J Gambl Stud (2017) 33:735–767
DOI 10.1007/s10899-016-9644-4

REVIEW PAPER

Rise of the Machines: A Critical Review on the Behavioural Effects of Automating Traditional Gambling Games

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Published online: 4 October 2016

Abstract Automated gambling products are now a common feature on many casino floors. Despite their increasing prevalence, little research has considered the impact of converting games traditionally free from technological enhancements to automated versions. This review seeks to illustrate how automation is likely to change the way people engage and experience traditional games based around five prominent modifications: visual and auditory enhancements; illusions of control; cognitive complexity; expedited play; and social customisation. Otherwise known as the "VICES" framework. The inclusion of rich graphics, event-dependent sound and game-play information such as statistics, history, betting options and strategic betting are likely to prolong and entice gambling while encouraging more intense betting. Changes to the social environment due to the asocial nature of automated products is also likely to significantly change the gambling experience. Given the increasing prevalence of these products in the marketplace, it is important to consider the implications of converting traditional products to automated form as technological enhancements have the potential to allow for faster, more intense betting. More research is needed to determine the full impact of automation on player behaviours in order to understand the potential risks associated with technological enhancements to traditional games.

Keywords Automation · Technology · Gambling products

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Introduction

The gambling industry has seemingly embraced the endless opportunities that modern technology offers for developing novel, automated gambling products. Games that were once free from technological enhancements are increasingly being introduced in automated or digitalised form (Armstrong et al. 2016). Automated products refer to "any product that has been electronically and/or mechanically enhanced to potentially alter consumer behaviour"; particularly via changes to the player/croupier relationship (Armstrong et al. 2016, p. 3). Conversely, digitalised products are those that are solely computerised without requiring a croupier or any mechanical components for operation (Armstrong et al. 2016). While the use of automation and digitalisation in the manufacturing of gambling products is in no way a new phenomenon (i.e., electronic gaming machines or EGMs); technological features are penetrating gambling activities traditionally free from technological enhancements. Casino based table games, roulette, novelty games or community style games, such as bingo or keno, have been enhanced or significantly altered by technology; potentially changing the player experience compared to traditional versions (Armstrong et al. 2016). These features offer a range of industry benefits making automated products more appealing than their traditional counterparts to gambling organisations. For instance, automated wagering systems and game play has the potential to increase capacity, as players can wager simultaneously, generating greater turnover due to rapid rates of play and reducing staff requirements and croupier errors. Despite these products already being a prominent feature in Australian Casinos nationwide (Armstrong et al. 2016) and the obvious benefits likely to be experienced by industry, minimal research has been conducted to determine how automation and/or digitalisation changes the gambling experience for the consumer and whether these changes increase the likelihood of experiencing harm.

New technology offers opportunities for faster games, linked jackpots, brighter and more dynamic visual and sound effects, multiple playing styles and other innovations that maintain the interest of the consumers and generate new market opportunities (Armstrong et al. 2016; Productivity Commission 2010). Many of the technological enhancements used by the gambling industry are designed to entice and prolong game play by appealing to players cognitive and emotional demands (Griffiths et al. 2006). These features can be understood in terms of either situational or structural characteristics (Dixon et al. 2007). Situational characteristics are attributes that contribute to the acquisition or initiation of game play such as advertising or membership requirements, venue location, or the number of venues in a given area (Dixon et al. 2007; Griffiths 1999, 2003; Griffiths et al. 2006; Parke and Griffiths 2006). Structural characteristics are those designed and incorporated into the play experience by the manufacturers such as visual and auditory effects, payout probabilities, features to increase an illusion of control or perception of skill, event frequencies (e.g., wins and losses), time between wagers and outcomes, and the frequency of payouts or wins (Griffiths 1999, 2003; Griffiths et al. 2006; Parke and Griffiths 2006). These structural features are generally designed to reinforce or perpetuate game play or excessive wagering rather than initiate gambling (Griffiths 1999, 2003; Griffiths et al. 2006).

It is well-known that electronic gaming machines or EGMs have rapidly become the most addictive form of gambling in Australia, and contribute significantly to gambling problems and gambling harm (Blaszczynski 2013; Productivity Commission 2010). Features associated with EGMs such as increased play rate, minimal down-time, stimulating auditory or visual displays or asocial environments that contribute to excessive and

harmful gambling behaviour, are now a prominent feature being incorporated into games traditionally free from technological enhancements. As a result, it is likely that these automated or digitalised versions will generate changes to consumer behaviour by intensifying gameplay comparable with EGMs. Automated or digitalised versions of traditional game may therefore pose a risk to those vulnerable to gambling problems or unable to control gambling urges, increasing the potential for harm. Most of the literature examining structural characteristics has focused on those involved with EGM play (Christopherson and Weatherly 2006; Delfabbro et al. 2005; Dixon et al. 2014; Griffiths 1999; Griffiths and Parke 2005; Parke and Griffiths 2006) or the implications of these features in terms of emerging internet gambling products (Griffiths 2003; Griffiths et al. 2006). Little research has focused on the potential impact of automation or digitalisation of traditional games on gambling behaviour. The following paper discusses the potential implications that automation and/or digitalisation has on gambling when incorporated into games traditionally free from technological enhancements.

Armstrong et al. (2016) have developed a framework in efforts to catalogue the changes associated with increased automation and digitalisation of traditional casino and community or novelty products. The VICES framework outlines five fundamental aspects that may be influenced by the automation of traditional games: Visual and auditory enhancements, Illusions of control, Cognitive complexity, Expedited play and Social customisation. The framework is neither exclusive nor exhaustive, but provides a useful tool for understanding the potential impact of technological trends on gambling behaviours. The VICES framework allows researchers to systematically explore consumer preferences, catalogue and assess product features, and identify those that may contribute to experiences of harm using one measure of assessment. The impact of each of the VICES can then be understood by its influence on consumer psychology and subsequent behaviours (see Armstrong et al. 2016, p. 6 for cataloguing criteria for each element of the VICES framework).

The following review used the VICES framework developed by Armstrong et al. (2016) to discuss how technology is likely to alter how people gamble on automated or digitalised products compared to their traditional counterparts. A targeted literature review was conducted to explore how changes to each element of the VICES framework would be likely to change player behaviour. As automated and digitalised versions of traditional games are relatively new to gambling research, the targeted review also considered psychological theory and research into the structural characteristics of EGMs to inform how consumer attitudes and behaviours may be altered with the introduction of technological enhancements. The following paper presents the findings of the targeted review and discusses each dimension of the VICES framework in turn with an emphasis on how automation may affect gambling behaviour and engagement. As there is currently minimal literature that focusses on changes to traditional types of gambling, this paper will also aim to identify avenues for further research in order to accumulate a body of knowledge to better understand the impact of automation on gambling.

Visual and Auditory Enhancements

Visual and auditory enhancements refer to any technological features such as graphics, animations, images, lighting, sound effects or music that are added to accompany the game above and beyond any generic or naturalistic sights or sounds. These features significantly

alter the sensory environment giving the impression of a lucrative and exciting experience thereby encouraging betting persistence and initiation (Griffiths and Parke 2005; Parke and Griffiths 2006). For instance, each year, International Game Technology spend millions in an effort to find novel ways to improve the sensory features of their games. Each of their games are encoded with an average of four hundred sound effects that change in intensity depending on in game events (Rivlin 2004). Sensory features such as event dependent graphics, animations, sound and music have been found to be prominent characteristics of automated and digitalised versions of traditional games (Armstrong et al. 2016), yet little is known about their impact on behaviour.

Visual Enhancements

Little consideration has been given to the influence of visual characteristics on gambling. Research suggests that altering the visual complexity of the game by changing the way information is displayed can influence gambling behaviour (Christopherson and Weatherly 2006; Ladouceur and Sévigny 2002). Ladouceur and Sévigny (2002) explored whether players would wager or play more when symbols on a video lottery terminal were presented sequentially rather than simultaneously. Findings indicated that the sequential presentation influenced gambling persistency, with those in the sequential group playing an average of 130 more games than those in the simultaneous group. Sequential presentation encourages people to systematically follow symbols as they are displayed, thus the time between each reel stimulates the player to play more games (Ladouceur and Sévigny 2002; Wolfgang et al. 1984). This delay is expected to create winning expectancies where players are in constant anticipation for imminent wins (Ladouceur and Sévigny 2002). Conversely, Christopherson and Weatherly (2006) found that the number of symbols displayed as the reels spun on a simulated slot-machine had no effect on gambling behaviour. This suggests that people may not be affected by quantity of visual features but rather the ways in which visual features are presented to enhance game engagement.

There has been strong support for different colours having emotive qualities. For instance, a number of research findings suggest that the colour red is more exciting or arousing than blue or green hues (Bellizzi and Hite 1992; Yoto et al. 2007). Other researchers exploring the effects of brightness (black to white quality), saturation (purity or vividness, higher saturation colours containing less grey) and hue have shown that brightness influenced pleasure levels more than saturation, while arousal decreased with increases in colour brightness (Valdez and Mehrabian 1994). They concluded that brighter colours (white, greys and lighter colours), while considered more pleasant, were less arousing and less dominance-inducing than darker colours (dark greys, black and darker colours).

Gambling researchers have also considered the effects of screen brightness (Delfabbro et al. 2005) and coloured lighting (Spenwyn et al. 2010; Stark et al. 1982) on gambling behaviours. In line with research detailing the arousing nature of the colour red (Bellizzi and Hite 1992; Yoto et al. 2007), Stark et al. (1982) showed that those who played a card game under red light (compared to blue) took greater risks, gambled higher stakes and wagered more frequently. The notion that red lighting can promote riskier decision making is supported in a review by Singh (2006) on marketing strategies. It was found that red light attracts attention and heightens excitement levels while also encouraging rapid decision-making; increasing the chances of making poor decisions. However, other research exploring gambling behaviour while playing virtual roulette found no difference between game play under red versus white lighting (Spenwyn et al. 2010). Delfabbro et al. (2005)

explored how screen brightness influenced gambling experiences. They found that the illumination of the display had no effects on machine preference or excitement but did impact the number of games played and the time spent playing. People spent more time on simulated gaming machines that had lower rather than higher illumination. Automated or digitalised games that have less intrusive visual displays, using dimmer illumination may be more likely to increase betting persistence compared to those considered visually overwhelming. While inconclusive, the above findings suggest that automation and digitalisation can provide manufacturers with the ability to manipulate visual game features to promote greater betting persistence and riskier decision making compared to traditional versions.

Auditory Enhancements

Traditional gambling such as casino table games usually rely on naturalistic soundscapes such as the dealer, the consumer and background noise of the casino to create an exciting and enriched atmosphere. There has been far more focus on auditory features of gambling products compared to visual features. Many authors suggest that event-related sound effects and background noise in gambling environments entice and perpetuate gambling, as sounds make wins more memorable and salient (Dixon et al. 2007; Griffiths and Parke 2005; Parke and Griffiths 2006). Parke and Griffiths (2006) argue that auditory cues act as reinforcers, since machines often have a particular sound effect or music that plays when individuals experience a win. The win is associated by the player with this auditory stimulus and thus reinforces their behaviour and perpetuates further gambling. Usually there are no auditory cues for losing and, when there are, they are often antagonising, invoking disappointment and frustration that cause the consumer to chase the sound associated with a positive outcome (Parke and Griffiths 2006). More sophisticated technology allows for more intricate musical pieces that can have greater effects on emotion and gambling behaviour (Parke and Griffiths 2006). Depending on the piece, music can heighten arousal or the tension associated with the game as well as the speed in which the game is played (Delfabbro et al. 2005; Griffiths and Parke 2005; Parke and Griffiths 2006; Spenwyn et al. 2010).

An exploratory observational study investigating how gaming machines utilise sound found that the auditory cues of the machine were associated with four main factors: the quality of the machine, familiarity, distinctiveness, and the sound of winning (Griffiths and Parke 2005). Results indicated that the familiarity of the music (e.g., a theme song from a popular movie or television show) was important in the acquisition of gambling, while the distinctiveness of the music (whether or not the sound was memorable to the consumer) would result in further play or returning to that particular machine. The sound effects associated with winning, such as coins falling or triumphant music, were considered to be vital in both the acquisition and perpetuation of gambling behaviour. Not only do these sounds give players the illusion of winning more than they actually are (perpetuating gambling behaviour), they send a signal to other players in the vicinity that someone has just won, suggesting that it may be beneficial for others to play and win too (Griffiths and Parke 2005). Sound effects associated with a specific machine can therefore be a deciding factor when consumers are choosing which machine to play (Griffiths and Parke 2005; Parke and Griffiths 2006).

Experimental research has generated similar results. Sound effects and music tempo have been shown to influence behaviour in a variety of settings (Caldwell and Hibbert 1999; Dixon et al. 2007; Milliman 1982, 1986; Spenwyn et al. 2010). Fast tempo music has

been found to increase the pace with which an activity is completed; whereas slow tempo music reduces it (Caldwell and Hibbert 1999; Dixon et al. 2007; Milliman 1982, 1986; Spenwyn et al. 2010). Using online or virtual roulette simulations, multiple authors have found that the faster the musical tempo, the faster the participant would place a bet (Dixon et al. 2007; Spenwyn et al. 2010); while slower music actually led to slower completion of bets than no music at all (Dixon et al. 2007). Similarly, Loba et al. (2001) found that participants experienced reduced tension, excitement and enjoyment when gambling on a video lottery terminal with the sound turned off. These findings were further supported by Delfabbro et al. (2005), who reported higher excitement and preference ratings among those playing on machines with sound, but sound had no effect on time spent or number of plays. However, Dixon et al. (2007) found that music tempo had no influence on either the size of each bet or the total amount spent.

Implications of Sensory Features for Automated Products

Despite the limited literature pertaining directly to automated or digitalised versions of traditional games, the research available does outline how structural characteristics (visual and auditory components) of machines can be manipulated and combined in order to improve the chance of acquisition and prolonged gambling behaviour. Manufacturers have the opportunity to tailor sound effects and musical riffs, as seen with EGMs, in order to increase tension and arousal rather than relying on naturalistic sounds in the venue environment. Effective use of sound may increase playing time, betting speed and the likelihood players will return to play again (Dixon et al. 2007; Griffiths and Parke 2005; Parke and Griffiths 2006; Spenwyn et al. 2010). Not only are manufacturers able to manipulate sound, but the graphics of the machines can also be altered in terms of colour, brightness and even saturation in order to present traditional games in the most enticing, arousing and stimulating way possible. These changes to traditional games may result in different gambling behaviours resulting in increased risk taking or faster betting speeds.

Computerised graphics are also a dynamic medium, where the display can animate and change according to events within the game. Event-dependent effects are already being used in EGMs and can change how gambling outcomes are perceived by the gambler. For instance, losses disguised as wins accompanied by event dependent music can cause people to believe they are winning more than they actually are (Dixon et al. 2014, 2015). Gamblers who played a simulated slot machine with or without event-dependent sound showed a greater preference for winning sounds that were associated with higher psychophysical and psychological arousal (Dixon et al. 2014). Event-dependent sound also caused people to significantly overestimate the number of times they had won. Manipulating the pairing of sound to different outcomes can alter gamblers perceptions of wins and losses. Dixon et al. (2015) investigated whether using negative sounds associated with losses paired with losses disguised as wins would change people's perception of their gambling experience. Similarly to their previous findings (Dixon et al. 2014), they found that when losses disguised as wins were paired with winning sounds, participants overestimated the number of times they won. However, when losses disguised as wins were paired with negative, losing sounds, participants were more likely to identify the outcome as a loss and were more accurate in their estimates of winning outcomes. Therefore, the configuration of sensory information on an automated or digitalised gambling product can cause people to generate misconceptions about their gambling outcomes.

Visual or sensory information is more easily stored and recalled than verbal or numerical information (McQuarrie and Mick 2003; Townsend and Kahn 2014). Auditory

and visual cues therefore hold more weight in people's perceptions of gambling outcomes than the actual gambling outcome itself. When information regarding the experience is recalled at a later date, people are more likely to remember the sensory cues rather than the outcome, and potentially perceive their gambling experiences to be more lucrative than it actually was. There is little research specifically pertaining to the effects of graphics and, more generally, visual stimuli on gambling behaviour. Nevertheless, enhanced visual presentation of games may result in similar outcomes as to auditory enhancements. For example, animated graphics when a player wins, or familiar and distinctive symbols or patterns, may affect acquisition and perpetuation of gambling behaviour. Future research into the effects of auditory and visual stimuli in both current gambling contexts and emerging automated products is warranted.

Illusion of Control

The maintenance of gambling is often perpetuated by people's underlying beliefs (Chau and Phillips 1995; Ladouceur and Mayrand 1984; Langer 1975). One of the main cognitive fallacies involved in the maintenance of gambling behaviour is the *illusion of control*. The *illusion of control* creates an expectancy of personal success that is inappropriately higher than objective probability warrants (Langer 1975), and is a consequence of people's erroneous beliefs that they exert some control over random events exercised through either skill or luck (Chau and Phillips 1995; Langer 1975). By incorporating additional features, digitalised versions have the potential to enhance illusions of control as gamblers are able to modulate play; the speed of play, the volume, betting amounts and strategies (such as selecting cards or numbers) (Armstrong et al. 2016), enhancing both psychological investment and perceptions of control over gameplay.

Many traditional casino games contain elements of skill that are critical to the outcome of the game. For example, blackjack relies on the individual making a decision whether to hold their hand or receive another card. While many table games do require individuals to make skills-based decisions, in a casino, statistically perfect play still results in negative long-run returns and, thus, the overall outcome ultimately remains decided by chance (e.g., which card is dealt next). Exceptions can include high skill games such as poker and, arguably, racing and sports betting, and instances where rare professional players can take advantage of novice bettors to make positive returns. More often, however, games such as blackjack create the illusion that skill is a fundamental feature of the game, although no realistic opportunity to overcome the house advantage is ever provided (Griffiths et al. 2006; Langer 1975). Langer (1975) suggested that there are five primary factors influencing the development and maintenance of an *illusion of control*: active or passive involvement, choice, sequence of outcomes, familiarity, and competition.

Active and Passive Involvement

Active versus passive involvement refers to the degree to which the individual participates directly in the process or procedures involved in the act of gambling. Research suggests that the higher the level of personal involvement, the more likely individuals are to perceive skill as a relevant factor in the determination of outcomes (Parke and Griffiths 2012; Weatherly and Flannery-Woehl 2009). This phenomenon stems from the belief that, due to one playing an active role in the game, the odds of winning somehow improve (Langer

1975). A comprehensive meta-analysis investigating factors influencing the *illusion of control* found that the largest effect sizes were related to personal control and skill related judgements; suggesting that when subjects had an active part in the situation, they experienced a heightened sense of control (Stefan and David 2013). These findings reflect those of Langer (1975), who found that participants had greater confidence when placing their own bets and exercising physical control over gaming apparatus than when experimenters performed the task for them. Davis et al.'s (2000) observational study investigating craps players in casinos (Reno, NV, USA) found similar results, as patrons wagered larger amounts on their own dice rolls than on the rolls of other gamblers. However, earlier research by Wolfgang et al. (1984) found neither level of involvement (type of bet) or participation (who is in control of the die) affected subjects' *illusions of control*. Therefore, *illusion of control* may affect betting behaviour without necessarily involving a cognitive recognition that influence over chance events is being sought or achieved through active involvement in betting.

Choice

In conjunction with active participation, subjects' ability to choose is also an instrumental driver of an *illusion of control*. When people have choice within their situation, they behave as if they have control over the outcome—even if their choices are irrelevant (Langer 1975). Casino games, gaming machines, sports betting and even lotteries give gamblers an element of choice, such as which numbers to bet on, the amount of the wager or even at which machine or table to play (Dixon 2000). Many of these choices have little relevance to the likelihood of winning, although they may affect the absolute amounts won or lost. Multiple studies have investigated the element of choice in gambling situations (Dixon et al. 1998; Goodman and Irwin 2006; Langer 1975). Despite the odds remaining constant, players generally preferred to pick their own numbers rather than have the experimenter do it for them (Dixon et al. 1998; Goodman and Irwin 2006; Langer 1975). Dixon et al. (1998) found that subjects would actually pay an extra unrecoverable bet premium in order to control the numbers they were playing in a game of roulette. Similarly, in Langer's (1975) study, subjects who had the freedom to choose the lottery ticket, as compared to those who were given the ticket, would charge a much higher price (i.e., \$8.67 vs. \$1.96, or 342 % higher) to sell the ticket. However, Dannewitz and Weatherly (2007) found that subjects actually gambled more when they had no control over how the game was to be played. Participants played video poker over three sessions. In the first session, subjects chose which cards were played while, in the second, the program identified the best move to make but subjects were free to choose how to play the hand. In the third session, the program identified the optimal move and participants were required to play that hand. Both the number of hands played per session and the total amount of money wagered increased significantly when control over the game decreased. These findings suggest that subjects had greater confidence in the computer's ability to pick the optimal hand, giving more weight—by gambling more—to the computers' decisions than their own. This, however, does not negate that people may prefer their own choice in the absence of perceived expert guidance.

Sequence of Outcomes

Characteristics of the game can also influence the *illusion of control*. Stefan and David's (2013) meta-analysis on the *illusion of control* found that the reinforcement rate (number

of cases where the expected result occurred regardless of the degree of control) and the sequence of outcomes (whether stimuli followed a winning or losing pattern) produced the largest effect sizes. These findings suggest that perceived control is largely affected by the number of times an expected result occurs and the pattern or sequence in which these outcomes are presented. As such, the sequence of outcomes and the rate of reinforcement can perpetuate gambling behaviour as people believe the outcomes are due to their skill or luck rather than a consequence of blind chance (Stefan and David 2013).

Chau and Phillips (1995) investigated gambling behaviour using a computerised blackjack simulation that manipulated short term odds using winning and losing streaks. Two levels of control were considered: control of skill relevant factors (requesting extra cards during game play); and control of skill irrelevant factors (choice of dealer). Those who did not have card control adjusted their bets more vigorously. That is, following a win, subjects would increase their bet sizes (taking advantage of their good fortune), while, following a loss, reduce their bet sizes considerably, minimising potential losses due to bad luck. When participants had card control, less alterations to bet sizes were made. Participants generally explained successful outcomes as results of their skill or ability while losses were due to uncontrollable circumstances (i.e., bad luck or misfortune). These findings were supported in a study by Weatherly and Flannery-Woehl (2009), who found that participants with greater misconceptions about chance wagered less money on video poker. In combination, these studies suggest that when the influence of chance is perceived to be an important factor, subjects' wagering becomes more erratic as they alter bets according to the previous outcome, increasing the likelihood of substantial losses from greater persistence (Chau and Phillips 1995; Weatherly and Flannery-Woehl 2009).

Familiarity

Familiarity with the game can aid in the development of an *illusion of control* (Langer 1975). When subjects have had practice and become familiar with a game of chance, they report having increased confidence in the outcome compared with when they receive no practice (Langer 1975). It is also suggested that being familiar with a task or how the task is conducted may motivate the development of strategies. For example, a seminal study by Henslin (1967) noted that, when playing dice games, people generally behave as if they can control the outcome of the roll. Players tended to throw the dice hard if they wanted high numbers, and softly if they wanted low numbers.

Competition

In addition to familiarity, the perceived competence of an opponent or competition can affect an individual's confidence in their own ability (Langer 1975). Often, a major consideration for players of table games is the luck of the dealer. People frequently believe they must exploit dealers' luck (or lack of luck) and pick the table that they perceive to be the most likely to pay out. By assessing their competition (the dealer), players are able to exercise choice, which creates an *illusion of control* (Chau and Phillips 1995; Langer 1975). However, when the competition is too threatening, the extent of perceived control is lost (Chau and Phillips 1995; Langer 1975). Other gamblers can also influence the *illusion of control.* Martinez et al. (2011) found that being informed of other gamblers exercising their control increased betting speed, gain expectancy and subjective personal control. This suggests that it is not solely directly perceived competition (dealer or the machine itself),

but also indirect (perceived) competition, such as that of other gamblers, that may affect the *illusion of control*.

Implications of an Illusion of Control for Automated Products

Personal involvement, choice, event outcomes and frequency, familiarity and competition all play a role in the development of an *illusion of control*. These factors can be more easily manipulated to encourage *illusions of control* with the digital technologies that typify automated gambling products. Griffiths et al. (2006) argue that digital advancement increases personal involvement by allowing players more perceived control over how the game is played. Ladouceur and Sévigny (2005) suggest that this occurs due to structural characteristics of the machine that the player can manipulate to uniquely tailor how the game is conducted. For instance, people have been found to prefer games that incorporate a stop wheel/reel function over standard games as this enhances the *illusion of control* or perceived skill associated with the game without altering underlying probabilities for winning outcomes (Ladouceur and Sévigny 2005; Loba et al. 2001). In a study by Ladouceur and Sévigny (2005), 58 % of participants believed that their ability to stop the device gave them control over the outcome, with 42 % perceiving skill to be an influential factor in the outcome of the game. Additionally, 89 % believed that, because they had stopped the reel themselves, the symbols were somewhat different to what might have resulted if the reel had stopped automatically. By adding additional functions, a new element of 'perceived skill' is introduced, which results in people believing that, by exercising their choice and personal involvement, they can alter the outcome in their favour (Parke and Griffiths 2012). Additional functions not only increase personal involvement, they also enhance the variety of choices associated with the game. Some players may prefer mechanical games to computerised programs as they believe they have more control over the start/stop functions (Chau and Phillips 1995). Consumers are able to choose the machine that they believe will give them the greatest level of control over the outcome of the game, and erroneously believe that these choices provide advantages to them (Chau and Phillips 1995).

Outcomes or event frequencies during a digitalised game may also be more frequent. Players are not reliant on the dealer or other gamblers to progress through the game, potentially increasing the speed at which a game is played. This may result in greater event frequencies over a shorter amount of time, reinforcing misconceptions about the influence of personal skill on advantageous outcomes. As discussed in the previous section "Visual and Auditory Enhancements", familiar characteristics of machines entice individuals to play and encourage extended play (Griffiths and Parke 2005). General familiarity with computer technology may result in greater confidence in one's ability to play a digitalised version of traditional games. Players of computerised games may have altered perceptions of the amount of control they exert, particularly when considering their competition (Chau and Phillips 1995). Chau and Phillips (1995) suggested that the *illusion of control* may be smaller when playing a programmed machine, and that some players may question the fairness or role of chance in event frequencies and outcomes as game parameters may be programmed to be less random or even unfairly biased.

As outlined above, there are multiple factors that facilitate the development of an *illusion of control*. While it is speculated that these factors (involvement, choice, event frequency/outcome, competition and familiarity) can be applied to automated products in a similar way, a comprehensive investigation of how *illusions of control* may differ between traditional and automated games has yet to be undertaken. Automated products could be

designed to use these factors to increase the perceived control players have in order to encourage play. However, an *illusion of control* may cause people to become more or less cautious depending on their perceived self-efficacy. This is particularly relevant for automated products given they are adaptions of traditional versions. Players may therefore have different perceptions of self-efficacy if they have had previous experience with the traditional version of the game. However, given that greater *illusion of control* seems to result in less alterations to bet sizes on simulated games (Chau and Phillips 1995; Weatherly and Flannery-Woehl 2009), perceived control in automated products may reduce the likelihood of substantial losses in short periods of time.

Cognitive Complexity

Complex tasks are generally those that incorporate multiple elements (e.g., functions, information cues, processes or qualities of the task itself) that must be processed in order to understand or perform a task successfully (Bedny et al. 2012; Liu and Li 2012; Williams 1999). Thus, tasks become more complex as the number of attributes or information cues that require processing increases: referred to as *attribute based complexity* (Asare and McDaniel 1996; Bedny et al. 2012; Carey and Kacmar 1997; Liu and Li 2012; Williams 1999). The more information or features associated with a task, the greater number of alternatives that must be considered in order to make a decision: referred to as *alternative based complexity* (Johnson and Bruce 1997; Liu and Li 2012; Sung et al. 2009). Complex games such as poker incorporate numerous alternatives and task attributes that must be considered to reach a decision. Not only must players attend to their own hand, but respond and incorporate estimated probabilities, amount spent and other players gambling behaviours into reaching their decision. Such information loads can increase the effort associated with completing the task, impairing the ability to process information effectively.

Attribute Characteristics

The characteristics of a task such as: inconsistencies and clarity of information (Mascha and Miller 2010; O'Donnell and Johnson 2001); routine versus non-routine functions (Schwarzwald et al. 2004); repetition and quantity of information (Mascha and Miller 2010); relationships or conflict between different task elements (Biggs et al. 1985; Boag et al. 2006) and complicated elements (Klein and Yadav 1989; Sung and Johnson 2007); can add to task complexity as it hinders information processing (Liu and Li 2012). For instance, EGMs incorporate a number of winning combinations of symbols that are often presented ambiguously in displays on the machine. Furthermore, there are multiple betting options (number of credits and lines) that are not well explained for the novice gambler. Element characteristics can adversely affect not only performance, but also time spent on the task (O'Donnell and Johnson 2001), how the task is approached (Schwarzwald et al. 2004), and perceived difficulty and control (Boag et al. 2006; Mascha and Miller 2010). This may result in increased playing time in efforts to master or understand the task while experiencing significant losses in the process. Additionally, gamblers may not choose the most appropriate course of action as increased complexity can often result in people taking the easiest or least ambiguous option rather than the most beneficial one (Johnson and Bruce 1998).

Johnson and Bruce (1998) investigated alternative and attribute based complexity in horse-racing wagering. They compared bets on races designed to reduce the discriminability between runners (handicap races) with bets on high discriminability races (non-handicap races). Alternative-based complexity was assessed by the number of runners, such that complexity increased along with the number of betting choices available to participants. Level of task complexity was shown to affect risk strategy. While complexity did not alter the size of the risk (amount wagered), both attribute and alternative based complexity influenced bettors' susceptibility to accepting greater degrees of risk (based on odds of winning). That is, individuals did not wager differently in dollar amounts when the task was more complex but were more likely to make riskier gambling decisions. This suggests that when gamblers are exposed to higher volumes of information, they may not process all elements or alternatives effectively, resulting in poorer decision-making.

Resource Requirements

As the complexity of the task increases, so too does the load on information processing systems (Bettman et al. 1990; Campbell 1988; Liu and Li 2012; Nadkarni and Gupta 2007). The greater the information load, the greater the strain on cognitive resources (Sung et al. 2009). For games that include additional features such as mini-games, jackpots or bonus rounds, a greater proportion of cognitive resources are required and appropriate decisions become more difficult to make. While simple information cues take significantly less cognitive resources to encode and store than complex informational cues (Nadkarni and Gupta 2007), cognitive load is cumulative and so engaging in multiple simultaneous tasks can be taxing on cognitive resources (Wixted 2004). Consequently, an individual's cognitive resources may be partially engaged in other activities such as conversation, self-reflection or emotional regulation, leaving fewer resources available to process risk related information during gaming sessions such as expenditure.

An individual may perceive a task as more complex when cognitive resources are overloaded due to difficulties comprehending incoming information (Bedny et al. 2012; Nadkarni and Gupta 2007). Li et al. (2014), for instance, found that video game players reported exerting more cognitive effort when they were required to mentally calculate, plan or strategies during gameplay compared to when gameplay was spontaneous or reactive. When people experience less cognitive strain, they are less likely to consider a task to be complex (Nadkarni and Gupta 2007). While the structural complexity of a task determines the resources required to complete the task, it is actually the subjective strain on these resources that results in the perception of complexity or difficulty. Increased strain can cause greater subjective effort, confusion, errors, and poorer performance (Jacoby et al. 1974; Johnson and Bruce 1998; Klein and Yadav 1989). In the context of gambling, this may be reflected in detriments to a player's ability to keep track of losses or to decide when to terminate play.

When confronted with challenging tasks, people tend to engage in compensatory or simplifying decision-making methods (Keren and Wagenaar 1985; Onken et al. 1985; Payne 1976; Sung et al. 2009). When a task incorporates multiple attributes or informational cues, people generally adopt a "search" strategy whereby they seek the information most relevant to their decision (Payne 1976). However, when the number of alternatives is increased, individuals seek to reduce cognitive load by eliminating undesirable alternatives, leading to possible failures to process relevant information (Payne 1976). Simplifying strategies have been shown to be more commonly used when presented with an increase in the number of alternative rather than the number of task attributes or elements

(Johnson and Bruce 1998; Payne 1976; Timmermans 1993). Consequently, when the complexity of a task increases to the point of multiple alternatives that require reflection, people attempt to simplify the task as quickly as possible. As a result people do not sufficiently consider all elements associated with each option or alternative, or the potential ramifications of their decision.

In exploring task complexity in relation to gambling, Johnson and Bruce (1997) found that increasing the number of task attributes associated with horse race wagering resulted in lower levels of participation as measured by total amount wagered. That is, individuals wagered significantly less money when required to process more task attributes, suggesting that gamblers are less inhibited when complexity is in the form of multiple alternatives. When exposed to increasingly numerous task attributes, gamblers may experience cognitive overload due to the amount of information processing required and an increase in the number of alternatives. Consequently, gamblers may adopt ineffective decision making strategies that may result in substantial losses. For example, there are numerous casino-based games in which large amounts of information are available upon which a player may base a strategy or make decisions (Keren and Wagenaar 1985). In blackjack, for example, players may choose strategies based on blind luck (e.g., randomly deciding whether to deal or sit), any number of systematic strategies based on the pre-determined card or value limits, reactive strategies based on available information regarding all players at the table (including the dealer), or even card counting requiring high levels of cognitive processing and memory (Keren and Wagenaar 1985). In roulette, players are typically presented with large amounts of information about previous winning numbers, frequencies of payouts within different sections of the table (e.g., black vs. red, 1st, 2nd and 3rd quarters, odd vs. even numbers), "hot" and "cold" numbers and more. In addition to processing this information, players must process the various (often complex) betting options while attempting to maximise the risk-to-benefit ratio of their own wagers.

It is possible that the information processing requirements in such games may consume a significant proportion of available cognitive resources, leaving only limited resources to process important information such as probabilities and how much money has been wagered (and lost). This process is also similar for other complex forms of gambling, such as horse-race betting. Johnson and Bruce (1998) suggest that gamblers have a methodology for processing race attributes and comparing alternatives. When attributes are more complex, gamblers often alter this methodology and adopt simpler strategies, such as the horses' name, in order to make a decision (Sung et al. 2009). This supports findings previously mentioned by Johnson and Bruce (1998), who suggested that higher gambling complexity resulted in risky gambling behaviour.

However, it is also important to note that the role of complexity in decision-making may work both ways. Ladouceur and Mayrand (1984) found that subjects' confidence significantly wavered and players failed to develop an *illusion of control* during a simple game of coin toss. Consequently, when complexity is high, people may compensate by employing simplifying strategies that result in greater risk taking behaviour. However, when tasks are too simple, the need for decision making becomes obsolete with outcomes being obviously reliant predominantly on chance. This is an important consideration in relation to complexity and gambling behaviour. It must be acknowledged that, with the exception of a small number of skill-based games, the perceived relationship between skill and outcomes is erroneous (see "Illusion of Control" section). Consequently, increased task complexity may function to encourage engagement with gambling products by injecting an "apparent complexity", in which an activity for which essentially no skill is required (and therefore may otherwise be uninteresting) is encouraged to appear complex and deep (and therefore

interesting). Game appeal may be heightened due to the perceived exciting and interesting information, potentially leading to greater player persistence and, ultimately, losses (Johnson and Bruce 1997).

Interaction between Task and Performer

The difficulty or complexity of a task is largely a subjective experience. Based on the attributes of the task performer, a task can be experienced as more or less difficult than as experienced by somebody else (Bedny et al. 2012; Campbell 1988; Liu and Li 2012). Individuals perceive tasks differently and have unique skill and ability sets that can affect task comprehension and performance (Bedny et al. 2012; Liu and Li 2012). When task complexity exceeds the abilities of the person, the task will be perceived as more difficult or complex (Bedny et al. 2012; Liu and Li 2012). Moreover, those that are familiar with aspects of the task or task stimuli may encode and process information more efficiently than others (Nadkarni and Gupta 2007). Thus, the relationship between structural characteristics and the resources required is mediated by individual characteristics (Liu and Li 2012; Nadkarni and Gupta 2007).

Two primary characteristics are believed to affect perceived complexity: task familiarity and expertise (Liu and Li 2012; Nadkarni and Gupta 2007). Familiar components of a task increase acceptance of complexity, allowing people to better process and comprehend task requirements and identify information relevant to their decision-making (Nadkarni and Gupta 2007). Lack of knowledge or expertise can result in elements of the problem appearing ambiguous, with the value of particular aspects going unrecognised, and potentially relevant alternatives appearing less attractive (Johnson and Bruce 1998). Haerem and Rau (2007) found that experts and novices gave attention to different aspects of a problem which affected both task perception and performance. This suggests that the level of familiarity or expertise with a task can influence how different individuals process information and perceive the same task. Consequently, novice players may be more prone to poor decision making in complex games compared with regular or experienced gamblers.

In research examining video-game playing, greater game familiarity has been shown to increase engagement (Li et al. 2014). The highest levels of game engagement were found for those in the high-familiarity/low-complexity group with the low-familiarity/high-complexity group reporting the lowest levels of game engagement. Although in a gaming context rather than a gambling context, these results may be indicative of what would be expected of gamblers. Individuals more familiar with gambling products may be more engaged than novices, although familiarity may not be effective in accommodating complexity due to the random nature of many gambling products and the accompanying lack of control over outcomes (Johnson and Bruce 1998). This suggests that bettors may engage differently depending on their level of education or expertise. However, further research should be conducted in order to validate these assumptions.

Cognitive Complexity and Automated Products

The complexity associated with games can create an enriched cognitive environment, and enhance the sense of absorption in the gambling experience. Traditional games such as poker or roulette have large amounts of information that must be processed, and can be attractive by virtue of the subjective intricacy involved. Digitalisation is expected to enhance opportunities to inject complexity, using automation to increase game play options

and engagement by adding additional features or layers to pre-existing game mechanics. Some automated products are already being manufactured to include features such as strategic betting options, side betting, progressive jackpots, and other novelty or fast bet features such as double down options or help menus and strategic betting guides (Armstrong et al. 2016). These increases in cognitive complexity of games may impede players' ability to keep track of other important information such as time spent playing, number of games played, and accumulating losses.

Many casino environments encourage patrons to think about the "big win" and thus, based on EGM findings, gamblers who play automated products may be more attracted to those that include additional features that are likely to increase gambling intensity. Features such as these have been shown to be evident on automated bingo products (Armstrong et al. 2016). Harrigan et al. (2015) provided a detailed description of the features of automated bingo products available to consumers through the Ontario Charitable Gaming Centers. Not only did these games include jackpots reaching as high as $115,000.00, they tended to provide information solely detailing past wins and not losses. Research shows that jackpots can have a significant effect on EGM gambling intensity (Browne et al. 2015a; Donaldson et al. 2016; Li et al. 2016). Hidden jackpots (Donaldson et al. 2016) or those with high values (Browne et al. 2015a) result in faster betting and greater betting persistence. Further, those who are primed with thoughts of a "big win" are more likely to be orientated towards EGMs with jackpot features (Li et al. 2016). Not only do jackpots have the potential to increase gambling intensity, having such a large emphasis on winning bets and failing to detail the losses encourages consumers to focus on winning and to disregard their losses. A study by Leino et al. (2015) has also shown that by increasing the features on which people can wager can significantly influence their betting frequency. In their study of the structural features of video lottery terminals, Leino et al. (2015) showed that those products that included bonus features resulted in greater betting frequency. Further, other additional features such as being able to bet on additional lines resulted in a greater number of bets being placed. Despite there being no observed influence of providing advanced betting options on gamblers behaviour; it seems that by providing more features for people to wager on can result in more intensified betting as observed by betting frequency and the number of wagers.

There has been limited consideration of complexity in automated gambling products or table games. While Keren and Wagenaar (1985) have outlined potential blackjack strategies, the introduction of digitalised forms may alter how people strategies and comprehend information cues to reach decisions. Johnson and Bruce (1997, 1998) consider that gamblers would be inconvenienced by higher levels of complexity. While their research has shown that increased complexity in horse-race wagering reduced participation (1997) and increased risk taking (1998), this cannot be generalised to traditional table games given the configuration and attributes associated with horse-racing (i.e., form, jockey, trainer etc.). However, they do suggest that bettors may enjoy certain levels of complexity as it provides people with an element of control over how to react to the information provided.

Increased complexity may actually serve to benefit the gambler by allowing them to use their skills and knowledge to generate a response. Those with skills or experience have been shown to be able to select more optimal responses and display greater accuracy on a number of gambling tasks (Khazaal et al. 2012; Lueddeke and Higham 2011). Greater complexity in automated products may therefore provide experienced gamblers with a greater "edge". Conversely, greater information does not guarantee a positive outcome and is said to provide very little insight into future events (Browne et al. 2015b). Greater

complexity may result in overconfidence as people believe they have greater insight in predicting chance outcomes, potentially leading to riskier gambling. However, this remains to be explored for automated products.

Expedited Play

Expedited play refers to features that facilitate and encourage accelerated or prolonged play that can affect customer expenditure. Compared to traditional gambling products where gambling opportunities are limited by the behaviours of other gamblers or dealers, automation may significantly reduce the time-delay between betting and outcome, as well as game reset intervals. Digitalisation also increases event-frequency and rapid reply within any given time period; encouraging fast, continuous play while leaving minimal time for financial reflection. Automated products incorporate numerous features that can allow for rapid play rates, such as configurable minimum and maximum bets, multi-denomination machines, instant high bet features and reduced time between bet and outcomes (Armstrong et al. 2016). Despite the prevalence of these features, little is known about the potential consequences for player behaviour.

The devastation caused by EGMs is considered to be due, in part, to the speed and intensity of which EGMs can be played. For instance, average losses on an EGM have the potential to reach $1500 in just over an hour of play (Productivity Commission 2010). In traditional table games, there is often a delay between placing a bet, learning the result of the bet, and making subsequent bets. The actions of other players or the dealer, casino rules, and the mechanics of the game itself, can all act to limit the rate at which games can be played. In contrast, EGMs are designed to facilitate greater numbers of games played over a set time period (Griffiths et al. 2006). The rate of play on EGMs is a structural characteristic implemented by the manufacturer and controlled by the consumer (within legislative constraints; Griffiths 1999; Griffiths et al. 2006).

Increasing the rate of play results in more frequent game outcomes, which may exploit psychological principles of operant conditioning (Skinner 1953) by providing frequent and rapid rewards for player behaviour (Griffiths et al. 2006). In particular, speed of play is thought to be associated with a number of factors that facilitate gambling maintenance including: number of games played and playing time (Blaszczynski et al. 2001; Delfabbro et al. 2005; Ladouceur and Sévigny 2006; Sharpe et al. 2005); reinforcement rates and expenditure (Griffiths 1999; Griffiths et al. 2006; Ladouceur and Sévigny 2006; Parke and Griffiths 2006; Sharpe et al. 2005); perceived enjoyment and satisfaction (Blaszczynski et al. 2001; Delfabbro et al. 2005; Ladouceur and Sévigny 2006; Loba et al. 2001; Sharpe et al. 2005); and contributing to dissociative gambling states (Dickerson 1993; Griffiths 1999; Ladouceur and Sévigny 2006). The following sections will focus on each of these factors in turn and discuss how rate of play affects gambling characteristics.

Number of Games and Playing Time

Multiple authors have hypothesised that increasing game speed may lead to people playing more games and for longer periods of time (Ladouceur and Sévigny 2006; Sharpe et al. 2005). Naturally, when total play-time is held constant, a greater number of games may be completed when game speed is increased. Indeed, several studies have shown increased rate of play to be associated with a corresponding increase in the number of games played

(Delfabbro et al. 2005; Ladouceur and Sévigny 2006). Ladouceur and Sévigny (2006) allocated people to either a high-speed (5 s) or low-speed (15 s) version of a video lottery terminal, "swinging bells". Participants in the high-speed condition played 2.5 times as many games as those in the low-speed group. Similarly, Delfabbro et al. (2005) had participants play either a 3.5 s or a 5 s computer simulated EGM and observed a significantly greater number of games played among those using the high-speed machine compared with the low speed machine. Conversely, Sharpe et al. (2005) found that game speed had no effect on the number of games played on EGMs in live gambling venues. Participants were recruited from hotels and clubs in New South Wales, Australia, and played at least one modified (5 s) and one unmodified (3.5 s) EGM.

Discrepancies between the findings of Sharpe et al. (2005) and those of other researchers may be due to differences in testing environments and apparatus. Both Ladouceur and Sévigny (2006) and Delfabbro et al. (2005) conducted their research in laboratory settings while Sharpe et al. (2005) observed players on-site in live gambling venues. There may be numerous factors differentiating player experiences in laboratory and live gambling environments that may be responsible for the incongruous findings (e.g., distraction, perceived realism, and perceived personal investment). When gambling in a club or hotels, for example, there may be factors that preclude people from giving their full attention, resulting in slower game-play despite the speed capabilities of the game. In addition, Sharpe et al. (2005) used a modified Aristocrat Leisure Technologies 'Pirates' EGM provided by the gaming manufacturers rather than a computer simulation. Consequently, the greater ecological validity associated with actual venues and realistic machines may lead us to place greater stock in Sharpe et al.'s (2005) results. Therefore, while it may seem intuitive that faster game play would increase the number of games played (a position that has been supported by laboratory studies), the implications of rate of play on games played remains unclear for live gambling venues.

Contrary to expectations (Ladouceur and Sévigny 2006; Sharpe et al. 2005), faster machines did not result in longer playing times in either laboratory settings (Delfabbro et al. 2005; Ladouceur and Sévigny 2006) or live gambling environments (Sharpe et al. 2005). In fact, Blaszczynski et al. (2001) found that those who played the slower machines (5 s reel spin) actually gambled for longer than those playing the faster machines (3.5 s reel spin). The amount of time spent playing a machine may, therefore, not be dependent on the speed at which people are playing but, perhaps, on other factors such as engagement, amount willing to spend, losses and wins, and reinforcement ratios or event frequencies.

It should be noted that there are other features that can influence the rate of play by encouraging people to place more bets. Electronic games can be configured in ways to alter the return to player rates to resemble those of EGM. Leino et al. (2015) investigated the structural characteristics of video lottery terminals on gambling behaviour and found that the fixed average payback percentages for video lottery terminals ranged from 84.56 to 93.04 % with an average return to player rate of 89.29 %. Australian slot machines typically have a return-to-player rate of 85–90 % (Frahn et al. 2015). These return-to-player rates were positively associated with placing more bets. That is, higher return-to-player rates translated into a greater number of bets placed on the game. Further, games that had a smaller difference between minimum and maximum bet sizes; and/or provided the opportunity to bet on additional lines, bonus features or simultaneous games; were associated with greater number of bets placed. In their investigation of automated bingo machines, Harrigan et al. (2015) found that people could play anywhere between 4 and 9 cards simultaneously. While the rate of calling may be no different to traditional bingo

where rate of play is determined by the speed of which the player can mark their cards; automated bingo was much faster by virtue of multiple cards in play, and was suggested to be more reflective of EGMs. That is, a player can complete a call in as little as 2 s or, potentially, 20 calls per minute if playing continuously. This speed of play is substantially faster than the traditional paper version. This suggests that through automation, games can be configured in ways that potentially increases the number of bets people are willing to place and the rate at which they can place them.

Expenditure and Reinforcement Rates

Wagering is believed to be affected by the amount of time players have to make decisions. It is suggested that the ability to gather and integrate information and make responsible and informed decisions is compromised when available time is significantly reduced (Phillips and Amrhein 1989). In addition, rate of reinforcement increases with game rate (Ladouceur and Sévigny 2006). For example, manufacturers are able to define the win/loss ratios, game completion rates, and reset intervals of EGMs (Parke and Griffiths 2006). Consequently, player experiences of loss are often brief while wins are reinforced frequently (Griffiths 1999; Griffiths et al. 2006). As a result, players often have limited time to make informed decisions and may re-invest their winnings immediately (Griffiths 1999; Griffiths et al. 2006). In contrast, traditional table games generally have slower play rates and lengthier reset periods per game. Consequently, reinforcement may occur less frequently and players may have more time to weigh relevant information during decision making in comparison with EGM play.

At present, there is some conflict between the findings of in situ and laboratory studies. Ladouceur and Sévigny (2006) found that those playing high-speed games wagered more money than a low-speed group when total time was held constant. In contrast, Sharpe et al. (2005) reported no significant differences in the amount lost between high and low speed games. In their study, Sharpe et al. (2005) had subjects gamble their own money while Ladouceur and Sévigny (2006) provided participants with funds. When people gamble with their own money, it is likely that they have a greater sense of personal investment and may attempt to limit losses by using strategies that may not be affected by the speed of the game. It is possible that different decision-making processes may be engaged in laboratory settings where participants are provided with funds or credits with which to gamble. In such cases, they may be more likely to play at a faster rate and make larger bets, thus playing a greater number of games and losing more money.

Faster games may provide more frequent reinforcements than slower machines, which may influence perceptions of a game and how people play. EGMs are capable of maintaining rapid response rates, minimising the time between wagers for financial reflection. Traditional games usually require individuals to, for example, wait until all cards are dealt before making a bet and then wait for the dealer to present the outcome. This leaves more time between reinforcements, during which individuals can process information in order to make decisions. By automating many of these features, these products have the capacity to increase game rate and reduce information processing and decision time between games. Consequently, it is possible for players to lose their wagers at a much faster rate (Blaszczynski et al. 2001). Although the evidence regarding the relationship between game rate and expenditure in EGM play is currently mixed, it is important to examine the impact of increases in game rate and reinforcement frequencies in expenditure in automated versus traditional casino games.

Average expenditures have been shown to be influenced by other features beyond simply the speed or rate at which bets can be placed. For instance, in their exploration of structural characteristics of video lottery terminals, Leino et al. (2015) found that people would consistently gamble more than the minimum denomination of the game. That is, the majority of gamblers sought to multiply their outcomes by placing larger bets. They concluded that not only were these multiplier features common, but that people were consistently using them to place larger wagers. Automated games can therefore incorporate features that make it easier for the consumer to multiply or increase their bet with relatively little consideration. As a result, gamblers may tend to place larger bets (and thus potentially gamble more money) on automated products simply due to the ease of which the calculations are made and applied for them.

Enjoyment and Satisfaction

It is suggested that faster speeds may increase levels of excitement and entertainment, thus encouraging more persistent gambling activity (Blaszczynski et al. 2001; Ladouceur and Sévigny 2006). In fact, there seems a relatively clear consensus in the literature that most people prefer faster games (Blaszczynski et al. 2001, 2005; Delfabbro et al. 2005; Ladouceur and Sévigny 2006; Loba et al. 2001). A preference for quicker games has been observed in experimental research. Delfabbro et al. (2005) found that faster games were more enjoyable and preferred by participants. Similarly, when given a choice, 91 % of subjects in a study by Ladouceur and Sévigny (2006) preferred to play a faster paced game. Two studies by Blaszczynski et al. (2001, 2005) suggested that slower game rates were less satisfying and less enjoyable to both recreational and problem gamblers. These findings are in contrast to those of an earlier study by Loba et al. (2001) who observed that non-problem or recreational gamblers disliked a faster game, but that problem gamblers disliked slower games. Regardless, the dissatisfaction found with slower speeds has not been found to affect players' apparent intentions or gambling behaviours (Blaszczynski et al. 2005).

Despite speed of play not effecting how people gamble, there seems to be a clear consensus that people get more enjoyment and satisfaction out of faster games. However, studies thus far have only examined the influence of game speed on enjoyment for EGM play. Consequently, how increases to play rate due to automation may affect player enjoyment in table games is currently unknown. However, these results do indicate that, for EGM play, there is a consistent preference for faster machines over slower machines.

Dissociation and Loss of Control

A fast rate of play in EGMs is believed to substantially increase players' focus and immersion in the game due to consistent interaction between the person and machine (Dickerson 1993; Ladouceur and Sévigny 2006). This can result in dissociation; an unthinking state often associated with conscious or unconscious attempts to escape from reality (Dickerson 1993). Characteristics of dissociation can include losing track of time, blacking out, not recalling where you are or what you have done, or feeling as though you are someone else (Griffiths et al. 2006). In a gambling context, dissociation most commonly occurs in the form of lost time, or losing track of expenditure or number of games played. Ladouceur and Sévigny (2006) suggest that dissociation is likely to increase with game-rate, and that this will result in lengthier play sessions, greater losses and reduced control.

Ladouceur and Sévigny (2006) found that speed of play did not affect concentration. Concentration was measured as the proportion of participants attending to a background auditory stimulus (ringing telephone) during an EGM gaming session. Overall, 40 % of participants reported not hearing the telephone ring while playing and, as such, were deemed to be in a high state of concentration. Importantly, however, no significant differences were observed between the high-speed group (38.5 %) and the low-speed group (41.2 %). In addition, Ladouceur and Sévigny (2006) also measured loss of control by assessing whether players adhered to their personal limits; either time or monetary. Game speed had no effect on loss of control in regard to time, as both groups respected their preset limits. A difference in adherence to monetary limits was observed between the high and low speed groups (86 and 66 %, respectively), however, the difference was not statistically significant.

Dissociation often results in people losing track of time or not being aware of their behaviour or actions (Griffiths et al. 2006). Ladouceur and Sévigny (2006) addressed whether EGM game rate affected the ability of participants to accurately recall how much time they had spent playing and the number of games played. While neither a high or low-speed group could correctly recalled the amount of time spent playing, the high-speed group underestimated the number of games played five times more than those in the low-speed group. While speed of play does not appear to affect concentration or perception of time, it may result in misconceptions regarding the amount of games people have played. However, it is currently unclear whether any increases in game speed made possible by automation within table and casino products would be associated with similar increases in dissociation and wagering relative to traditional games. Immersion may be increased in automated products due to the capacity for uninterrupted and continuous play. However, it is not currently known whether such an effect would be dependent upon increases in game rate.

Conclusions for Automated Products

It is suggested that, by slowing down the rate of play, gamblers have more time to consider their spending and subsequent actions (Loba et al. 2001). However, given the preference for high-speed games, slower games may result in a loss of interest, resulting in player abandonment (Ladouceur and Sévigny 2006). While rate of play has been shown to be positively associated with enjoyment on EGMs, the impacts of increased game-speed on dissociation and reinforcement are less clear (Blaszczynski et al. 2001, 2005; Delfabbro et al. 2005; Ladouceur and Sévigny 2006; Loba et al. 2001). It is important to note that the findings of the studies outlined above may not inform outcomes associated with automated products. These studies often compared EGMs and may not be easily generalised to a comparison of traditional and computerised table and casino games. Additionally, inconsistent findings were reported between laboratory and field-based studies, suggesting that speed of play may operate differently under different conditions. It seems necessary to investigate the effects of game speed, comparing traditional to computerised games in both laboratory and field studies. For instance, it is possible that players who transition from traditional to automated products may be accustomed to the time associated with traditional games and, consequently, game speed may not increase enjoyment, or may even affect player enjoyment adversely. Similarly, speeding up traditional games may have an effect on expenditure, time spent and dissociation despite conflicting findings in EGM literature.

Social Customisation

The final category in the VICES framework is social customisation. The social environment can be an important facilitator or inhibitor of gambling behaviour. They can promote interest and excitement for some, while increasing stress or distraction for others given potentially tedious breaks in play. Furthermore, the presence of others can increase betting persistence as others' wins create an expectation for an imminent win for the gambler. Traditional table games incorporate and facilitate social interaction. Automation can significantly alter the level and quality of social interactions, potentially increasing the risk for developing gambling problems.

Traditional casino gambling occurs in a social environment and attracts people from diverse backgrounds (Bernhard et al. 2007). Table games often involve a social element as players share gambling experiences with other gamblers. In contrast, machine (EGM) gambling is often considered a more solitary or asocial activity, where the gambler is more isolated and can choose not to engage in social interactions (Griffiths 1999; Griffiths et al. 2006). The rising asocial nature of gambling as a result of technological advancement has been predicted to increase the likelihood of gambling problems (Griffiths 1999; Griffiths et al. 2006). Regardless of the level of direct social interaction, there is often an undeniable presence of others in gambling venues. Psychological behavioural theory and research suggests that the presence of others can alter people's behaviour, even without overt social interactions (Geen 1991; Martinez et al. 2005; Rockloff and Dyer 2007; Rockloff et al. 2011; Triplett 1898; Zajonc 1965). As the popularity of gambling increases, it is important to investigate social aspects of gambling in order to understand the effects of automated products on gambling behaviour. The two most widely cited social factors contributing to gambling behaviours are: social facilitation and social connectedness, each of which will be discussed in the following sections.

Social Facilitation

Social facilitation refers to the influence of a social presence on individual behaviour and performance (Rockloff et al. 2011). Due to the mere presence of others, some behaviour can be facilitated, enhanced, energised or inhibited (Martinez et al. 2005; Rockloff and Dyer 2007; Rockloff et al. 2011; Zajonc 1965). In a gambling context, energised behaviour may result in greater risk taking, larger bet sizes or prolonged play (Martinez et al. 2005; Rockloff and Dyer 2007; Rockloff et al. 2011). Zajonc (1965) outlined two paradigms under which social facilitation can be classified: audience effects and co-action effects. In a gambling environment, people are often subject to both audiences (bystanders spectating) and co-action (others gambling simultaneously).

Audience effects refer to the influence of passive spectators on behaviour or performance on a task (Zajonc 1965). Zajonc (1965) conducted a comprehensive review of the effects of audiences on performance. Findings indicated that, for simple or attentional tasks, the presence of an audience significantly improved performance of participants. However, when engaging in novel or complex tasks, audiences impaired learning ability resulting in slower performance. Despite this, when asked to recall learned information, those confronted with audiences performed considerably better than those who tried to do so alone. Such results suggest that, when required to perform tasks that are previously learnt, audiences can actually improve people's performance. Contrarily, people's ability to learn is significantly inhibited when faced with spectators. In a gambling context,

spectators at table games are common as it can be exciting and stimulating for an individual to watch without actively participating. If the gambler is familiar with the game they are playing, spectators would then be presumed to enhance their engagement and subsequent performance. However, an individual who was uncertain of the games rules and subtleties may struggle to make adequate decisions in the presence of an audience. Audience effects may cause novice gamblers to avoid wagering in complex table games in fear of looking foolish or inexperienced. Automated products may therefore allow those unfamiliar to engage in such games privately, without fear of judgement from others, resulting in players being more likely to take greater risks or gambles.

Co-action effects describe behaviour occurring when there are others engaging in the same action concurrently (Zajonc 1965). Co-action or co-actors have received a greater amount of attention in gambling literature compared with the effect of audiences. Co-actors in a gambling setting refer to other gamblers in the vicinity whose presence and actions influence individual betting behaviour (Rockloff et al. 2011). Hardoon and Derevensky (2001) examined gambling behaviour in children (9–13 years old) either playing together or alone on a roulette wheel game. Subjects played the game (1) alone (baseline), (2) in groups (group exposure), and then (3) alone again (post-test). Wagers significantly increased from baseline to group exposure, and were maintained during post-test. Given the absence of a control group, it is difficult to identify whether findings were a result of group play or more indicative of an order effect as children became more familiar with the game (Rockloff and Dyer 2007). As an alternative to the potentially inhibiting effects of audiences, co-actors may generate competition; facilitating and energising gambling behaviour.

Martinez et al. (2005) investigated the effect of co-action in an adult sample via knowledge of other players betting behaviour. Using a computer simulated roulette wheel, subjects were told that other players had either (1) lost, (2) won, or (3) made only small gains. Those who were told of either wins or loses made riskier bets than those in the control condition whom had been given no information regarding prior participant's results. While this study did not assess the physical presence of other gamblers in real-time, it did portray the effect that information regarding other gamblers results has on energising betting behaviours as demonstrated in more recent research (Rockloff and Dyer 2007; Rockloff et al. 2011).

Rockloff and Dyer (2007) expanded on these findings. In their study, participants played a computer simulated EGM with a sample receiving false feedback suggesting others were playing and winning simultaneously in adjacent rooms. Players were allocated either to a control condition (no feedback), sound condition (winning bell), sight condition (pop up banner on computer screen), or the sound and sight condition (both winning bell and pop up banner). Those who received both sight and sound information placed more bets and lost more money than those in the other conditions. Results indicated that both sight and sound information associated with co-actors' success reduced final payouts and bet sizes, and increased persistence through greater numbers of trials. Additionally, gambling pace was significantly slowed among those exposed to both visual and auditory feedback. These results demonstrate that information regarding the performance of others can intensify gambling behaviour, particularly persistence.

None of the aforementioned studies investigating co-action have explored the influence of the physical presence of multiple others on gambling behaviour. While information about the behaviours of others has been shown to alter gambling behaviour, Rockloff et al. (2011) examined whether the magnitude of co-action effect would increase with the number of co-actors. Larger crowds in gambling venues are expected to amplify player

losses by increasing speed and persistence and accelerating the pace in which individuals experience losses (Rockloff et al. 2011). Given that EGMs broadcast wins via flashing lights and sounds, an increase in the number of gamblers may result in false perceptions of winning expectancies if other players are seen winning. As such, Rockloff et al. (2011) investigated how gambling behaviour was affected in the presence of other gamblers simultaneously gaming alongside a participant, and whether the magnitude of the effect increased with the number of other players. Participants were required to play a computer simulated EGM while in the company of a simulated crowd via video conference and a live confederate who gambled concurrently with the participant. Players were given $20 to gamble with and allocated to one of three conditions: (1) alone, (2) in a simulated group of 5 plus 1 live player (6 co-actors), or (3) in a simulated group of 25 plus 1 live player (26 co-actors). Players in the 26 co-actor condition had higher betting speeds and greater losses than those in the 6 co-actor condition, with no significant differences found between the groups on bet size or number of trials played. However, when compared to the alone (control) condition, co-actor conditions bet faster, persisted for a greater number of trials, and had lower final payouts. In support of their previous findings, bet sizes in the alone condition were larger than in the co-actor conditions, suggesting that people decrease their bet sizes to heighten the number of wins displayed to others. That is, to maximise the number, or frequency, of wins rather than maximising the value of wins. Results indicated that larger crowds influence gambling intensity by creating greater betting persistence. Automated products may allow for greater numbers of people gambling simultaneously. With greater numbers of co-actors, the perception of competition or winning expectancy may be higher, resulting in greater gambling persistence than traditional versions.

While the studies discussed above demonstrate how social facilitation affects behaviour, it is also important to understand the underlying mechanisms that may drive these effects. Geen (1991) proposed that the social facilitation effect could be understood in the context of two theoretical explanations: *the arousal hypothesis*, and *attentional effects*.

The arousal hypothesis suggests that the presence of others results in an adverse affective state (Geen 1991). That is, the presence of co-actors or audiences can create the expectation among players that others will negatively evaluate their performance, and the prospect of public failure results in negative performance apprehension (Geen 1991). Consequently, there is a drive to promote a positive self-image, resulting in changes to behaviour (Rockloff and Dyer 2007). For gamblers, the presence of others may create fear of being seen as novice, foolish, unlucky, or being otherwise judged negatively, and may increase persistence despite mounting losses or, alternatively, avoidance of the game (Rockloff and Dyer 2007; Rockloff et al. 2011). Interviews with problem gamblers have demonstrated a desire to appear skilful or lucky (Wood and Griffiths 2007). Accordingly, the presence of others may facilitate gambling intensity designed for self-presentation purposes (Rockloff et al. 2011). Hardoon and Derevensky (2001) observed that participants increased their wagers as a means of impressing one another when playing. The broadcasting of EGM wins throughout the venue may arouse competitive instincts and, as a result, gambling behaviours may intensify to make a positive impression and avoid being perceived as a failure (Rockloff et al. 2011). Automated table games are likely to yield similar results given the ability for wins to be broadcast to others in near proximity.

Attentional effects refer to the influence of co-actors or audiences on cognitive information processing (Geen 1991). Geen (1991) suggests that increased presence can increase cognitive load by creating uncertainty or distraction. High cognitive load limits the ability to attend competently to the task at hand, resulting in a narrowing of attention to a few salient features of the task (Payne 1976). As discussed earlier in this review (see Chapter 4:

Task Complexity), focusing on only a few elements of a task often results in other important factors being neglected (Payne 1976). The presence of an audience in a gambling venue may increase gamblers' focus on the game at hand to avoid distractions by onlookers (Rockloff and Dyer 2007). However, if gamblers are unable to do this effectively, important information regarding the play at hand may be missed, leading to an increase in losses or riskier gambling decisions. It is likely that automated products will enhance on-task concentration as external distractions would be lessened given that interaction is solely between the gambler and a machine. While this may reduce the possibility of mistakes, it may also lead to dissociative states, resulting in players losing track of time, number of games played, or losses.

Social Connectedness

While social facilitation generally refers to the influence of passive or non-direct interactions with others, social connectedness describes the degree to which people feel connected to others through direct interaction. Casino games, particularly table games, provide gamblers with multiple opportunities to connect with others and to share their experiences (Bernhard et al. 2007). For many, the community atmosphere that many gambling environments create is important to their enjoyment of the gambling experience. Cotte and Latour (2009) interviewed 20 casino gamblers residing in Las Vegas, Nevada. Respondents stated that gambling provided them with social connections with people whom they did not know and who shared similar interests, creating a sense of community. Most agreed that social visibility was vital to the experience and that the nature of such social contact can alter the subjective meaning of the game. Players suggested that, rather than a solitary or lonely experience, social contact (with both players and casino employees) created a warm and welcoming atmosphere, which enhanced enjoyment. Players reported enjoying the familiarity and superficiality of interactions, with one participant suggesting that casinos allowed the benefit of social interactions without becoming deeply involved in their lives.

Similar finding were reported from interviews with regular poker players who gambled both online and in casinos (Barrault et al. 2014). Barrault et al. (2014) found that most commonly, live-poker was associated with greater social benefits. Players stated that they enjoyed the atmosphere whilst playing against real opponents using real apparatus. Further, participants stated that they would prefer live poker (over online poker) but play online simply due to ease of accessibility and convenience. While online poker may not be directly comparable to automated products, these results may indicate that poker players have a preference for an authentic poker experience and thus, if given a choice at the casino, would be more likely to choose a traditional poker table over an automated table. Automation of table games may reduce the level of interaction as players are not gambling with or against each other but, rather, playing with or against a machine. As such, gamblers who enjoy the social aspects of gambling may experience lower levels of enjoyment and satisfaction playing the automated version of the game, potentially reducing player engagement.

It is unclear as to how altering the social nature of traditional gambling may affect gambling behaviour. For instance, some authors suggest that those who gamble alone are more likely to experience greater problems depending on their motive for gambling (e.g., Parke and Griffiths 2006). Socially motivated gambling (i.e., gambling to socialise and have fun) is considered to create a safety net, reducing excessive gambling and risk of developing gambling problems. In contrast, when the primary goal of players is to win money, gambling alone is believed to increase the likelihood of developing gambling

problems (Griffiths 1999; Griffiths et al. 2006). Those who gamble alone have been shown to be more likely to make riskier decisions and place larger bets, and gamble more frequently (Bernhard et al. 2007). Given that EGM play is often asocial or solitary, automated products may provide more opportunities for isolated play among those who would otherwise play table games. Automation of traditional games may then result in greater risk taking and susceptibility to gambling problems given the reduction in social interaction.

Conversely, gambling with peers for social reasons could indirectly contribute to gambling problems by initiating game play. While Thomas et al. (2011) found socially motivated gambling to be unrelated to EGM gambling frequency and problems, they suggested that socially motivated gambling is likely to have an indirect effect on gambling problems by providing an incentive to initiate play. For example, someone who is lonely may gamble in order to connect with others but may instead find that other mechanisms (e.g., dissociation or mastery) facilitate escapism and encourage more intense play (Thomas et al. 2011). There is also evidence to suggest that gambling with friends and peers increases risk-taking behaviour (Smith et al. 2014). Smith et al. (2014) found that when people believed they were being watched by a peer, they gambled more often than those gambling alone. They concluded that the presence of peers increases risk taking even when information about the probability of winning or losing is available. The influence of peers on gambling has also been demonstrated in a study by McDougall et al. (2011) who explored how a gambling confederate can change gambling behaviour. Results showed that the number of hands played and the total wagered by the participants varied according to the confederates bet size. Based on these findings, having private betting screens and more isolated gambling may reduce risk-taking behaviour by removing the influence of the presence and behaviours of peers.

Conclusions for Automated Products

The psychological theories of behaviour and empirical research discussed in this section have provided substantial evidence for the social affects on gambling behaviour. Both social facilitation and social connectedness can change how a game is played and experienced through overt or passive interactions with others by increasing gambling persistence and enjoyment. Given the similarities of structural characteristics of EGMs and automated products (Armstrong et al. 2016), it would be expected that co-actors and audiences would have similar effects on behaviour when playing automated products. Due to the broadcasting of wins to others, automated table games are expected to increase gambling persistence as gamblers strive to appear lucky or skilful to fellow gamblers. Whether these behaviours differ from traditional versions however, remains unknown. Additionally, it is unclear as to whether reduced social involvement seen with a shift away from traditional forms would reduce enjoyment levels when playing automated versions. Where in table games successes and failures are often shared and sometimes linked with other players, automated gaming has led to human–machine interactions instead (Bernhard et al. 2007). While audiences and co-actors may lead to greater gambling persistence, it is unclear as to whether direct social interaction has any effect on gambling behaviour other than enjoyment. As gambling in isolation is likely to increase gambling frequency and the risk of developing gambling problems, creating an asocial environment in casinos via the introduction of automated products may lead to a rise in gambling related harm. Conversely, it could also reduce riskier gambling by removing the influence of peers on gambling decisions. In order to fully understand the potential impact of automated

products, further investigation is needed regarding how social facilitation and interaction impact gambling behaviour differentially for traditional and automated games.

Discussion

As technologically enhanced gambling products become more readily available to consumers, there is a necessity to understand how automation and digitalisation may affect gambling behaviour in order to minimise potential harm. This review used the VICES framework implemented by Armstrong et al. (2016) to explore how the automation of traditional gambling games may affect player engagement and behaviour. The VICES framework defines five dimensions along which automated or digitised versions of casino, community and novelty games may differ from their traditional counterparts. The five dimensions of the VICES framework are: visual and auditory enhancements; the illusion of control; cognitive complexity; expedited play; and social customisation; each of which can be used to understand how automated or digitalised features can change player experience

Research examining EGMs provides evidence to suggest that manipulations of structural characteristics significantly affects gambling behaviour (Chau and Phillips 1995; Dixon et al. 1998; Ladouceur and Mayrand 1984; Ladouceur and Sévigny 2005; Langer 1975; Loba et al. 2001; Spenwyn et al. 2010; Stark et al. 1982). Introducing similar structural characteristics into games traditionally free from automation is anticipated to generate similar patterns of behaviour observed among EGM players.

Automated and digitalised games have the capacity to incorporate an array of exciting and stimulating visual and auditory effects (Armstrong et al. 2016; Griffiths and Parke 2005; Parke and Griffiths 2006), that can be event-dependent, making wins more salient while reducing the impact of losses on player behaviour (Dixon et al. 2007; Griffiths and Parke 2005; Parke and Griffiths 2006). Such dynamic stimulation heightens arousal and increases gambling persistence as individuals feel the need to chase wins or beat the machine. Heightened arousal while gambling can result in increased wagering and risk taking behaviour (Stark et al. 1982), accelerated betting (Dixon et al. 2007; Spenwyn et al. 2010; Stark et al. 1982), and heightened levels of enjoyment and satisfaction (Loba et al. 2001; Singh 2006), which, in turn, may lead to longer game playing sessions and greater losses.

Real-time visual presentation of information and auditory feedback about, for example, hot and cold streaks or lucky numbers may create a perception of skill and generate an illusion of control over random outcomes (Griffiths and Parke 2005). While information such as statistics and history is commonly already available for some non-automated traditional games (i.e., roulette), it has become a prominent feature on many automated products where traditionally, this information would not be available (Armstrong et al. 2016). Illusions of control are influenced by the level of gambler engagement, perceived choice, and the frequency of events (Langer 1975). However, given that event frequencies and payout ratios are functions of software design for electronic games, some players may question the fairness of algorithms and their ability to win against a machine. Conversely, electronic gambling may also eliminate uncontrollable factors (such as other players at the table) that might influence game outcomes. For example, in blackjack, the number of players at the table determines the cards that each player is dealt. While not affecting long-term probabilities, this may influence the individual's perception of control. An increase in

perceived control or skill may lead to greater risk taking and, ultimately, losses (Chau and Phillips 1995; Dannewitz and Weatherly 2007; Weatherly and Flannery-Woehl 2009).

While automated gaming products have the capacity to increase perceptions of skill and illusions of control, it is important to acknowledge that, with few exceptions, the outcomes of wagers are not directly affected by players' decisions. However, the introduction of real-time digitised game information, additional game features and options, and player feedback made possible by the automation of traditional casino and table games may inject 'apparent complexity' into games of chance. This apparent complexity is likely to affect gambling behaviour in two ways. First, the introduced complexity may lead players to perceive games as being more enjoyable due to a belief that there is some skill to be obtained and that, with a better understanding of 'the system', a player's choices may ultimately produce more wins. In this case, player persistence and, therefore, losses are likely to be increased (Johnson and Bruce 1997). Second, increased complexity may impede players' ability to attend to important information and produce poorer decision-making. For example, adding features to digitised versions of roulette such as virtual wheels, free-spins, double up features, touchscreens, and multiple bet or credit facilities in addition to information about the player's performance or hot and cold numbers may heighten the attractiveness of some games (Sharpe et al. 2005), but has the potential to increase task complexity (Nadkarni and Gupta 2007) and therefore impair decision-making due to fewer cognitive resources available to fully consider all options (Bedny et al. 2012; Liu and Li 2012). This is particularly relevant for novice gamblers, as the availability of game variants and extra features may cause confusion or ambiguity (Johnson and Bruce 1997; Sung et al. 2009).

EGMs have been recognised as the leading games played by problem gamblers, in part due to the intensity and speed at which they can be played. Traditional table and casino games typically constrain betting speed as factors such as dealers, game refresh rate, and other gamblers can limit the rate between wagers and outcomes, allowing time for reflection over financial investments. Digitised and automated versions of traditional games allow manufacturers to increase the rate at which games can be played (Armstrong et al. 2016). Literature investigating rate of play in EGMs suggests that machine speed may not affect gambling behaviour directly but rather enjoyment and satisfaction, which may then lead to prolonged play and greater losses (Blaszczynski et al. 2001, 2005; Delfabbro et al. 2005; Ladouceur and Sévigny 2006; Loba et al. 2001). While the rate of play may be influenced by multiple environmental, social or structural factors, and not yet identified as a factor associated with excessive behaviours, simply providing the opportunity for faster, more intense gambling is likely to cause harm to those who have trouble controlling their gambling expenditures.

Socialisation as a motive for play may also vary between traditional table and casino games and automated products. Gambling on traditional games often creates opportunities for social connectedness and inclusion either directly or indirectly. Research has indicated that while individuals playing at tables may be more likely to be gambling alone (Bernhard et al. 2007), the presence of the dealer and other gamblers can enhance feelings of community and social cohesion (Bernhard et al. 2007; Cotte and Latour 2009). Automated products provide opportunities for those who prefer traditionally social games (such as roulette, blackjack, craps, or bingo) to play in isolation. Reducing social connectedness may place players at greater risk of developing harmful gambling behaviours (Martinez et al. 2005; Rockloff and Dyer 2007; Rockloff et al. 2011). Like EGMs, automated gaming products can also broadcast wins to others in the vicinity using sounds and graphics and may encourage gambling persistency and artificially increase players' expectations of the

likelihood of winning (Rockloff and Dyer 2007; Rockloff et al. 2011). Generally, people playing traditional games among a group of players can see others wins, observe how the wins occur, and can understand the process involved with the outcome. This is often not the case with electronic or computerised gambling as players are typically presented with personal and private screens. Thus, it is likely that automated products will facilitate riskier game play by promoting erroneous beliefs about the good fortune of other near-by players. In addition, the availability of private and individual gaming interfaces in computerised versions of traditional games may act to remove barriers to entry for novice players who may otherwise avoid complex or unfamiliar traditional games out of fear of appearing foolish or inexperienced.

At present, there is insufficient literature pertaining specifically to automated or digitalised versions of traditional gambling products as technological advancements are relatively new to the gambling market. Consequently, there is currently no clear or agreed definition of what constitutes an automated product and only one study is known to have reviewed automated products and features available to consumers (Armstrong et al. 2016). Much of the literature considered in the previous sections has been extracted from investigations of EGM gambling behaviour and may not be easily generalised to the effects of automating traditional gaming products. Although this information may provide a basis for understanding automated product design, the extent to which automated products will impact gambling behaviour remains unknown at this time.

While there has already been efforts to catalogue the features associated with automated and digitalised games (Armstrong et al. 2016), whether player behaviour differs when playing automated games compared to traditional versions and how players interact with game features is yet to be determined. Future research should focus on exploring what features are associated with increased gambling intensity and greater risk of gambling problems, and how these features may contribute to experiences of harm. Knowing what features pose the greatest threat to consumers will allow for policy and regulation of automated products that aims to promote safer gambling. Further, crucial to this broader understanding is determining the role these products have in initiating game play and those who may be more vulnerable to risks associated with automated and digitalised games. Research is needed to explore who are using the products, who might be vulnerable to these products and what makes these products appealing to new consumers. By understanding the characteristics of consumers and the appeal of automated products, it may be possible to implement more effective harm minimisation strategies that are relevant to a specific consumer base.

Automated and digitalised gaming products are likely to become increasingly common in venues across Australia (Armstrong et al. 2016; Bernhard et al. 2007). Products that facilitate continuous, rapid play with frequent and substantial reinforcement can contribute to the development of gambling problems (Blaszczynski et al. 2001). Gaming products which are automated or digitalised have the capacity to alter the way gambling industries operate creating new social norms, perceptions and gambling behaviours. Technological influences are expected to have large effects of the development and maintenance of gambling behaviours (Griffiths 1999, 2003; Griffiths et al. 2006). Consequently, acquiring a comprehensive understanding of the extent to which automated products may influence gambling behaviour is a critical first step in developing strategies to minimise potential harm. By investigating these products using the VICES framework outlined in this review, we hope to gain insight into the dynamic and holistic impacts of automated products on gambling behaviours.

Acknowledgments This research was funded by Gambling Research Australia.

Compliance with Ethical Standards

Conflict of interest None.

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