rules without display of the specific conditions relating to prizes (e.g., Win up to $3,000, $5,000 or $10,000 with information on the highest prize not accompanied with information that a maximum bet was required to win the prize).

In a study examining the marketing and advertising of gambling in New Zealand, Schottler Consulting (2012) found that gamblers would typically assume that the highest promoted prize was able to be won, implying that gamblers were unaware that prizes were merely prize pools (e.g., Win up to $10,000, where the $10,000 was merely a total prize pool, rather than first prize). It was also argued that some gambling providers would use such techniques, given that large prizes have a greater impact on gambling expenditure than smaller prizes.

Several other potentially harmful practices were similarly identified as having potential to mislead gamblers. Some NZ lottery and scratch ticket products, for instance, were found to not clearly identify ticket purchase costs or prizes (e.g., a scratch ticket showing that a holiday could be won, where the prize was only money to buy a holiday). Scratch tickets promoting the slogan 'still available' were also found to lead purchasers to believe that major prizes had not been won (in reality, the promotion was only referring to the fact that tickets were still available). In addition, TAB advertisements not clearly explaining prize assumptions were found to be common (e.g., Confusion about the conditions for the Guaranteed Pick 6 prize).

Similar approaches were also identified in casino advertising. Prize draws in casinos were found to often display large prize values without stipulating that the displayed prize was only a prize pool (i.e., Win $80,000 daily often implied a prize pool, but gamblers assumed that there was a single prize of $80,000 every day).

Focus groups undertaken with gamblers also highlighted a general view that advertising focusing on entertainment was significantly less harmful than advertising focusing on gambling to 'make money'. Accordingly, this highlights the need for clear information on prizes to ensure that consumers are not misled when reviewing prize information. Moreover, it also supports the potential for harm in using language that focuses on monetary themes.

Walker et al (2018) also recently conducted three experiments to show the effects of presenting unclaimed prize information (i.e., the number of prizes still available to be won) for scratch cards. The authors hypothesised that presenting unclaimed prizes may bias player judgements. Findings of their study also confirmed this effect. Participants favoured scratch cards with greater numbers of unclaimed prizes, highlighting the potential for display of prize information to affect player judgements.

GUIDELINES AND CODES RELATING TO ADVERTISING

Supporting the need to avoid inappropriate advertising, most jurisdictions within both Australia and internationally have developed codes and guidelines for both gambling and general advertising. The purpose of codes and guidelines is to identify and prohibit inappropriate advertising that may harm consumers. Also of relevance to New South Wales, are regulations under the Gaming Machines Regulation 2010. Clause 21, in particular, outlines a requirement for information on the chances of winning prizes to be displayed on gaming machines.

The Australian/New Zealand Gaming Machine National Standard 2016 also highlights standards related to advertising to prevent gambling harm to consumers. This states that there must be sufficient game instructions to allow a player to determine the correctness of prizes awarded (5.12) and that game play and device usage instructions must be stated unambiguously and must not be misleading to players (5.13).
Several states have also implemented a range of special advertising requirements relating to gambling products and services. For instance, Victoria and South Australia legislated against inducements to gamble and currently prohibit bonus offers and similar promotions (e.g., including free bets from sports betting companies).

Australian Consumer Law provides a legislative basis for the content of gambling advertising codes. This prohibits misleading and deceptive conduct in all forms of trade and commerce and requires that suppliers making pricing representations must not state that a price is only a component of the total cost of a product or service (termed 'Component pricing'). Rather, the total price must be displayed inclusive of all pricing components.

For a New Zealand study, Schottler Consulting (2012) reviewed international standards in gambling advertising and identified a number of best practice standards for consumer protection. Most notably, it was recommended that gambling advertising must not mislead consumers about the odds of winning, must not verbally urge non-gambling customers to buy gambling products, must not challenge or dare a person to gamble and must not promote inducements that could lead to gambling or exacerbate gambling problems.

Several characteristics of gambling advertising associated with harm were identified. This included advertising where:

- There was low informed consent about what was being purchased
- Advertising content reinforced problem gambling risk factors (e.g., reinforces escapism, superstition, a focus on money as the reason for gambling)
- Advertising uses other forms of gambling as part of promotions (as gambling advertising depicting gambling activities were found to be very appealing to at-risk gamblers)
- Advertising contained content which financially vulnerable gamblers related to (e.g., stories of winning in lotto advertising and how the money won addressed financial concerns - implying that use of themes relating to money or financial difficulties could be harmful)
- Advertising phrases were inconsistent with the objectives of responsible gambling
- Offers presented low value inducements to gamble – These were seen as posing more risk to gamblers than the value of the inducements and particularly, risk to financially vulnerable gamblers
- Advertising which pressures gamblers or encourages 'on the spot' decisions - This included use of advertising words such as 'hurry', 'quick', 'beat the odds', 'Don't miss your chance', 'Be a good mate' and even pressure from sports commentators during live sporting events (e.g., 'talking up' live odds)
- Advertising uses other forms of gambling as part of promotions - gambling advertising depicting gambling activities was reported to particularly appeal to at-risk gamblers due to their fixation on gambling

EGM BRANDING AND MARKETING - SUMMARY INSIGHTS

General EGM branding and appearance

- Colourful and exciting sounds may give players the impression that winning on an EGM is more common than losing and may serve to reinforce gambling behaviour
- EGM music generally may increase player confidence, increase arousal, relax players and even lead players to disregard or dissociate from previous EGM losses
- UK fruit machines have a sound that increases in pitch and speed to encourage players to make quick decisions – Faster temp music may increase the speed of gambling
- Sounds in social casino games may serve a number of purposes including setting the scene for gaming, creating an image, demarcating space, interacting with visual features, prompting players to act, communicating achievements, providing reinforcements and heightening player emotions
- Eye tracking research shows where gamblers fixate on EGMs – One study found that reels accounted for 53.6% of the gambler's visual fixations while placing bets and this was 91.7% when the reels were spinning.

  In comparison, fixations on credit balances were around 14% of total fixations when betting, but only 5.1% during reel spins. This may highlight that gamblers pay less attention to credit balances during reel spinning and that the reels take gambler's gaze away from betting.

Colour of EGM lights

- Use of red lighting may be more arousing to EGM players and may increase speed of gambling

Sound on EGMs

- Sound on EGMs is generally found to be more arousing by EGM players
- Sound paired with Losses Disguised as Wins (where wins are less than the amount bet) may lead players to overestimate wins
- Associating sound with symbols leads to player attention to be drawn to symbols

Impact of background music and ambience on EGM play

- Moderate-risk and problem gamblers were found to be over four times more likely to self-select music than were non-problem or low-risk gamblers
- Casino environmental sound, lights and music may lead gamblers to spend less time reflecting on and thinking before acting on their gambling losses

Manipulation of EGM player preferences

- EGM player preferences for a particular machine can be manipulated in a venue when players learn to conditionally discriminate machines based on attributes such as words, sounds and colours

Free spins, features and the effect of free spins near wins

The following characteristic/s of relevance to this section is/are on the NSW Gaming Machine Prohibited Features Register:

#2 - EGM games were found to be offering 100 free games with virtually no chance of winning the games. Consequently, a 40 free game limit was introduced.

IMPACT OF FREE SPINS AND FEATURES

Many studies have found that gaming machine features are attractive to gamblers and may explain why gamblers spend more money on gaming than they can afford. For instance, Schottler Consulting Pty Ltd (2010) undertook a shadowing study to record live EGM play of 200 participants. The factors influencing adherence to monetary pre-commitments were analysed. Players were found to be more likely to exceed their EGM expenditure limits if they experienced an increasing number of free spins (after moving from the first to second EGM) and experienced high excitement from features received during EGM play. Total free spins received during play was also found to positively predict overall EGM play excitement. Recent analysis of VLTs in Norway has also further supported the value of free spin features to players, with the three most played games found to offer bonus features (Leino et al, 2015).

Schottler Consulting (2014) also conducted a further observational study investigating the impact of free spins and features on gamblers. Live play observations were undertaken with 222 EGM players across Australia, along with an attitudinal survey of each participant. A particular focus of the study was to examine the impacts of different EGM structural characteristics on problem gamblers.

Based on findings of a study involving both attitudinal and observational research with EGM players, free spins were generally rated as the most exciting EGM structural characteristic by all gamblers. The top three most exciting free spin characteristics overall involved getting free spins during free spins, win multipliers during free spins (which multiply wins by a number – e.g., 10x) and free spins and winning from free spins.

Key findings also suggested that win multipliers during free spins led to significantly higher levels of play excitement for problem gamblers, compared to non-problem gamblers. This may suggest some potential for win multipliers to be associated with higher player persistence in problem gamblers. Several other findings of note also provide insight into the effect of different numbers of free spins.

Specifically:

- Obtaining a single free spin was relatively unexciting for gamblers, compared to getting multiple free spins at once
- Problem gamblers have significantly higher cognitive activity involving thoughts that free spins are coming during play compared to non-problem gamblers
- Not experiencing any free spins (or features) during a gaming session was described as leading to play persistence, as this is found to be 'frustrating' for gaming machine players
- Win multipliers during free spins were strong unique predictors of play excitement and the urge to continue EGM play
- Free spins/features DURING a real win increased EGM play persistence (as compared to those BEFORE or AFTER a real win), as did win multipliers during free spins

Gamblers additionally reported clear expectations of the amount they should have to spend to obtain free spins – In particular, non-problem gamblers were prepared to spend a mean of $12.24 for each free spin, while the same amount for problem gamblers was $23.79 (or a mean of $16 for all risk segments). EGM designs which do not provide a free spin within desired spending limits have potential to contribute to EGM play persistence.

When the overall amount of $16 (spending) was used as the reference point ('overall expectation') for one free spin (with EGMs as the basis of analysis), analysis showed that around 60% of EGM play sessions required players to spend more than $16 on average for each free spin event achieved and only around 40% got a free spin within this overall average limit. This was taken to suggest that the fundamental design of many EGMs observed during the study may have potential to lead to play persistence. As problem gamblers were prepared to spend significantly more money on EGM play for a free spin, this may suggest that EGM designs that provide few free spins (relative to money spent) could potentially be more harmful for problem gamblers (as it may lead to play persistence).

The Schottler Consulting (2014) study also investigated the effect of obtaining a free spin around a large win. Interestingly, obtaining a feature or free spin immediately after a large monetary win was found to be very exciting by all gamblers and significantly more exciting by problem gamblers (relative to non-problem gamblers). In addition, problem gamblers reported increasing betting upon receiving a feature - near a large win or a free spin near a large win - more frequently than non-problem gamblers. This may highlight that this type of 'combination event' could lead to increased betting by problem gamblers and associated gambling harm.

Features – as distinct from free spins – were also investigated in the Schottler Consulting (2014) study. Features were defined as any combination of special visual effects or sounds that were associated with players winning bonus points during EGM games. While all gamblers found features exciting, receiving a feature during a free spin was considered even more exciting. Problem gamblers were also noted to think a feature is coming during play to a much larger extent than non-problem gamblers. In addition, receiving a feature directly after a large win was also found to be more exciting. Similar to free spins, not receiving any feature during a gaming session was found to be associated with play persistence – a type of 'frustration' effect for gamblers. A feature was similarly expected for every $18 spent overall. In addition, problem gamblers were prepared to spend a higher mean amount for each feature ($23.93) compared to non-problem gamblers ($16.38).

The impact of feature characteristics on play persistence was also examined in the study. This is also one of the few studies conducted to examine the effect of different feature characteristics. Findings showed that features that simulated another gambling game were least exciting, while features that provided a chance to win a linked jackpot or involved selecting different options (like '10 spins and win 5x' your bet versus '15 spins and win 3x your bet') were most exciting.

Three EGM feature characteristics were also found to be more exciting for problem gamblers compared to non-problem gamblers: (A) Features that involved role playing a character (PGs mean=3.4, NPGs mean=2.4), (B) Features that gave the impression of a game of skill (PG mean=3.0, NPG mean=2.3) and (C) Features with funny characters (PG mean=3.4, NPG mean=2.5). It was then suggested that this may provide some evidence that such feature characteristics could pose some level of harm to problem gamblers.

WHY FREE SPINS AND FEATURES APPEAL TO GAMBLERS

The reasons why free spins and features are exciting have also been of research interest. Livingstone and Woolley (2008) advocated that free spin features of EGMs are attractive to gamblers, as they provide secondary reinforcement during gaming machine play. A qualitative study with problem gamblers in treatment by AIPC (2006) additionally found that most gamblers were excited by free games, as they valued the higher odds paid on wins during free spins. This was attributed to the sense of satisfaction associated with 'playing for free'. The authors reported that many gamblers would up-scale their bets in anticipation of winning free spins and would return to a base strategy after free spins (typically playing minimum bets on multiple or maximum lines).

A further recent study by Hamilton et al (2013) examined the specific machine features which attracted non-problem versus problem gamblers to Video Lottery Terminals in Canada. Results showed that problem gamblers were more attracted to games that were 'winning-focused' and these games resulted in greater excitement, faulty gambling beliefs and more dissociation than 'entertainment-focused' games. The authors then suggested that VLT selection for the marketplace should be 'entertainment-focused' rather than 'winning-focused' into the future. It was also noteworthy that, while both problem and recreational gamblers liked features, problem gamblers didn't like machines that did not provide low bonus features and would postpone gambling waiting for machines with a higher bonus.

Landon et al (2016) recently conducted qualitative research to identify the characteristics of EGMs that players found most attractive. Using 40 players and six focus groups, two groups of EGM characteristics were identified as important. The first concerned factors associated with winning, while the other concerned characteristics of betting. Winning related to sub-features of EGMs such as free spins, small wins, jackpots and lights and sounds. Betting related to EGM denominations and number of lines.

The most favoured characteristic was reported to relate to free spins irrespective of the risk status or frequency of play of the gambler. Frequent small wins was the second most favoured characteristic. EGMs able to offer 'value for money' and those offering maximum time at a machine for the lowest cost were particularly preferred and perceived to be seen as relatively safer, compared to high denomination EGMs. However, given that frequent small wins allow maximum time expenditure at a machine, Landon et al (2016) proposed that low denomination machines with multiple lines should also be the focus of future research (i.e., as they are highly valued by gamblers and allow long sessions of play, which has the potential to trigger behavioural reinforcement of gambling (e.g., Templeton et al, 2015).

In spite of free spins and features being fundamental to player enjoyment of EGMs, there has been very little research into the effects of different feature game styles in gaming machine play. This has also been recently espoused by Goodie (2015). Goodie (2015) concluded that temporal characteristics such as speed and duration of games have received the most research attention, but other nuanced characteristics have not been well researched. These were described to include skill elements in EGM games, online formats and 'superficial' characteristics.

FEATURES IN THE CONTEXT OF DIFFERENT REINFORCEMENT SCHEDULES

While there is still much to be learned about the impact of features, recent research has started to explore their impact in the context of different EGM reinforcement schedules. Previous research by MacLin et al (2007) also suggested that gamblers will show a higher response to dense rather than 'lean' reinforcement schedules, while overall rates of reinforcement are held constant. Considering this impact, Belisle et al (2017) recently conducted an experimental study investigating the impact of bonus rounds on EGM play during dense and lean reinforcement schedules.

Twenty-three university students were provided an opportunity to play EGMs that varied in both win density and bonus rounds. To hold the rate of reinforcement constant, wins on the dense schedule provided three times the credit for a win, while wins on the lean schedule provided six times the amount bet. A repeated measures design was used in the experiment, where each EGM was played for 7.5 minutes and ordering effects adjusted through subject allocations. Bonus rounds were then introduced into EGMs and response allocation was measured as a dependent measure.

Findings showed that there was significantly higher response to EGMs with dense win schedules with or without bonus rounds. In addition, adding bonus rounds increased responses across both conditions. Accordingly, this may highlight that, in spite of strong player enjoyment of features, dense reinforcement schedules on EGMs may even be more powerful in increasing gambling behaviour than features.

IMPACT OF FREE SPIN AND FEATURE CHARACTERISTICS

A further impact of free spin characteristics has been recently investigated in a study by Taylor et al (2016). The authors examined the impact of different free spin characteristics on gambling behaviour in an experimental study. Highlighting that gambling research has not kept up with the modern pace of EGM design, Taylor et al (2016) highlighted that much research to date has involved laboratory simulations with simulated EGMs that lack the features of modern EGMs. Taylor et al (2016) also noted that free spin features are not homogenous. Features can be simple free spins, offer multiplied pay outs and in some cases, jackpots can only be won during features.

Within this context, the purpose of the study was to examine whether players would bet more on EGMs offering free spins and to determine the characteristics of free spins that most appealed to players. Three experiments were conducted. Participants were 32 undergraduate psychology students.

In the first and second experiment, participants played on a machine with a free spin feature, while in experiment two, participants played on a machine with a more complex free spins feature (i.e., with additional elements over and above just the standard free spin). In the third experiment, participants played on a complex bonus feature with spins that were NOT free. During the second phase, participants could then switch machines and the number of bets played on each was recorded. It was then expected that participants would choose to play EGMs with free spins or bonus features.

Findings interestingly showed that 29 of the 32 participants preferred the free spins machine. However, the freeness of the spins was not the most attractive preference driver. Rather, it was found that the additional features were the main preference driver. These included additional features such as an animated image congratulating players that they had won free spins (replacing a still image), a button to 'start' the feature, music when the feature was playing and an opportunity to match three symbols to gain five free spins plus extra bonuses for wins (a win multiplier).

As this interestingly contradicts findings of Livingstone et al (2008) (that identified that free spins were desired by players), the authors proposed that this different finding may in part be because players cannot articulate what they like about free spins. In addition, as free spins are effectively taken out of the RTP, the other reason reported by Livingstone et al (2008) driving gambler preferences (i.e., gaining extra time on the machine) was also not supported. Further supporting this, results of the third experiment suggested that participants even preferred the bonus machine, when they had to pay for bonus spins.

As one of the few recent studies that have attempted to experimentally break down the impact of free spins and features, Taylor et al (2016) also highlighted that future studies should attempt to identify feature characteristics that drive preferences and influence gambling behaviour.

POTENTIAL HARM OF VIDEO GAME FEATURES - POSSIBLE LEARNINGS FOR EGMS

While not specifically about EGMs, some emerging research in the field of video game monetisation highlights the possible impact of 'within game' purchases on gambling behaviour. While not currently permitted in Australian EGMs, loot boxes have some parallels to EGM features as they offer opportunities to win unique prizes. Such features may also become increasingly relevant, if EGM manufacturers use video game themes on EGMs.

In a submission to an Australian Parliamentary review, Knoop (2018) defined proposed that loot boxes use the same psychological principles as slot machines and can have addictive effects. The idea of loot boxes is that items can be purchased for opportunities to win or purchase other unique items within games. An industry leader in successfully implementing Loot boxes is the game 'Counter Strike: Global Offensive'. While players only pay a

nominal purchase price for the game, substantial company revenue is generated from players purchasing keys to open loot crates within the game.

King and Delfabbro (2018) identify how Loot Boxes reinforce behaviour through 'hook loop' mechanics. This is also discussed by Walker (2018). Players gain high value rewards after an average number of plays and this serves to further reinforce play behaviour.

Walker (2018) also reports that countries such as Japan, Belgium and the Netherlands have banned such game features, fearing that they exploit player vulnerabilities for consumer retention and profit. In this respect, they were described as a type of 'slot machine'. In addition, they have received regulatory scrutiny from jurisdictions such as South Korea, China and the UK. The UK Gambling Commission, in particular, released a discussion paper in 2017 and a position paper on the topic in 2017. Of relevance to the current review, it concluded that the use of loot boxes was essentially a form of gambling.

It was reported that (3.17):

"The payment of a stake (key) for the opportunity to win a prize (in-game items) determined (or presented as determined) at random bears a close resemblance, for instance, to the playing of a gaming machine. Where there are readily accessible opportunities to cash in or exchange those awarded in-game items for money or money's worth those elements of the game are likely to be considered licensable gambling activities."

The need for regulatory intervention was also highlighted (3.18):

"Additional consumer protection in the form of gambling regulation, is required in circumstances where players are being incentivised to participate in gambling style activities through the provision of prizes of money or money's worth. Where prizes are successfully restricted for use solely within the game, such in-game features would not be licensable gambling, notwithstanding the elements of expenditure and chance."

However, while the product was not described as officially considered licensable gambling, where facilities using such items for gambling (even on third party platforms), licences were deemed to be necessary (3.8).

To protect consumers from the impacts of loot boxes, Walker (2018) proposed that all chance-based loot boxes should be required to disclose the odds of winning and that loot box safe guards or harm minimisation features should be implemented. This was described to include limiting the number that can be opened in any given time period, undermining hook loop mechanisms by lessening auditory or visual stimuli (e.g., lights, colours, sounds) and to amend legislation to make chance-based microtransactions within the definition of 'gambling'. Accordingly, such recommendations may have implications for the design of 'safer' EGM features.

King and Delfabbro (2018) have also recently outlined the structural characteristics of games that could be introduced as social responsibility measures to prevent gambling harm. These notably included several recommendations that may have some implications for feature design:

- Making loot boxes less exclusive, by also offering these as part of standard play
- Ensuring that loot boxes do not increase competitive advantage, as this may encourage players to 'pay to win' (However, cosmetic items and the like were deemed less harmful)
- Not linking loot box reward probabilities with player behaviour (i.e., increasing the odds for high expenditure players) - For instance, the authors report a patent by McClelland et al (2017) for 'mystery boxes', where the pay out is influenced by player statistics – including previous expenditure
- Ensuring audio-visual aspects of loot box opening are not harmful (e.g., ensuring their appearance is consistent to the rest of the game)

IMPACT OF STOP BUTTON FEATURES

A common characteristic of feature games in Australian gaming machines involves gamblers having to press buttons to 'stop' the EGM at a point during feature play. For instance, one Australian EGM has a 'clown feature' that requires gamblers to stop the game to release a ball from the clown into a slot. While a random event, such features could be theorised as increasing the illusion of control. Experiments by Ladouceur and Sévigny (2005) provide some evidence to support the possible effects of having gamblers 'stop' reel spins during gambling. During the study, gamblers were able to 'stop' virtual reels spinning at any point during play. The purpose was to test whether introduction of a stopping device increased the illusion of control.

Findings showed that, following exposure to a stopping device, 87% of gamblers believed the virtual reel display would differ depending on when they activated the stop button. A total of 57% also believed that this could control the outcome of the game and 41% believed that some level of skill was involved in the decision about when to hit the stop button. A second experiment similarly showed that gamblers with access to a stopping device played twice as many games as a control group. Together, such findings may indicate that game features that create an illusion of control could be harmful to gamblers and particularly problem gamblers (who illustrate a higher tendency to possess the illusion of control). In addition, the presence of either perceived or real skill in EGM games may also conceivably contribute to the state of Dark Flow, as described by Dixon et al (2018) (i.e., a state where gamblers become effectively entranced by their EGM play).

Parke and Griffiths (2006) discussed the types of feature games available in UK gaming machines. These were interestingly categorised to include (p154): 1) Lapper features - where prizes are won by doing circuits (i.e., laps) on a game board. 2) Trail features - where prizes are won by progressing up a 'trail' in the hope of winning a jackpot or top feature, 3) Hi–lo ladder features - where prizes are won by advancing up a prize ladder by successful gambles (i.e., gamblers guess whether the next number on the game board will be higher or lower) and 4) Grid features - another variation of the 'hi–lo' game where progression is made by successful gambles.

There was a noted trend in the UK for many fruit machines to have multiple features in the same game. Other variants have a series of small features linked to a major jackpot feature. Parke and Griffith (2006) noted that features are generally developed based on the principle of involvement and skill. Both were described as increasing the psychological involvement of the gambler and were seen to have potential to lead to increased play excitement and support the maintenance of play behaviour. Both Griffith (1990) and Parke and Griffiths (2006) asserted that the gradual introduction of more complex features over time (as compared to basic features like nudges, hold and gamble buttons in early fruit machines) may have contributed to the creation of 'perceived skill' during play.

Bonus features are also described as a type of 'feature' that would influence gambler involvement and perceptions of skill. Examples of bonus features in the UK were described to included skill stops, shuffles, superholds, trail boosts, feature hits, free skill, win spins, the selector, the re-spin and the stopper. Secret functions were a further common characteristic of fruit machine features. One subtle example in the UK related to a 'Simpsons fruit machine' where a verbal cue forewarned that a secret play may be on offer.

Other common 'secret' functions included use of the cancel button to give hints or slow down tasks that are skill related, the three holds rule where the third symbol will always be a match if held twice before (assuming two winning symbols are being held) and a guaranteed win after holds following a nudge.

All three types of 'secret' features were described as increasing the illusion of control in players. The authors similarly argued that machines with features would often be far more attractive to players than machines which offered higher winning, because those features encouraged greater player involvement.

Given the potential harm of certain gaming features, Livingstone and Woolley (2008) advocated that limiting the number of free spins and the multiples by which win pay outs are increased during free spins may reduce excessive gambling. However, it was acknowledged that the view relating to reduction of multipliers was speculative. The Australian Productivity Commission (2010) similarly highlighted the need for more research into Australian EGM features by concluding - *Some features of jackpots are problematic and may impact disproportionately on problem gamblers. This should be the subject of further research (Chapter 11.1).*

A more recent study by Dixon et al (2017) investigated the impact of stop buttons on EGM play. Reflecting on the player tendency to see near misses during EGM play, the authors examined the impact of stop buttons, which cause reels to stop during EGM play (though does not affect the game outcome). Findings showed that near misses and stop buttons made players feel in control of the EGM and fostered cognitive biases.

FREE SPINS, FEATURES AND THE EFFECT OF FREE SPINS NEAR WINS - SUMMARY INSIGHTS

Impact of free spins

- Free spins may be associated with players exceeding limits and high play excitement
- One survey found the top three most exciting free spin characteristics were receiving free spins during free spins, win multipliers during free spins (which multiply wins by a number – e.g., 10x) and free spins and winning from free spins
- Win multipliers may be associated with high play excitement and have a relatively greater impact on problem gamblers, compared to non-problem gamblers
- The greater the number of free spins, the higher play excitement
- EGM designs that do not lead to at least a single free spin within a set spending limit may contribute to play persistency - Non-problem gamblers were prepared to spend a mean of $12.24 for each free spin, while the same amount for problem gamblers was $23.79 (a mean of $16 applied to all risk segments)
- One Australian study also showed that only 40% of gamblers received a free spin within the $16 spend – This may suggest that free spin frequently may be too low in some Australian EGMs and may also lead to gambling harm
- One study showed that the freeness of the spins was not the most attractive preference driver for EGMs. Rather, it was the additional features

Free spins near larger wins

- Obtaining a feature or free spin immediately after a large win is exciting for all gamblers and significantly more exciting for problem gamblers
- Problem gamblers report increasing betting upon receiving a feature near a large win or a free spin near a large win more frequently than non-problem gamblers.

  This may highlight that this type of 'combination event' could lead to increased betting by problem gamblers and associated gambling harm

Impact of features (as distinct from free spins)

- Receiving a feature during a free spin was considered even more exciting
- Not receiving any feature during a gaming session may be associated with play persistence –- A feature is generally expected for every $18 spent.

  In addition, problem gamblers may be prepared to spend a higher amount for each feature ($23.93) compared to non-problem gamblers ($16.38)

Feature characteristics (i.e., relating to which features should be permitted in EGM design)

- Features that simulated another gambling game are least exciting, while features providing a chance to win a linked jackpot or involved selecting different options (like '10 spins and win 5x' your bet versus '15 spins and win 3x your bet') may be more exciting
- Three EGM feature characteristics have been found to be more exciting for problem gamblers compared to non-problem gamblers:

  (A) Features that involved role playing a character
  (B) Features that gave the impression of a game of skill
  (C) Features with funny characters
- Problem gamblers may be attracted to features that are more winning focused, rather than entertainment focused
- Gamblers will gambler longer on EGMs with dense win schedules with or without bonus rounds – This may highlight that reinforcement schedules are still fundamental to EGM design, irrespective of available features
- Video game research shows that 'within game' loot boxes may have addictive effects – especially if these are very exclusive and significantly more attractive than other game features
- Stop buttons may create a perception in EGM players that they can control the game outcome and may lead to the misperception that skill can be used in EGM play
- Some EGM features in the UK are reported to be designed to promote high player involvement and the perception of skill

Jackpots

TYPES OF JACKPOTS

Rockloff and Hing (2013) prepared a paper covering the type of jackpots available in Australian EGM venues. A number of different types of jackpot were identified:

- Progressive versus Non-progressive Jackpots - Progressive or cumulative jackpots incrementally grow in value as players make additional bets. In contrast, non-progressive jackpots are for a fixed prize amount
- Deterministic versus Non-deterministic Jackpots - Deterministic jackpots have a guaranteed pay out after a fixed number of gambles, which is determined at random and concealed
- Hidden Jackpots – This is where the prize amount 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
- Mystery Jackpots – This is where the winning combination of symbols is not shown
- Linked jackpots – This is where draws can be won on several machines on a linked network of EGMs. Stand-alone jackpots in comparison are tied to a single machine
- Local-area versus Wide-area Jackpots - Linked jackpots can be either shared within the same local venue (or local area), or shared across multiple venues (wide-area)

The authors concluded that the mere presence of jackpots in EGMs can stimulate gambling consumption. They also highlight a need for more research about the specific types of available jackpots and their impact on gamblers.

IMPACT OF JACKPOTS ON GAMBLING BEHAVIOUR

Schottler Consulting (2010) investigated the factors affecting adherence to EGM limits through an observational study of EGM players live in venues. This study examined the machines selected by gamblers by risk segment including the prizes on machines and whether machines had linked jackpots. Findings showed that both moderate risk and problem gamblers selected EGMs offering higher prizes. The average prize for EGMs played by problem gamblers was $4397 and the average prize of EGMs played by non-problem gamblers was $3744. It was also noteworthy that the mean prize of EGMs for moderate risk gamblers was $8396. In addition, higher-risk segment gamblers played a higher proportion of linked jackpot machines (especially problem gamblers), compared to lower risk segments.

Following an observational methodology of Schottler Consulting (2010), Rockloff et al (2014) investigated the impact of jackpots in a further observational study of EGM players in a regional Queensland location. In addition, four laboratory experiments were conducted. The first experiment investigated the joint influence of Progressive and Deterministic jackpots. Players gambled to win a $500 cash prize or 500 scratch tickets for a $25,000 top prize. Findings revealed that players bet higher on high jackpot EGMs that were deterministic and non-progressive, highlighting that deterministic may be associated with more intensive play.

The second experiment examined the impact of Hidden and Mystery jackpots on player behaviour. This study showed that large jackpot prizes (lottery tickets) where the dollar value of the prize was hidden (i.e., not shown on the EGM as a $25,000 top prize), but where winning symbol combinations were displayed (a non-mystery) produced the fastest bets per minute and strongest persistence while losing (total trials played). The authors then concluded that large Hidden jackpots (a concealed prize) may contribute to intense gambling. However, mystery jackpots where a winning combination was concealed did not.

The third experiment used a pretend video-conference to simulate a wide area network, or alternatively a collection of confederate subjects to simulate a venue-based linked-jackpot (a local area network). However, interestingly, the authors reported no significant differences in player behaviour or enjoyment between the conditions.

The fourth experiment examined the concept of 'jackpot expiry'. This was where jackpots expire after a fixed interval of play. In an experimental condition, players were shown a message stating that the jackpot had expired and could no longer be won. In another condition, an irrelevant message was displayed that told the player to push a button to continue. In a control condition, no pop-up message was displayed about the jackpot expiry. Results showed that betting speeds were slowed by the expiry message. This led most players in the condition to quit, leaving such players with more money remaining. The authors highlighted that this implied that jackpot expiry was effective in minimising player losses.

In the observational study, half of EGM players observed were primed with a message about jackpots (to think about what aspirational purchases they could make if they win). Findings showed that at-risk gamblers who were 'primed' to think about jackpot wins were more likely to select large-jackpot oriented machines. In addition, they selected jackpot EGMs and played more intensively on such machines. Accordingly, this established a link between jackpot EGMs and at-risk gambling behaviour.

En at al (2015) more recently conducted an experimental study comparing Deterministic and Progressive jackpots. Once again, Progressive jackpots are those that increasingly grow as players bet, while Deterministic are won after an unknown, but fixed number of bets (which is randomly selected). This involved EGM players betting on a simulated EGM offering jackpots of either $500 or $25,000.

Findings of the experiment showed that players bet highest on large jackpot EGMs that were represented as deterministic and non-progressive (20.3% higher than average). Large jackpots that were non-deterministic and progressive were similarly associated with high bet sizes (17.8% higher than average). This was likened to a 'goal-gradient' effect, where players were reported to feel 'close to a pay-off' for a higher prize value. However, the same effect was not observed for players betting on small jackpot EGMs.

Reflecting on findings of the previous jackpot study, the potential for jackpot expiry to assist with gambling harm minimisation was recently discussed by Rockloff et al (2015). This is described as a potential future EGM characteristic, where jackpots could be made to expire as part of a player pre-commitment system (such as through a loyalty program).

WIN OR JACKPOT LIMITS

Walker et al (2015) recently highlighted in a paper the notion of win limits as a Responsible Gambling (RG) measure. There was a general view that win limits – rather than loss limits – may help protect casino gamblers, by having gamblers be required to leave after reaching a certain amount of money. They then tested the idea in an experiment with a group of slot players.

The treatment group had self-imposed and self-enforced win and loss limits, while the control group had a self-imposed loss limit or no limit. Interestingly, findings highlighted that win limits resulted in improved player performance and reduced casino profits. It was also recommended that a RG measure could involve requiring players who win over a certain amount to leave the casino for a short time to encourage informed decisions about further spending.

Quilty et al (2016) similarly conducted a recent study to investigate whether limiting prizes on jackpots may be useful as a gambling harm minimisation strategy. It was felt that such restrictions may encourage people to gamble for entertainment rather than as a source of income. A total of 178 participants took part in an online survey and shown a series of vignettes showing different prize sizes. They were asked to report how much they would gamble to win each prize with and without accruing a gambling debt.

Findings interestingly showed that self-reported gambling increased with monetary pay outs and this even occurred for different types of gambling. Moreover, it also occurred for gamblers with different motivations, impulsivity and negative affect. Accordingly, such results further highlight there may be some harm minimisation value in keeping pay outs from gambling low in size.

Crewe-Brown et al (2014) examined the relationship between EGM play, debt size and impulsivity during EGM play. A total of 171 students took part in the study. Findings showed that, as prize levels increased, there was an increased likelihood that subjects both bet on EGMs and that a higher amount of money was used for the bet. Findings also showed that debt size influenced the propensity to gamble along with the level of bets placed. The authors then suggested that findings may have implications for the size of jackpots offered, as higher jackpots could increase player motivations to gamble.

IMPACT OF JACKPOTS - SUMMARY INSIGHTS

Major types of jackpots

- Progressive versus Non-progressive Jackpots - Progressive or cumulative jackpots incrementally grow in value as players make additional bets. In contrast, non-progressive jackpots are for a fixed prize amount
- Deterministic versus Non-deterministic Jackpots - Deterministic jackpots have a guaranteed pay out after a fixed number of gambles, which is determined at random and concealed
- Hidden Jackpots - This is where the prize amount is not shown to the player, although the existence of a jackpot prize is advertised
- Mystery Jackpots - This is where the winning combination of symbols is not shown
- Linked jackpots - This is where draws can be won on several machines on a linked network of EGMs. Stand-alone jackpots in comparison are tied to a single machine
- Local-area versus Wide-area Jackpots - Linked jackpots can be either shared within the same local venue (or local area), or shared across multiple venues (wide-area)

Impact of jackpots

- There is limited available research on the impact of different types of jackpots
- Moderate risk and problem gamblers look for EGMs with high jackpots – including linked jackpots
- EGM players may bet higher on high jackpot EGMs that are deterministic and non-progressive – This may suggest that deterministic jackpots may be associated with more intensive play
- Large hidden jackpot prizes, but where winning symbol combinations are known (a non-mystery) may be associated with the fastest bets per minute and strongest play persistence while a player is losing
- Mystery jackpots where a winning combination is concealed may not be associated with play persistence
- Jackpots over linked networks may not be associated with play persistence – however, problem gamblers have also been found to prefer linked jackpots because of their typical size

- Having jackpots expire after a certain time may lead to players ceasing play and may thus minimise losses
- Win limits – rather than loss limits – have been recently proposed as having potential to reduce gambling harm – a similar effect has also been proposed for prize limits on EGM jackpots
- Gamblers with large debts may be at risk for persistent gambling if large prizes (as players will bet higher on larger prizes)

Immersive characteristics of gaming

The following characteristic/s of relevance to this section is/are on the NSW Gaming Machine Prohibited Features Register:

#13 - A number of jurisdictions expressed objection to the proposed operation of EGMs with headphones. As EGM players have potential to immerse themselves in gaming with the use of headphones, it was entered into the Register.

FRAMEWORKS OF IMMERSIVE GAMING CHARACTERISTICS

While there is limited research on immersive characteristics of gaming machine play (apart from the impact of gaming machine free spins and features to a basic level of analysis), research on immersive features of video games may provide some indirect indication of the likely effects of immersive gaming features.

Tanskanen (2018) describes 'immersion' as not an area that is unique to video games with research noted in other fields such as literature, cinematography and journalism. The author describes immersion as being characterised by 'deep mental involvement', while other authors have described the phenomenon as a 'softening of mental division between player and avatar;' (Sylvester 2013), a feeling of participation (Bryant & Giglio, 2015) and deep engagement (Qin et al. 2009).

Calleja (2014) developed a Player Involvement Model to describe key elements of games that create deepening levels of immersion. The model defines six key dimensions that promote player involvement in video games:

- Kinesthetic – involves elements related to controlling the game
- Spatial – relates to game spaces and environments and the navigation and exploration within these
- Shared – involves interaction with and awareness of others in the environment
- Narrative – deals with story elements of games
- Affective – relates to emotional engagement in the game
- Ludic – relates to choices made in the game and their repercussions

Each dimension affects players, along with the Macro and Micro temporal dimensions of game play. Micro-involvement includes the aspects that involve players in the moment of game play, while Macro-involvement consists of factors that motivate the player to return back to games when they are not playing the game.

A further conceptual framework was proposed by Wood et al (2004). The authors aimed to summarise the features of video games that made games appealing to players. These were described to include:

- Sound and sound effects
- Graphics
- Background and settings (e.g., whether a game is based on a story or film)
- Duration of the game
- Rate of play or how quickly the player gets absorbed in the game
- Advancement rate – how quickly the game advances
- Use of humour
- Control operations (e.g., choices over settings)
- Game dynamic (e.g., fulfilling a quest, shooting, Easter eggs etc.)
- Winning and losing features (e.g., ability to gain bonuses)
- Character development
- Brand assurance (e.g., brand loyalty, celebrity endorsement)
- Multiplayer features (e.g., being able to play against others, build alliances etc.)

King et al (2009) proposed a taxonomy of video game features that further built on the Wood et al (2004) framework in the context of problematic video game playing. Five key domains of structural characteristics were identified by the authors. These included:

Feature types	Sub-features
Social features	• Social utility features (in-game voice and text chat) • Social formation • Leader board features • Support network features
Manipulation and control features	• Use input features • Save features • Player management features • Non-controllable features
Narrative and identity features	• Avatar creation features • Storytelling device features • Theme and genre features
Reward and punishment features	• General reward type features (e.g., rewards, bonuses) • Punishment features) (e.g., restarting a level) • Meta-game reward features (e.g., achievement points) • Intermittent reward features (e.g., increasing difficulty) • Negative reward features (e.g., gaining health) • Near miss features • Event frequency features • Event duration features • Pay out interval features
Presentation features	• Graphics and sound features • Franchise features (e.g., Trademarked names) • Explicit content features • In-game advertising features (e.g., sponsorships)

While King et al (2009) developed the model for video gaming, it is conceivable that many of the characteristics may also apply to electronic gaming machine play (either current or future characteristics). Vorderer et al (2003) additionally argued that competitive elements – such as leader boards – are the most important determinant of enjoyment from playing video games. Such tools were described as encouraging social competition in video games and because leader boards are updated regularly, they may be associated with some level of prestige and increased feelings of self-efficacy.

The possible implications of future EGM design characteristics may also be inferred from other research. In particular, King et al (2009) propose that car racing games providing vibration feedback to players via the game controller may be an example of a reward characteristic of the game that is distinct from a visual or audio related reward.

Similar to EGMs, many video games were described as featuring both fixed and variable schedules of reinforcement that help to sustain a player's motivation to play including 'meta-game' reward features. Such features help to provide players with an overall assessment of their level of mastery of the game (e.g., such as achievement points for accomplishing various requirements on a game). Some of these are also time based (e.g., play for 8 hours and certain points are received) and may serve to promote continued play.

While the five feature model proposes a framework for assessing the impacts of problematic video game players, King et al (2009) highlight that there is a need for more research to identify exactly how such characteristics may link to problematic video game behaviour. In addition, there is also potential to examine the extent to which such features could impact EGM play or add to problematic gambling.

VIRTUAL REALITY AND 3D GAMING EFFECTS

Video gaming technology now includes three-dimensional visual imagery and Virtual Reality (VR) graphics to increase the realism and enjoyment of the video gaming experience. While such games have not yet been implemented in EGMs within Australia, it is conceivable that such effects could be introduced into the future. A study by Roettl and Terlutter (2018) recently compared the impact of different variants of a game to assess their impact on a range of psychological and attitudinal variables. A total of 237 players played the game that was either in a 2D game, stereoscopic 3D game or in a Head-Mounted Display (HMD) VR game.

Results showed that presence was higher in the HMD VR game than in the stereoscopic 3D game or the 2D video game, but neither arousal nor attitude towards the video game differed. Memory for brands was interestingly also lower in the HMD VR game, than in the stereoscopic 3D or the 2D video game, though attitudes towards brands was unaffected across each condition. In addition, findings of a further study of 53 players also showed that cognitive load was highest in the VR game, and lowest in the 3D game. While the impact of such technology on EGM games has not yet been researched, it is conceivable that high cognitive load may impact the level of attention that players place on EGM expenditure during gaming. On this basis, this study raises the potential for VR to increase cognitive load on within-game characteristics and take concentration away from important external factors (e.g., time and money spent on play).

Shelstad et al (2017) additionally examined in a study how VR technology may impact overall game user satisfaction. Subjects in the study were asked to play a game using different VR technologies including the Oculus Rift (a VR headset developed by Oculus VR) and a computer monitor. Game user satisfaction was measured using the Game User Experience Satisfaction Scale (GUESS), which measures the impact of games across nine constructs. Constructs measured in the GUESS scales include:

- Usability/Playability - The ease in which the game can be played with clear goals/objectives in mind and with minimal cognitive interferences or obstructions from the user interfaces and controls
- Narratives - The story aspects of the game (e.g., events and characters) and their abilities to capture the player's interest and shape the player's emotions
- Play Engrossment - The degree to which the game can hold the player's attention and interest

- Enjoyment -The amount of pleasure and delight that was perceived by the player as a result of playing the game
- Creative Freedom - The extent to which the game is able to foster the player's creativity and curiosity and allows the player to freely express his or her individuality while playing the game
- Audio Aesthetics - The different auditory aspects of the game (e.g., sound effects) and how much they enrich the gaming experience
- Personal Gratification - The motivational aspects of the game (e.g., challenge) that promote the player's sense of accomplishment and the desire to succeed and continue playing the game
- Social Connectivity - The degree to which the game facilitates social connection between players through its tools and features
- Visual Aesthetics - The graphics of the game and how attractive they appeared to the player

Findings of the research showed that VR enhanced overall satisfaction, enjoyment, engrossment, creativity, sound, and graphics quality. However, no significant differences were found in relation to usability, narrative, personal gratification, or social connectivity. Accordingly, VR was associated with a more satisfying overall gaming experience, compared to a game on a more traditional computer monitor.

While research has not examined EGM play on a monitor versus an identical VR or 3D EGM game variant, it is conceivable that VR EGM games may also deliver a more satisfying play experience. In turn, this may increase the level of player immersion in the game and in turn lead gamblers to pay less attention to important external factors (e.g., time and money spent gaming etc).

HEADPHONES AND EGM PLAY

Headphone use during EGM play is prohibited in many jurisdictions (e.g., New South Wales, Victoria), however, no study to date has investigated the impact of headphone use during EGM play. Certain fields of related research, however, have potential to inform about possible effects of headphone use during EGM gambling. For instance, research indicates that problem gamblers are highly involved in gambling and that mechanisms that increase involvement have potential to contribute to gambling harm.

In particular, Schottler Consulting (2014) identified that EGM features encouraging greater involvement in play may engender higher player involvement and greater play persistence. Based on research undertaken, problem gamblers rated features promoting higher involvement in play, as significantly more exciting than non-problem gamblers. This included features involving role-playing or depiction of 'funny characters' and features giving the impression of games of skill.

Research studying within-session EGM play has similarly shown that problem gamblers are more absorbed and involved in EGM games. This has also been linked to unaffordable gambling expenditure. In an observational study of factors influencing EGM player adherence to pre-commitments, Schottler Consulting (2010) found that players were more likely to exceed expenditure limits, if they reported being highly absorbed and involved in play. The authors then concluded that involvement may play a role in players not adhering to gambling pre-commitments.

It is therefore conceivable that use of headphones may increase player involvement in EGM play. Headphone use has potential to block external stimuli (e.g., venue noise, staff interactions) and lead to increased player focus on gambling. In addition, as players are able to better 'concentrate' on play, there is potential for headphone use to increase the speed of EGM play (and associated expenditure).

The tendency of problem gamblers to use gambling to regulate mood and escape from personal problems may also imply the potential for head phones to be associated with some level of possible gambling harm. EGM play has been found to provide gamblers with an opportunity to escape problems and concerns (e.g., Wood and Griffiths, 2007; Dickerson and Adcock, 1987). Thomas et al (2009) proposed that problem gamblers have a tendency to rely on avoidance-based coping when dealing with personal stressors and that EGM play may be an example of such a mechanism. Other research has similarly shown that problem gamblers tend to dissociate from EGM play.

Diskin and Hodgins (1999), in particular, examined the narrowing of attention and dissociation in pathological video lottery terminal players. Study findings highlighted that pathological gamblers were slower in reacting to stimuli while gambling and were more likely to report dissociation from play (as measured by the Dissociative Experiences Scale) (Bernstein and Putnam, 1986). The authors suggested that VLT players become so engrossed in gambling that they block out a range of external stimuli (e.g., sights, sounds, interactions) and lose track of play (and time and money expenditure). The authors similarly hypothesized that an increase in arousal may result in narrowed attention and a tendency to lose track of EGM play.

A further study exploring the effects of dissociation was undertaken by Jacobs (1988). Responses of problem and non-problem gamblers were compared following a 30-minute gambling session. Findings showed that dissociation was higher when music was louder and when the machine displayed flashing lights. This was also true for all gamblers, though problem gamblers tended to experience higher levels of dissociation.

If headphones serve to narrow attention on EGM play and increase arousal, this may support the potential for possible gambling harm associated with head phone use during EGM play. Based on study findings by Jacobs (1988), there is also the potential for increased levels of dissociation from play, if music is perceived to be louder due to the use of headphones.

Accordingly, such studies provide some indirect evidence that headphone use during EGM play has some potential to lead to gambling harm. Based on literature, however, the potential for harm may be greater in the case of people using gambling to escape or people generally experiencing gambling problems.

MUSIC AND DISSOCIATION FROM GAMBLING

A further field with potential to inform the possible effect of headphones relates to research on the psychological effects of music on gambling. Most notably, the effects of music were examined in a casino-based study by Noseworthy and Finley (2009). The study altered tempo and volume in the casino environment and measured gambler estimates of elapsed time and dissociation from gambling. Sound was varied on two levels. The first presented general background casino sounds (e.g., coins, jackpots, people chatting) and the second level presented additional music on top of the casino sounds. Two volume levels of each were presented – Low and High.

Findings showed that gamblers exposed to casino sounds alone underestimated the time spent gambling and this was linked to dissociation from reality. However, when additional music was played, it helped players more accurately estimate play duration. This was found to be particularly the case when external music was slow and volume was high. Findings were described in terms of music providing temporal cues to assist gamblers to determine the time they spend gambling.

While head phone use during EGM play has not been studied, such results may highlight the potential for head phones to block out temporal cues in the gambling environment that may assist gamblers to track play. This could potentially include background music or other events occurring in the venue. However, the impact of such factors have not been well-researched and the playing of music is not consistent or regulated across NSW gambling venues, the possible effects of headphone use are difficult to establish. Study findings, however, highlight that there is a need to consider the possible effects of removing temporal cues from EGM players through use of headphones.

IMMERSIVE FEATURES OF GAMING - SUMMARY INSIGHTS

Immersive features of gaming

- A number of frameworks have been developed to identify the potential structural characteristics of video games that may lead to problematic play behaviour – These could potentially apply to EGMs,
  although effects remain unknown

- Key immersive features of games that may make EGMs more immersive include:

  Sound and sound effects, Graphics, Background and settings, Duration of the game, Rate of play or how quickly the player gets absorbed in the game, Advancement rate (how quickly the game advances), Use of humour, Control operations (e.g., choices over settings), Game dynamic (e.g., fulfilling a quest, shooting, Easter eggs etc.), Winning and losing features (e.g., ability to gain bonuses), Character development, Brand assurance (e.g., brand loyalty, celebrity endorsement), Multiplayer features (e.g., being able to play against others, build alliances etc.) *and Social features*

- VR and 3D variants of EGM games may theoretically increase player immersion in games and be associated with higher cognitive load – Indirectly, this has potential to lessen a player's focus on external play factors - such as the time and money spent on gambling

- As research has shown that problem gamblers have greater involvement in gambling and are more absorbed in play, there is some potential for EGM headphones to increase player involvement in play, increase the speed of gambling and lead to gamblers exceeding pre-commitments

- As problem gamblers often use gambling to escape problems and dissociate from reality as a means of coping with stressors, VR games and even gaming headphones may potentially contribute to play dissociation (and losing track of time and money expenditure)

- Gamblers may use temporal background music and other cues in venue environments to keep track of play duration – While these are not well-researched, there is potential for VR and headphone use to block temporal cues that assist gamblers to self-monitor their play

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