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The Impact of an Audience and Venue-size on Poker Machine Gambling

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The studies described herein explore how the intensity of gambling behaviour on Poker Machines (e.g., bet-size and speed of betting) is influenced by the size of the venue, and more specifically, the number of patrons within a venue. These studies suggest that large gaming venues contribute to behaviours consistent with greater player losses, and this effect may chiefly result from the informational effect of the broadcasting of wins across the gaming floor.

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Executive Summary

Three experimental studies investigated how the presence of large numbers of persons in a gaming venue impacts individual betting behaviour. These findings have implications for the relationship between the size of the venue and the long-run losses experienced by players. A long tradition in psychological research has shown that the actual or implied presence of other people can have either an energizing or an inhibiting effect on behaviour across a wide range of domains (Zajonc, 1965). In sport, for instance, the presence of spectators and competitors generally helps athletes perform better in competition than when practicing alone (Triplett, 1898). Poker machines are not a competitive sporting activity, but other recent studies have suggested that the presence of other players can similarly have an energizing effect on gambling: causing players to take greater risks, bet larger amounts and play longer (Martinez, Le Floch, & Gaffié, 2005; Rockloff & Dyer, 2007).

The Effect of Co-actors on Betting

The *Social Facilitation Effect* refers to the impact that social presence has on individual performance. The effect of '*co-actors'* on performance refers to the social presence of others performing the same activity. In the case of gambling, co-actors are 'other gamblers' who may influence individual betting behaviour by both their physical presence and actions in the gaming venue. Martinez, Le Floch and Gaffi (2005) conducted a study with a computer-simulated roulette wheel to explore the influence of reported wins and losses of 'other' players on betting behaviour. Participants were told that a previous player had: 1) lost, 2) won, or 3) made only a small gain during play. These were randomly assigned conditions, and bore no relationship to the actual performance of the prior participants. When compared to a control-condition where subjects had not been told of the results of a prior participant,

those told of either wins or losses tended to make riskier bets. Although this study did not strictly test for the effects of physical presence (co-acting) on the social facilitation of gambling, it supported the informational effect that wins and losses have on energizing betting behaviour.

Hardoon and Derevensky (2001) similarly employed a roulette wheel game to examine the gambling behaviour of children, aged 9-13, playing either together (i.e., in groups) or alone. In a within-subjects design, all children played the game in the order of 1) alone, 2) in groups, and 3) alone again. The authors found that girls increased average bet-sizes from the first 'alone' trial to the group trial, and larger bets were maintained thereafter. The design of the study was hampered by the existence of possible order effects and problems of statistical independence of the observations, but nevertheless provided some suggestion that co-actors (groups of players) tend to magnify risk-taking as measured by bet-size.

Rockloff and Dyer (2007) provided more definitive evidence of the effects of social facilitation on gambling. Study participants played a computer-simulated poker machine, with a portion of participants receiving false feedback suggesting that other players were simultaneously playing and sometimes winning at the game in adjacent rooms. Players who received both 'sight' and 'sound' information including a winning bell and a pop-up message about the performance of other players placed more bets and lost more money than others not receiving this feedback. The study demonstrated that the informational effect of wins from other players tends to intensify betting in the form of gambling persistence.

Venue-size and Layout

Although previous research has generally supported that gambling is intensified by the presence of co-actors, there has been missing knowledge about the

form of this influence. Specifically, past studies have suggested that social facilitation intensifies gambling when comparing a control condition to an alternate condition (or conditions) consisting of a minimal number of co-acting gamblers. However, it is important to understand how varying group-sizes, some with much larger numbers of co-actors, might further intensify betting. This issue is particularly important in determining whether larger gaming venues might intensify betting compared to smaller venues. In addition, past research has only focused on the influence of co-actors on gambling. Other social influences may be important as well. Gaming venues have other patrons that move through the gaming space, but who do not concurrently participate in gambling. Such patrons may simply observe others gambling (as an audience), or move through the gaming space on their way to enjoy other amenities of the venue such as dining or theatre.

Co-actors, Audience and Mere-presence

The present series of studies was designed to test the social facilitation effects of gambling and address the above gaps in the current state of knowledge. The first "co-actor" study examines the influence of co-actors (cf., Rockloff & Dyer, 2007) or other gamblers who simultaneously play alongside the participant, but with the added purpose of discovering if the intensification of gambling is amplified by the presence of a large number of other players. The second "audience" study was designed to test for the possible influence of other patrons who only observe the participant gambling. This study has potential implications for venue designs that either encourage or discourage patrons, who do not intend to gamble, from walking through and observing the gaming floor area. Lastly, a third "mere presence" study examines whether social facilitation effects can be discovered from the mere physical presence of other persons who cannot see or hear the gambling wins or losses of the participant.

This study has implications for venue-design, as crowded venues may contribute to intensification of gambling behaviour irrespective of the gambler having an awareness of being watched or receiving other feedback from other patrons. Gaming venues that encourage foot-traffic, place patrons in close proximity to one another, or otherwise encourage the perception of a crowded environment (e.g., through use of mirrors) may similarly impact on players behaviour and ultimate losses.

Summary of Findings

Co-actor Study. Crowds of differing sizes were simulated using a fake video-conference along with a live confederate, all of whom gambled concurrently with the subjects. Fifty-four male and 85 female subjects (N = 139), aged 18 - 82 (M = 47.0, SD = 16.7), played a laptop simulated 3-reel poker machine using a $20 stake in 3 conditions: 1) alone, 2) in a simulated group of 5 persons plus 1 live confederate (6 persons group), or 3) in a simulated group of 25 persons plus 1 live confederate (26 persons group). The poker machine outcomes were rigged with a fixed 20 trial winning sequence followed by an indefinite losing sequence. As hypothesised, gambling intensity as measured by trials played, speed of betting and lower final payouts was progressively greater with larger crowd sizes. In contrast, bet-size was slightly lower with larger crowds, although this outcome may be consistent with players attempting to display more wins to others. The results supported that the presence of large numbers of co-actors increases both gambling persistence and speed of betting, thereby contributing to greater long-run gambling losses. As a corollary, larger gaming venues with more players may also contribute to greater gambling intensity and higher player losses when compared to smaller venues with fewer players.

Audience Study. One component of the social facilitation on gambling is the potential for an audience of people to observe the play of poker-machine gamblers and potentially influence their behaviour, without participating directly in gambling. As such, an experiment was conducted with an audience of onlookers, purported to be 'students of research methods', taking notes while watching the participant play a poker machine. Forty-two male and 80 female participants (N = 122), aged 18 - 79 (M = 49.6, SD = 15.6), played a laptop simulated 3-reel poker machine using a $20 stake in 3 conditions: 1) alone, 2) watched by a simulated audience of 6 persons, or 3) watched by an audience of 26. Outcomes on the poker machine were rigged with a fixed sequence of 5 wins in the first 20 spins and indefinite losses thereafter. Contrary to the initial hypothesis, the results found smaller bet-sizes associated with larger audiences of onlookers, although this outcome may be consistent with a hypothesized motivation to display more wins to the audience. Final payouts were generally greater in the audience conditions compared to the control, indicating that an audience may be a protective factor limiting player losses.

Mere Presence Study. Intensification of gambling behaviour may partly result from arousal caused by the mere physical presence of others in the gaming venue. Some patrons may move through the gaming floor on their way to enjoy other amenities such as dining and theatre. In a third experiment, 56 male and 76 female participants (N = 132) gambled on laptop-simulated poker machine, either alone or with a simulated crowd of 6 or 26 others who were wearing blindfolds and earphones. These crowds of other persons were falsely said to be participating in another experiment on 'sensory deprivation', but in actuality were present as a non-evaluative source of social influence. Among players with pre-existing gambling problems, the results showed that these crowds contributed to a 'passive/avoidant' style of

gambling, whereby players generally bet smaller amounts, but were more persistent as losses mounted. These changes in persistence occurred despite the inability of these others to witness or evaluate the actions of the participants. The experiment suggests that control of foot traffic should be an important consideration in gaming venue design.

Implications and Limitations

Betting on poker machines appears on the surface to be an asocial activity, where patrons are consumed by their interaction with the machine to the exclusion of the outside world. In support of this contention, evidence suggests that poker machines are a means to escape negative self-reflection by engaging in a dissociative trance-like experience, which is the antithesis of sociability (Rockloff, Greer, Fay, & Evans, 2010). Nevertheless, these three experiments suggest that social forces shape the behaviour of players in ways that are not well understood by gamblers. The presence of other players in the venue tends to increase the speed and persistence of individual betting, thereby magnifying long-term losses. These results suggest that larger gaming environments with more players may be more risky in encouraging persistence despite mounting losses. Other factors such as the geographical spread of gaming venues, accessibility and responsible-gaming support must also be considered in determining the mix of venue designs that best protect the community.

Audience effects on gambling behaviour are more equivocal, and may even be a protective factor. Onlookers may tend to moderate bet sizes rather than increase them, although the context for the evaluation also is likely to matter. For instance, a potentially critical audience may have a different influence to an audience that cheers or otherwise is viewed by the player as encouraging his or her betting. Lastly, persistence at gambling is not only encouraged by other players, but for gamblers with

pre-existing problems, also by the mere presence of others in the venue. Therefore, crowded gaming environment also may encourage persistence and magnify player losses. Safe venue designs should consider the potential influence of foot-traffic in gaming areas that is unrelated to gambling, as the physical presence of others in a crowded environment may motivate persistence among players with gambling problems.

Safe gaming environments should maximize the ability of players to be in conscious control of their commitment to play. The effects of social facilitation on gambling are large in magnitude, and likely not to be consciously recognized as factors that influence gamblers' choices on the machines. Minimizing the effect of social facilitation, while maintaining the desirable and entertaining features of poker machine play, can provide a safer environment for players and ultimately contribute to the sustainability of the gaming industry.

The Co-actor Study

Co-actors is a term describing a group of people who are acting in concert with the study participants. In the context of the present study, co-actors are other gamblers who through their gambling behaviour and other features of their presence have a potential impact on the betting of the subjects of the experiment. Past research has delineated three circumstances that lead to Social Facilitation effects, including: Co-acting, Audience, and Mere-presence (Cottrell, Wack, Sekerak, & Rittle, 1968). The first study in this report explores the impact of co-acting on gambling, although Audience and Mere-presence influences are also present in most situations of co-action, including those simulated in the present experiment. When gamblers are in close proximity, one gambler may have some awareness of how the other is betting and whether or not he or she is winning (a potential *audience* effect). Likewise, with rare exception, most players are in the immediate physical presence of other gamblers in the gaming venue, and thus may be affected by the influence of a crowded environment (a potential *mere-presence* effect). The effects of social facilitation on gambling can be viewed as a series of concentric circles illustrating the progressively specific effects of each circumstance on behaviour (see Figure 1). In any specific situation, whether real or contrived, one of these features of influence may have a predominant effect on behaviour. In the present co-actor study, however, it is presumed that at least some portion of all of these influences is contributing to behaviour, without providing a means of identifying which effects are most important. By progressively subtracting unique effects of co-acting (in the 2nd audience study) and audience (in the 3rd mere-presence study), the series of 3 experiments is designed to give a holistic account of these situational features on poker-machine gambling.

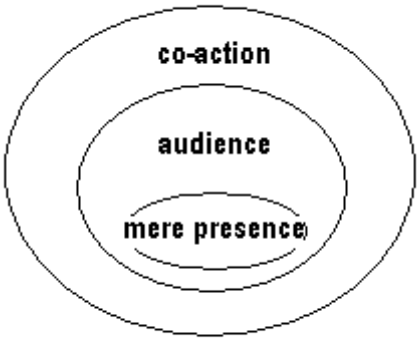

Figure 1. Venn diagram showing the inclusive influence of Mere presence on Audience and Co-action effects of Social Facilitation.

The co-action study, compared to the subsequent studies, was designed to be the most like the social situation typically faced by patrons of a commercial gaming venue. Gamblers have some awareness of the betting of other players and are also aware that others can observe them, although they are often focused on their own game. The situation constructed in the experiment was not devised to faithfully replicate the casino or club environment in every detail. Instead, the experiment relies on a tradition of *experimental realism* whereby the situation replicates the key features that are presumed to act on the psychology of the subjects in a real gaming venue – including the presence of co-actors. Experimental realism was generally preferred to so-called *mundane realism*, where many detailed aspects of the physical environment are faithfully recreated. This preference was a practical consideration given the need to simulate large crowds of 'other players' and to investigate the impact of 'other players' on gambling behaviour.

The co-actor study, by simulating an environment where gamblers play together and share some knowledge of each others betting, has potential implications

for the ideal size of the venue and how that might impact risk taking behaviour. In particular, the hypothesized effect of the presence of co-actors was to intensify individual gambling behaviour.

Gambling Intensity

Measures of Gambling Intensity include those markers or traces of behaviour that contribute to long-run gambling losses. In a commercial gaming venue, the odds favour the house. As such, gambling faster, betting larger amounts and placing more bets before quitting are features that contribute to greater losses over long term play. In addition, final payouts during a session are a direct measure of losses.

A Brief History of Social Facilitation Research

Triplett (1898) made an early investigation of what later became termed the *social facilitation effect* in a study of bicycle racing. Bicycles were a high technology item in the late 19th century, and a personal interest in bicycle racing motivated Triplett to make the observation that racers tended to perform better in competitive races than in timed trials or paced against faster quad-cycles. The explanation that Triplett gave for this increase in performance had a social and psychological basis. He argued that a competition unlocked performance in the racer that otherwise was inaccessible:

> *This theory of competition holds that the bodily presence of another rider is a stimulus to the racer in arousing the competitive instinct; that another can thus be the means of releasing or freeing nervous energy for him that he cannot of himself release; and, further, that the sight of movement in that other by perhaps suggesting a higher rate of speed, is also an inspiration to greater effort. (Triplett, 1898, pg 515)*

Some criticism of these bicycle racing results (Strube, 2005) included Triplett's failure to understand and account for the beneficial effects of drafting on racing performance, where competitors can use the slip-stream behind another competitor to gain an energy saving advantage. Fortunately, Triplett also performed a follow-up study on the social facilitation effect that looked at an experimental task of children winding fishing line onto a reel. He found that children winding line on to a reel were faster when competing against one another in pairs than when acting alone, providing further evidence of what he termed the 'competitive instinct' aroused by the presence of co-actors.

Triplett's studies were restricted to competitive situations, which may have coloured his interpretation of the reasons for the energizing effects of co-actors on performance. Moreover, subsequent research suggested that in some circumstances the presence of co-actors inhibited performance rather than enhanced it. Zajonc (1965) reinvigorated the field of research on Social Facilitation by providing a comprehensive understanding of which situations would tend to enhance performance in the presence of others as opposed to inhibit performance. Task complexity was identified as a key mediating variable. Performance on complex or not well-learned tasks is generally inhibited by the presence of co-actors, as these others may be a source of distraction from competent enactment of the behaviour. In contrast, simple or well-learned tasks tended to be facilitated by the presence of others, as these others may be motivated by competition (as suggested by Triplett) or spurred by the excitement from the presence of others.

Social Facilitation and Gambling

The prediction that the presence of co-actors should magnify gambling intensity is based on the assumption that poker-machine gambling is a simple and

well-learned task for most players. Although poker machines may have a myriad of features that impact on the payoffs, decision about play typically consist only of choosing a bet size on each trial (or spin).

The intensification of betting on poker machines in the presence of co-acting players is supported on general theoretical grounds, but is also a logical product of the information flows in a commercial gaming environment. Poker machines broadcast wins within the venue with flashing lights and ringing bells. In fact, both this 'sight' and 'sound' information proved necessary for facilitating the intensification of betting in a prior study on poker-machine gambling (cf., Rockloff & Dyer, 2007). The broadcasting of wins can alter the perceptions of the likelihood of winning, as the gambler has some awareness that 'others' are winning, which may in-turn provide an indication that another win is 'due' for the player. In larger venues with more players, wins are broadcast more frequently, and thus potentially alter perceptions towards viewing individual wins as more likely.

Interviews with problem gamblers have demonstrated their desire to appear lucky or skilful at gambling, and the presence of a number of other gamblers may therefore tend to facilitate greater intensity of gambling for self-presentation management (Wood & Griffiths, 2007). Geen (1991) identified Social Facilitation as a complex phenomenon, but explainable at least in part as a consequence of the fear of a negative evaluation of behaviour. In the context of poker-machine gambling, players are concerned with making a favourable impression and with avoiding embarrassing failure. Intensification of gambling may result from the fear of appearing to be a loser (financially and as a matter of personal character), and motivated by a negative motivational state to avoid this outcome.

Other Theories

In addition to Social Facilitation theory and research, there are other theoretical foundations that help to justify the prediction of greater gambling intensity in the presence of co-actors. Bandura's Social Learning Theory (1977) posits that people learn new behaviours and increase the frequency of previously learned behaviours by watching others get rewarded for their performance. In a gaming environment, the broadcasting of wins provides a potent signal that continued betting is the pathway to financial reward.

Kahneman and Tversky (1979) introduced Prospect Theory, which details how people frame their decisions in terms of a mindset of focusing on gains or losses. If people focus on the potential gains in a decision (e.g., how much might I 'win' on the next bet), they tend to be risk-adverse – favouring sure-bets over more risky and potentially more profitable options. In contrast, if people focus on potential losses (e.g., how much might I lose on the next bet), their decisions tend to be risk-seeking – favouring a risky option to avoid any potential for loss, rather than accepting the certainty of a small loss. Kahneman and Tversky suggest that people frame decisions (as a potential 'gain' or 'loss') based on salient cues in the environment, potentially including the gains and losses made by others. In a commercial gaming environment, only 'wins' (and not losses) are broadcast to others. As such, a gambler who is experiencing losses, according to Prospect Theory, would tend to be risk-seeking to avoid losses, and would see their losses as more severe given the perception that others are winning.

Purpose of the Co-actor Study

The co-actor experiment was devised to expose participants, by random assignment, to crowds of players of varying sizes gambling concurrently with the

subjects. In particular, the study sought evidence that larger crowds, when compared to smaller crowds, contribute to greater intensity of gambling in the forms of higher bet-sizes, faster betting, greater betting persistence while losing, and lower final payouts. These predictions are important for understanding how the size of a venue might contribute to the intensification of gambling.

Methods

Participants. One-hundred and thirty six participants, including 54 male and 82 female subjects, aged 18 - 82 (M = 47.0, SD = 16.7), successfully completed the experiment, following recruitment from newspaper advertisements in Bundaberg, Queensland. Three other female participants were excluded from the analyses present below, as these potential subjects indicated some suspicions about the veracity of the 'live' video feeds (as described in the procedures section, below). The cultural backgrounds of participants included: 120 Australian (91.2%), 4 Aboriginal or Torres Straight Islander (2.9%), 4 English (2.9), 3 Scottish (2.2%), 1 Irish (0.7%), 1 American (0.7%), 1 Filipino (0.7%), 1 other (0.7%), and 1 missing (0.7%). As calculated from the 9-item Problem Gambling Severity Index (PGSI, Ferris & Wynne, 2001), the problem-gambling status of participants included : 37.5% (51) no identifiable problems, 16.2% (22) low risk, 24.3% (33) moderate risk, 19.9% (27) problem gamblers, and 2.2% (3) unclassified due to incomplete questionnaires.

The Simulated Poker Machine. A laptop simulated poker machine (or Electronic Gaming Machine) was created by the study author in Visual Basic (see Figure 2).

Figure 2. Illustration of Laptop Simulated Poker-Machine

The machine had 3 reels and 3 pictured ‘fruits’ on each reel. Winning spins were defined by three matching fruits across the win-line, and all winning bets payed-off at 10 times the amount bet. Players could bet amounts of 25, 50 or 100 cents on each trial (or spin), with potential payoffs of $2.50, $5.00 and $10.00, respectively. Credits were presented in cents, with an initial bankroll of 2,000 cents ($20) appearing at the start of play. The machine was programmed (rigged) with a fixed sequence of 5 wins (on spins 3, 8, 12, 17 and 20) and indefinite losses thereafter. The theoretical maximum payout was $61.50, which is calculated from the $20 initial bankroll, plus $50 in maximum wins, and less $8.50 in minimum bets required. The poker machine produced the typical noises associated with play, including the musical sounds of spinning reels and winning bells.

Video-recordings. To simulate crowds of co-actors of varying sizes, two pre-recorded videos were shot with professional-grade sound, video and lighting

equipment. The first video simulated a crowd of 5 people who were (falsely) represented to subjects as participating in the experiment 'live' from a remote location (Rockhampton, Queensland – 290 km distant) via video-conference (see Figure 3, Panel a).

Panel a: Five co-actors

Panel b: 25 co-actors

Figure 3. Frame capture from pre-recorded videos of 5 and 25 co-actors participating in the gambling task.

Although recorded on separate occasions, the 5 co-actor video filmed a subset of the same confederates used in the 25 co-actor video. In addition, the 5 co-actor video had the same proportion of male to female confederates (i.e., 2 males: 3 females) as the 25 co-actor video. The video of the five person audience was composed of 2 males (40%) and 3 (60%) females, ages ranged from 21 to 59 years of age with a mean age of 34 years (*SD* = 15.23). The video of twenty-five persons gambling was composed of 10 males (40%) and 15 (60%) females, ages ranged from 19 to 59 years with a mean age of 33.2 years (*SD* = 16.04). The wins in each film were evenly spread across the 40 minute recordings when calculated in 5 minute blocks, and the rate of wins experienced by the confederates in the videos was directly proportional to the number of players. This kept the win-rate for individual confederates constant

between the two videos at approximately 1 win for every 3 minutes of play. Therefore, the winning bells on the 25 co-actor video (at approximately 8 winning bells per minute) was five times the winning bells present in the 5 person condition (at approximately 1.6 winning bells per minute).

Design and Procedures. Participants were given $20 upon arrival at their session as compensation for their time. All subjects completed a basic demographic questionnaire as well as the Canadian Problem Gambling Index of Severity (PGSI, Ferris & Wynne, 2001). In a completely randomized design (CRD), subjects were assigned by clandestine dice rolls into one of 3 conditions, including: a) Alone (n = 48), b) 6 co-actors (n = 47), and c) 26 co-actors (n = 44).

In the alone condition, participants immediately proceeded to the gambling task after having completed their questionnaires. In the test conditions, participants were brought into the experimental room where one 'other participant' was already waiting to take part in the experiment. In reality, this other participant was a confederate hired by the experimenters to act as if she was another subject in the study. The live confederate was given instructions to not initiate any conversation with the real subject, and to be polite but minimally responsive to any queries from the real subject. The confederate, a 42 year-old woman, confirmed that only a few subjects attempted to converse with the confederate, and most only made minor comments on their own performance on the poker machine.

The experimenter asked the participant and confederate: 'Are you ready to gamble with this $20 on the poker machine for the chance to win up to $62 and possibly win $500 in a jackpot draw?' The $20 compensation was retrieved from both the experimenter and the confederate to reinforce the (correct) impression that

participants were gambling with their own money. No participants refuse to gamble with their $20 compensation.

Both the participant and the confederate were told that they could push a buzzer button (a remote door-bell alarm attached to the table) when they wish to quit and cash-out their credits, which would summon the experimenter from another room. The experimenter emphasized that they could quit at anytime, and they would receive the full amount of money remaining on the machine plus 1 ticket in a $500 cash draw for every dollar remaining on the machine. The confederate's machine was shielded from the participant's sight by a solid partition. While unknown to the participant, the confederate's machine was pre-loaded with enough credits for virtually indefinite play, and replicated the win-rate of the other confederates (i.e., approximately 1 win per 3 minutes of play).

In the test conditions, the 'live' confederate was supplemented by additional 'virtual' confederates who joined the experiment via a fake video-conference. The experimental room was equipped with an AccessGrid video conferencing system (Wolfgang), which was used to create the illusion of a live video-conference session. This included a camera view of both the participant and the live-confederate projected against the wall, which was presumably broadcast to the remote site. In addition, there was a camera view from the fake 'remote' site (see Figure 3), which in reality was one of the 2 video-recordings described above, which included either 5 or 25 other players. The experimenter started each fake video-conference by announcing that other subjects would be joining the session via video-link from Rockhampton. No additional explanation was offered to participants for this procedure. At a set time in the recording (50 seconds), the experimenter asked the remote site "Rockhampton, are you ready to start?" An experimenter at the remote site responded "yes, we're ready to

begin." This interaction with the video-recoding was intended to enhance the credibility of the video-conference session as a live experience. The experimenter asked all participants (including confederates) to begin play. A 30 second countdown to the start of play was programmed into the poker machine to allow time for the experimenter to leave the room.

Results

Data Analysis. ANCOVA models were used to predict each measure of gambling intensity including Bet Size, Final Payouts, Speed of Betting, and Total Trials Played from the 3 conditions and the covariates of Age and Gender. Preliminary analyses failed to find any interactive effects between Conditions, Age and Gender for any of the outcomes. For simplicity of exposition only models with main effects are reported below.

Bet Size. Condition was a significant predictor of Bet Size, $F(2,121) = 4.14$, $p = .02$. However, contrary to predictions, Bet Size in the Alone condition was larger than the 6 co-actor condition, $p = .01$ (see Figure 4). There was no significant difference, however, between the 6 co-actor condition and the 26 co-actor condition, $p = .17$. There was a main effect for Age, such that younger players made higher larger bets, $F(1,121) = 4.26$, $p = .03$. There was no significant effect for Gender on Bet Size, $F(1,121) = 2.95$, $p = 08$.

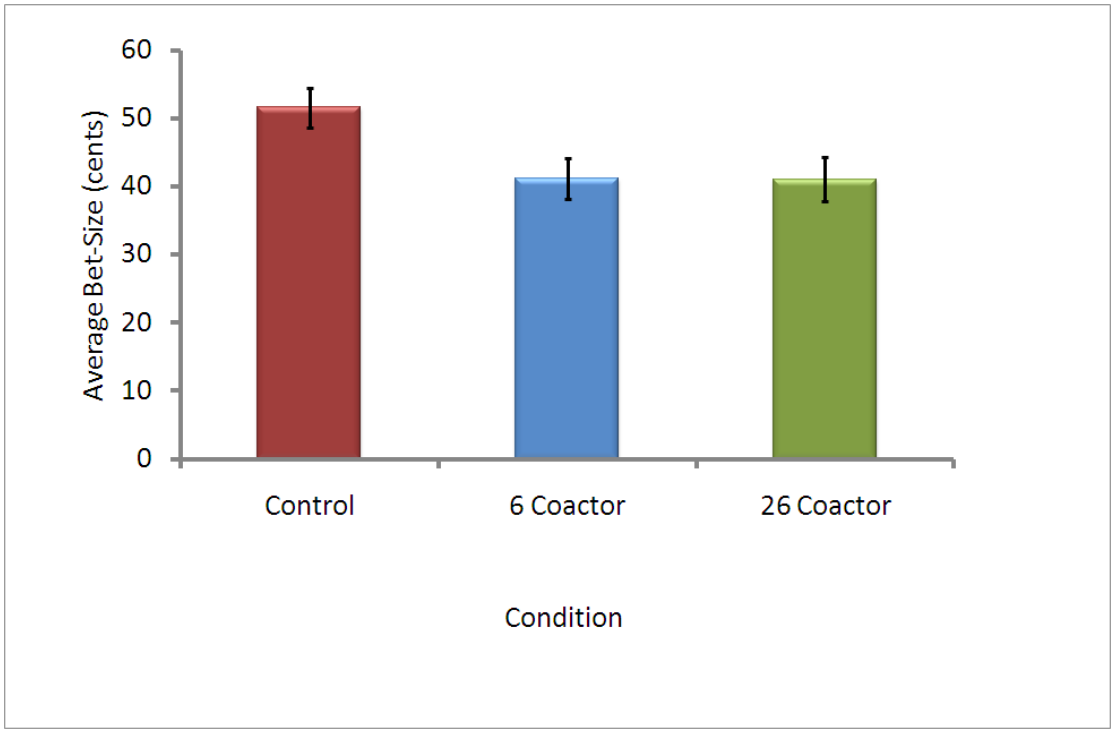

Figure 4. Bet Size by Condition.

Speed of Betting. Bets-per-minute was a variable measuring the average number of bets each subjects made during 1 minute of play, with higher means indicating faster speeds (see Figure 5). There was a significant effect for Condition on the Speed of Betting, $F(1,121) = 8.55$, $p < .001$. Contrasts showed that players bet faster in the 6 co-actor condition compared to the control, $p = .01$. Players also bet faster in the 26 co-actor condition compared to the 6 co-actor condition, although the difference was not significant, $p = .14$.

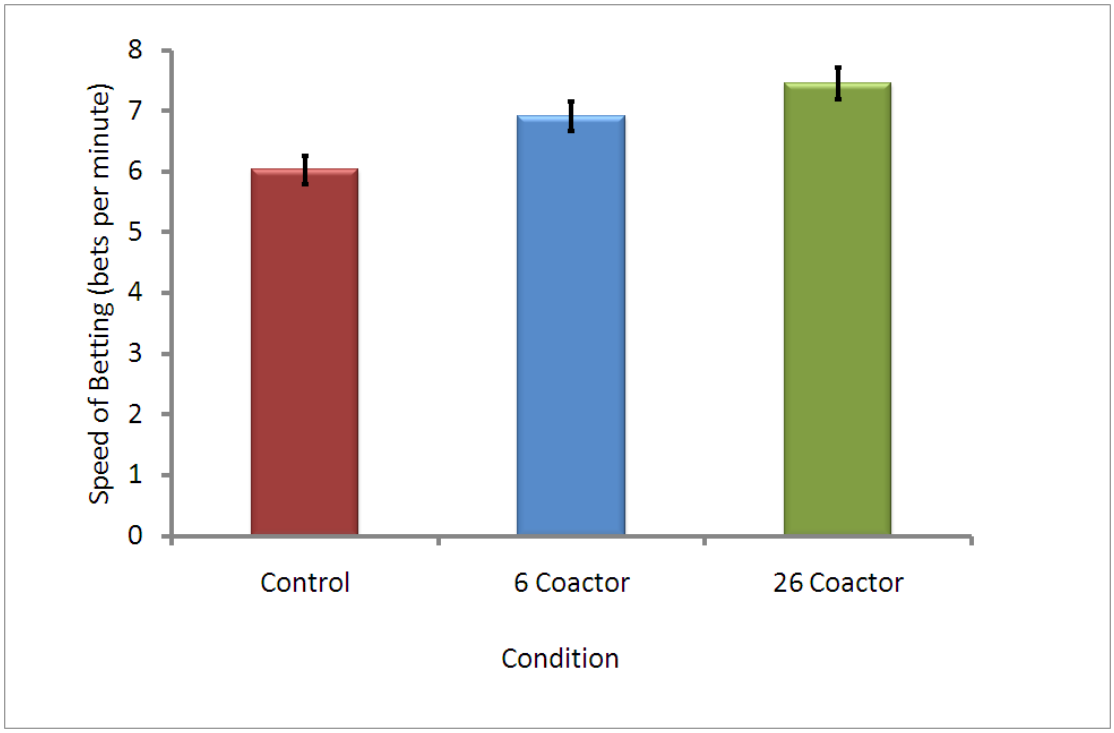

Figure 5. Speed of Betting by Condition

Total Trials Played. There was a significant effect for Condition on the Total Trials Played (or bets placed) on the Poker machine task, $F(2,121) = 12.77$, $p < .001$ (see Figure 6). Contrasts revealed that players in the 6 co-actor condition placed more bets than players in the Alone control condition, $p < .001$. There was no significant difference, however, in the number of bets placed between the 26 co-actor condition and the 6 co-actor condition, $p = .88$. There was a significant effect for Age, $F(1,121) = 5.44$, $p = .02$, such that older players placed more bets. There was also a significant effect for Gender, $F(1,121) = 4.84$, $p = .03$, such that female players placed more bets.

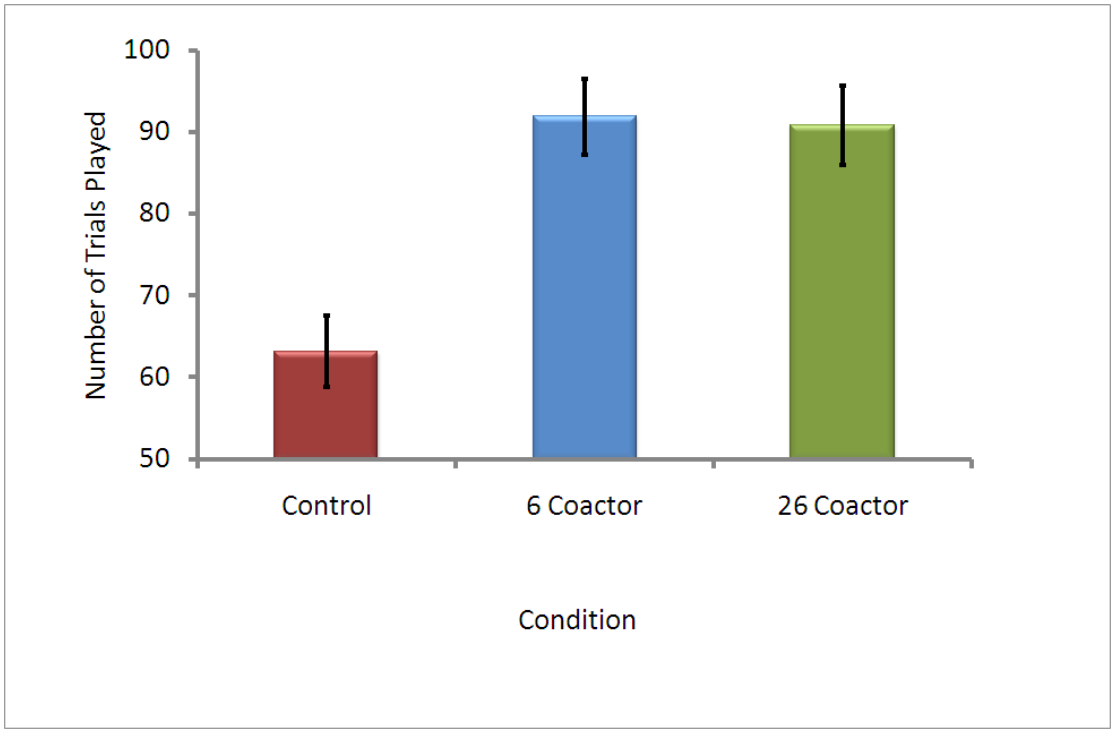

Figure 6. Total Trials Played (or Bets Placed) by Condition

Final Payouts. Half of the players (68 or 50.0%) ended the game with no credits remaining. As such, scores on this variable were converted into rank-scores for analysis. There was a significant effect for Condition, $F(2,130) = 8.31$, $p < .001$ (see Figure 7). Contrasts revealed significantly lower payouts for the 6 co-actor condition compared to the Alone control condition, $p = .001$. There were lower payouts in the 26 co-actor condition compared to the 6 co-actor condition, although the difference was not significant, $p = .64$, ns. There was no main effects for either Age, $F(1,130) = 0.001$, $p = .98$, ns, or Gender, $F(1,130) = 0.74$, $p = .39$, ns, on Final Payouts.

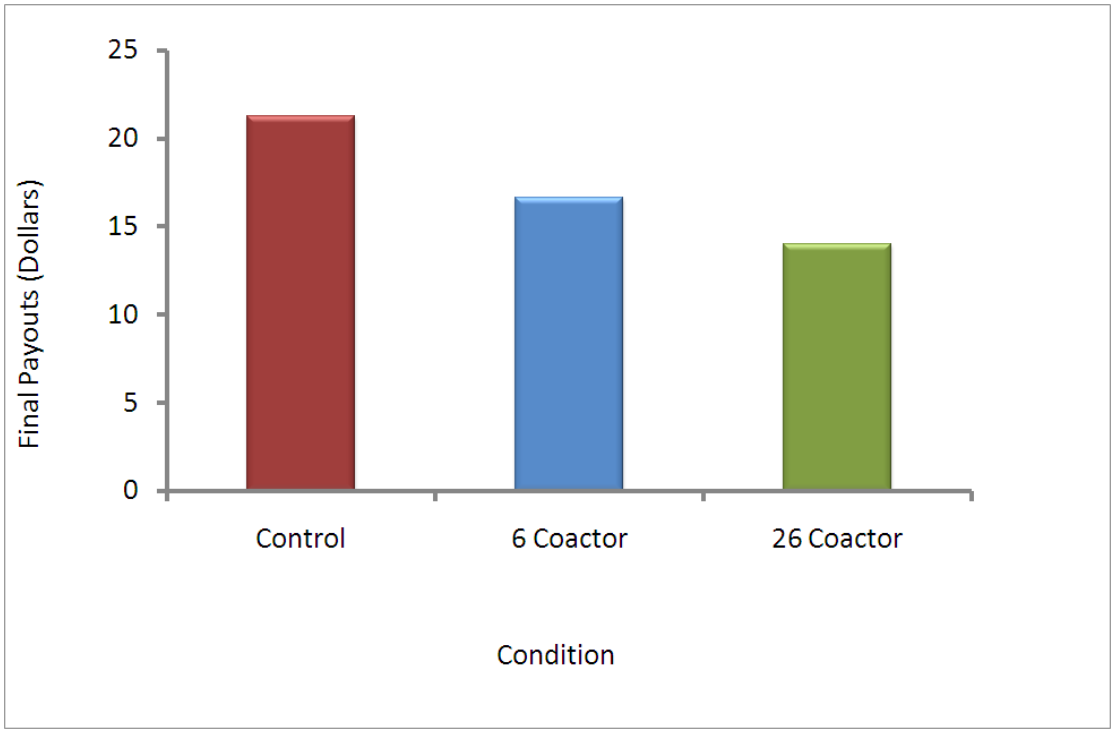

Figure 7. Average Final Payouts by Condition *
* excludes 68 subjects who left the experiment with no money remaining

Discussion

As predicted, the presence of other co-actors had the effect of magnifying gambling intensity in terms of betting speed and gambling persistence. Moreover, these behaviour changes conspired to lower the Final Payouts that players received at the end of the poker-machine task. The 26 co-actor condition also showed higher betting speed, gambling persistence and losses when compared to the 6 co-actor condition, although these differences were not statistically significant. Contrary to predications, however, the Bet Sizes of subjects in the Alone condition were significantly higher on average than either of the 2 co-actor conditions.

The Anomaly of Bet Size

One potential explanation for why Bet Size showed lower intensity in the co-actor conditions compared to the control is that players may attempt to ‘conserve’

their gaming credits to remain playing for a longer time, although unfortunately this same logic could apply equally well to predict slower betting speeds in the presence of co-actors (which did not occur). Betting small amounts, however, does maximize the number of total trials, or bets that can be played in the session before ultimately running short of credits. As a corollary, it also acts to maximize the number of potential wins a player accrues in a fair game. Although the current game was rigged - with a short sequence of wins followed by indefinite losses - our debriefings suggested that the players believed the results to be a fair representation of real poker machines. Therefore, the reduction in bet size in the presence of other co-actors may have acted on the players to change their behaviour in a way to allow them to maximize the number of 'wins' displayed to others. In short, the goal of players was to maximize 'wins' rather than maximize the amount won. This motivation may be either a conscious or pre-conscious effort at maximizing the number of winning trials. Of course, this is only a post-hoc explanation given the current experimental design, and needs further testing to demonstrate its validity. However, the results provide a novel look at the potential social motivations of gambling that transcend monetary wins, and instead reveal a hypothesized motivation to display wins to others - regardless of the amounts won.

Limitations

Like all experimental studies, this study has potential concerns regarding the external validity of the results. Our debriefings indicated that participants believed in that the co-actor situation presented to them was genuine, with 'other' players being genuine participants in the same experiment. However, our experimental task was not a close replication of the details of a real gaming environment. Most importantly, the subjects were aware that we were studying their behaviour, and this could have had an

effect on their betting. In addition, the co-actor conditions were only ‘simulated’ with crowds of 6 or 26 others. One of these confederates was ‘live’ actor, and gambled alongside the participant in real time. It was not practical, however, to have an entire cast of confederate co-actors available to gamble ‘live’ with each subject. The fake video-conference was a necessary compromise towards inducing a mindset similar to that actual mindset believed to operate in real commercial gaming venues. This is only an assumption, however, and other evidence with greater external validity can be useful in verifying these results.

Implications and Conclusion

The presence of large crowds of gamers in a venue appears to increase gambling losses by increasing the speed of betting and persistence at gambling in the face of mounting losses. Translating these findings to commercial gaming venues suggests that large gaming venues, and/or large rooms within venues, may tend to accelerate the pace of at which individuals experience losses. Of course, larger losses alone cannot be used as evidence that a gambling environment is unsafe. An attractive gaming product, such as a popular poker-machine design, might attract greater individual losses, but likewise it may also provide greater gambling enjoyment in the process. This research suggests, however, that crowd size may influence betting behaviour in a process that is likely not well understood by gamblers. A safe environment, in contrast, provides gamblers with a high degree of control over the choices they make in terms of their gambling expenditure and ultimate levels of acceptable losses. Other elements of the gaming environment, such as the geographic distribution of gaming machines within the community and the availability of responsible gambling services, must be considered in deciding the ultimate optimal size of gaming venues. Nevertheless, this experiment suggests that smaller gaming

venues, other factors remaining equal, put more control in the hands of gambler in terms of consciously deciding on their own expenditures.

The Audience Study

The previous Co-actor study focused on the influence of other players in the gaming venue and their social influence on betting behaviour. It did not, however, specifically test for what features or aspects of social influence created the change in behaviour - other than the presence of others performing the same activity. The influence of the other gamblers on betting, however, can be deconstructed into co-action effects, audience effects, and the effects of mere presence (cf., Cottrell, et al., 1968). The co-action study contains at least some elements of both Audience and Mere-presence effects, as illustrated in Figure 1 (see pg 12). Co-action effects include the informational influence of other players. Large crowds may tend to give an impression of more frequent wins, and thus create the false impression that a win is 'due' for the player. Audience effects, which are the focus of this second study, exclude this informational influence, and instead focus on the influence from others who observe rather than participate in the gambling. This influence of observation, or the 'Audience', may contribute uniquely to betting apart from the informational influence provided by co-action.

Drive Theory and Audience Effects

One prominent theory advanced for the Social Facilitation effect was based on the motivational 'drive' hypothesis. Zajonc (1965) proposed that the presence of others raises an aversive state of autonomic arousal, and creates a drive to reduce that aversive state. Part of this arousal may be from the mere-presence of others in the environment, but it may also result from the fear of a negative evaluation of performance. Cottrell (1968) argued that social facilitation occurs because an individual believes that an audience will evaluate his or her behaviour, and an apprehension about a potential negative evaluation will tend to enhance performance

of a dominant response. A dominant response may lead to either an increase or decrease in performance, depending on the learning history of the target actor. A professional basketball player, for instance, is likely to have his or her scoring performance enhanced by the presence of an audience of spectators, as successfully completing a scoring basket is a dominant (or more frequent) response for that player. In contrast, an amateur player is more likely have his or her performance impaired by the presence of an audience, as 'missing' a scoring basket is likely to be a dominant response for this type of player. In a related line of reasoning, Baron, Moore and Sanders (1978) suggest that audiences are a source of distraction, and the competition that people experience between attending to the crowd and the needs of the task creates autonomic arousal. Unsurprisingly, this 'distraction' can inhibit performance of complex or poorly learned tasks. Ironically, however, the distraction caused by an audience can enhance performance of easy or well-learned tasks, as people focus more intently on the task their attempts to regain control.

Control Theory and Audience Effects

Carver and Scheier (1981) introduced Control Theory, which suggests that social facilitation effects do not need a mediating 'drive' state. Instead, the presence of an audience focuses the attention of individuals on their performance relative to a salient standard of correctness. It is this discrepancy between their actual performance and the salient standard that people act to reduce, rather than an emotional drive-state. This more 'cognitive' explanation for behaviour requires knowledge about the salient standard to accurately predict audience effects, whereas the drive theory more parsimoniously predicts enhanced performance of dominant responses in the presence of an audience.

Drive or Control Affects Betting Behaviour?

Study 1 investigated the influence of co-action on gambling, and found the predicted increases in betting speed, persistence and consequent player losses. In contrast, however, players generally bet smaller amounts in the presence of other gamblers than when playing alone. A post-hoc explanation for this unexpected result was that players sought to maximize 'total wins' during play, rather than maximizing the amount won. In this case, the salient standard was 'winning' rather than 'making money.' Betting smaller amounts allows players to stay in the game longer, and maximize the number of 'wins' for any fixed level of expenditure in a fair game. Displaying wins is most obviously relevant as a social motivation for players, who display these wins to an audience of onlookers. As the current study is investigating 'audience' effects, this tends to suggest that we might also find similar reductions in bet size when players are simply observed by an audience. In fact, since the audience in this current study is not distracted by any other activity while observing the player, it is reasonable to expect that this reduction in bet size might be more dramatic. This prediction is consistent with a control theory explanation for social facilitation, where the audience encourages players to examine their performances relative to a salient standard. In this case, the salient standard is 'total wins', and the audience encourages adherence to this standard. A contrasting prediction, however, can be made from Drive Theory (Zajonc, 1965), where the presence of an audience increases arousal and (potentially) also a fear of negative evaluation. This drive should increase production of a dominant response, which arguably would be to intensify all aspects of gambling behaviour, including larger bet sizes. Regardless of a *Drive Theory* or *Control Theory* orientation towards prediction, other measures of betting behaviour – apart from bet size - should be intensified by the presence of an audience through the encouragement

of dominant responses. In short, gambling on a poker machine is a simple task for virtually all players, as bet-size is the only choice available on the simple version of the poker machine.

Hypotheses

Contrasting predictions for bet-size lead to the hypothesis that bet size will be either increased or decreased by the presence of an audience as predicted by Drive Theory or Control Theory, respectively. Other measures of gambling intensity, including Speed of Betting, Gambling Persistence (Total Trials) and Losses (i.e., lower Final Payouts), are predicted to be intensified by the presence of an audience of onlookers.

Methods

Participants. Subjects were recruited via flyers distributed in a daily newspaper in Bundaberg, Australia. The flyers advertised for potential participants to play a 'simulated poker machine' (EGM) and stated that they would be provided the initial gambling stake, and that they could keep any winnings. One-hundred and twenty-five subjects, 43 male and 82 female, completed the study. Participants were aged between 18 and 79 years with a mean age of 49.2 years (*SD* = 15.6). Based on the 9-item Problem Gambling Index of Severity (PGSI, Ferris & Wynne, 2001), participants were categorised into the following groups: (a) 65 (53.7%) non-problem gambler, 29 (24%) low-risk, 18 (14.9%) moderate-risk, and 9 (7.4%) problem-gamblers. Four participants (3.2%) had not gambled in the last 12 months and therefore were not categorised according to the PGSI. The cultural backgrounds of participants included: 104 (83.2%) Australian, 10 (%) English, 4 (8.0%) Aboriginal or Torres Straight Islander, 2 (1.6%) New Zealander, 1 (0.8%) Irish, 1 (0.8%) German, 1(0.8%) Italian, 1 0.8(%) American, 1 (0.8%) Scottish, and 1(0.8%) Croatian.

The Simulated Poker Machine. The study used a laptop simulated poker machine programmed by the principal researcher in Visual Basic as a 3-reel traditional machine (see Figure 2, pg 18). The poker machine was programmed (rigged) to payoff on trials 4, 7, 13, 16, and 20. All bets placed past trial 20 were programmed as losses. Players could place bets of 25, 50 or 100 cents on each trial, and winning bets payed-off 10 times the amount bet (i.e., $2.50, $5.00 or $10.00, respectively). The laptop was setup so that the image on the screen was split to a monitor placed directly behind it and facing outwards. A camera was set-up in a position before the laptop where it could capture the screen image of the poker machine and the face of the player (participant) seated behind the monitor.

Pre-recorded videos of five and twenty-five persons watching and taking notes were recorded prior to commencement of the study (see Figure 8). The recording took place at Central Queensland University, Bundaberg, in a lecture theatre with local students helping as actors. The video of the five person audience was composed of 2 males (40%) and 3 (60%) females, ages ranging from 21 to 59 years of age with a mean age of 34 years (*SD* = 15.23). The video of the twenty-five person audience was composed of 10 males (40%) and 15 (60%) females, ages ranging from 19 to 59 years with a mean age of 33.2 years (*SD* = 16.04). All actors in the five-person recording were also included in the twenty-five-person recording. The actors were given notepad and pens and were instructed to pretend they were students in class taking notes from a lecture they were watching. Prior to the commencement of the note taking a female actor, acting as the local experimenter, walked before the group and announced to the camera: "okay, we are ready". This was setup to give the impression to the subjects that the video-feed was live. The duration of the videos was 45 minutes, although all subjects completed play prior to the end of the video.

Panel a: Audience of Five

Panel b: Audience of Twenty-five

Figure 8. Frame capture from pre-recorded videos of 5 and 25 audience members observing the gambling task.

Design and Procedure

In the experiment, participants were randomly assigned prior to their arrival to 1 of 3 conditions, including: a) 6-person audience (a 5 person video-recording plus 1 live confederate, n = 36), b) 26-person audience (a 25 person video-recording plus 1 live confederate, n = 43), or c) an Alone condition (n = 44). In the test conditions, participants were also informed that there would be a group of students from the Rockhampton campus viewing the session via a live video-feed, as well as one student on campus who would sit in on their session. They were told that these students were learning about experimental research methods. It was emphasised that the group would be able to see and hear the participant, and that they would be able to see and hear them. All participants gave permission to be watched with the exception of one, who was subsequently excluded from the data analysis for failure to follow study directions. The pre-recorded video tapes of five or twenty-five persons taking notes were used in the 6 and 26 person audience conditions, respectively (see Figure 8, pg 35). The participant was also observed by a 'live' 42 year-old female confederate, who also acted as an additional 'student' observing the experiment. The cover-story was concocted to given a reasonable explanation for why their gambling was being observed, without suggesting that their behaviour was being judged as 'good' or 'bad.' In the control condition participants gambled alone on the simulated poker machine without a confederate or faked video-conference.

Participants were given $20 as compensation for their arrival at the experimental session. After receiving their $20 compensation, subjects completed a questionnaire which included basic demographic questions, and the Problem Gambling Severity Index (PGSI, Ferris & Wynne, 2001). Participants were invited

to gamble with their $20 compensation money, and no participants refused to gamble. The experimenter retrieved the $20 compensation money prior to the start of the task. This retrieval of the compensation money was intended to give the (correct) impression that subjects were gambling with their own money. Participants were told that they could decide when they would like to quit the game by signalling the experimenter via a remote buzzer fixed to the table next to them (i.e., a wireless doorbell alarm). The experimenter left the room, retrieved the live confederate, and brought them into the room. The seat was placed in close proximity behind the participant in a position where the confederate could see his or her monitor. The experimenter then connected to the 'live-feed' of the additional students by playing the pre-recorded video of either 5 or 25 other audience members. The experimenter started the poker-machine for the subject, which was programmed with a 30 second count-down to allow the experimenter to leave the room. The confederate was instructed not to initiate conversation, and that if the participant initiated it themselves they were to keep their responses to a polite minimum.

Results

Data Analysis. The outcomes of Bet size, Speed of Betting, Trials Played and Final Payouts were analysed with ANCOVA models, each of which used Condition (Alone, Audience of 6, Audience of 26) as the independent variable, and Age and Gender as covariates.

Bet size. There was a significant effect for Condition on Bet Size, $F(2, 113) = 3.49$, $p = .03$ (see Figure 9). Tests of simple effects revealed that the Alone condition had significantly higher bet-sizes than the 26 person audience condition, $p = .01$, although other differences between conditions were not significant. The covariate of Age, $F(1,113) = 9.19$, $p < .01$, was also significant, whereby younger gamblers on

average bet larger amounts. There was no significant effect for Gender on bet size, $F(1,113) = 0.05$, $p = .82$, ns.

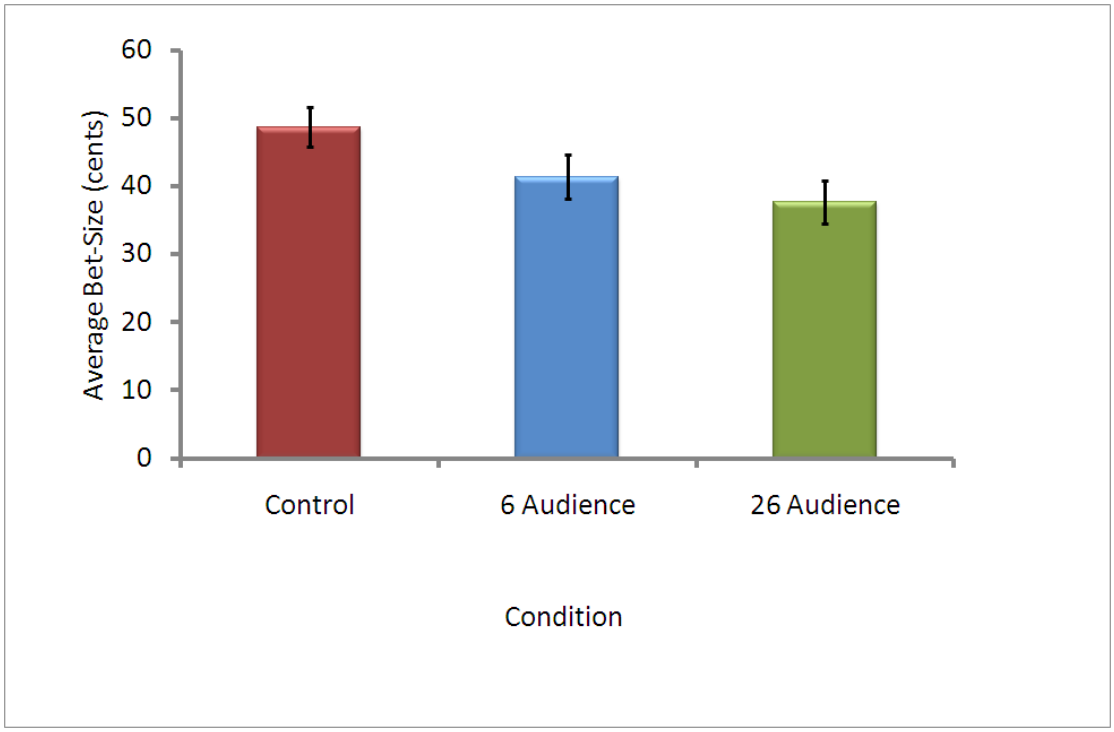

Figure 9. Bet-Size by Condition

Speed of Betting. Bets-per-minute was calculated as the average number of bets each subjects made during 1 minute of play, with higher mean scores indicating faster speeds. There was *no* significant effect for Condition on Speed of Betting, $F(2,113) = 0.38$, $p = .68$, ns. However, the covariate Age had a significant effect on Speed of Betting, $F(1,113) = 12.46$, $p < .01$, such that younger participants on average bet faster. There was *no* effect for Gender on Speed of Betting, $F(1,113) = 0.12$, $p = .73$, ns.

Trials Played. Persistence at the task was measured by the number of trials played during the entire session. There was *no* significant effect for Condition on the number of Trials Played, $F(2,113) = 2.69$, $p = .07$, ns. There was a significant effect for Age on trials played, $F(1,113) = 5.57$, $p = .02$, such that older participants on

average placed more bets before quitting. There was *no* significant effect for Gender on the number of Trial Played, $F(1,113) = 0.87$, $p = .35$, ns.

Final Payouts. Approximately one-third ($n = 42$, 34.4%) of participants ended play on the poker machine with no money remaining. As such, this variable was converted into rank-scores to make them amenable for analysis with the ANCOVA model. There was a significant effect for Condition on Final Payouts, $F(2,116) = 3.52$, $p = .03$ (see Figure 10). Contrary to predictions, tests of simple effects showed that the 6 person audience condition had higher Final Payouts than the alone/control condition, $p = .01$. There was no significant difference in Final Payouts, however, between the 6-person audience and the 26-person audience conditions.

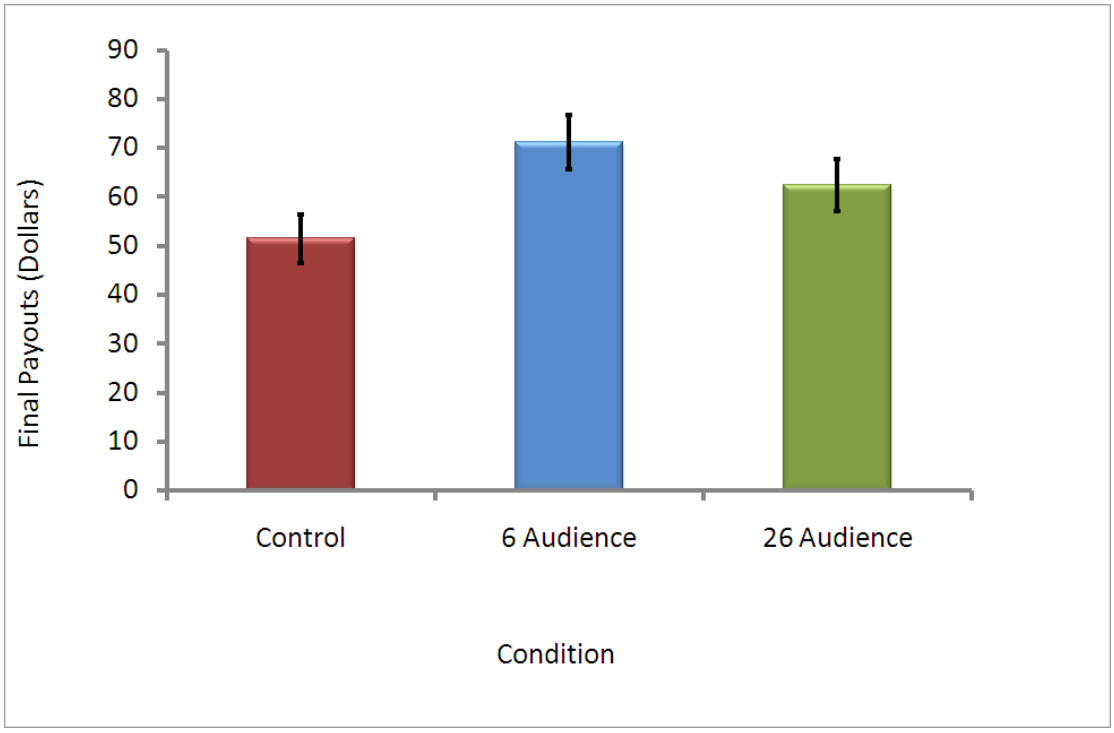

Figure 10. Final Payouts by Condition

Discussion

The results of the Audience study failed to show the predicted intensification of gambling behaviour in the presence of an attentive audience. In fact, the two

measures of gambling intensity that did show audience-effects contrarily showed that an audience moderates bet sizes and improves final payouts. Similar social facilitation effects on bet size were found in Study 1 (the co-action study), where greater numbers of other players also moderated bet size. A post-hoc explanation for Study 1's unexpected outcome was that players had a goal of maximizing 'wins' during the session that could be observed by others. The results of the present audience-study are consistent with this explanation too. Moreover, the audience-study suggests the importance of understanding the salient features of performance to which players are responding (e.g., total number of wins vs. dollar amounts won).

Drive Theory versus Control Theory

The drive theory of social facilitation, as proposed by Zajonc (1965), suggests that the presence of others creates autonomic arousal, which enhances the performance of a dominant response. As gambling is a simple task for most players, intensification of betting by all measures; including bet-size, speed of betting and trials played; was the predicted outcome based on drive theory. In contrast, control theory (Carver & Scheier, 1981) suggests that the presence of an audience causes people to conform closely to a salient aspect of performance. If we can assume that the salient aspect of performance is to 'display' the largest number of wins to an audience, then the present results are consistent with a control theory explanation for the social facilitation effect. The lack of any significant effects for speed of betting and total trials played in the audience study may simply be a consequence of a lack of salient standards for performance by the subject on these aspects of gambling. The players may not have considered faster gambling to be judged as more (or less) desirable in the presence of an audience. Likewise, quitting earlier or later in the session is ambiguous with respect to its social desirability, as quitting early admits

defeat and quitting late shows intemperance. Higher final payouts in the audience conditions relative to the control condition in this study was a natural consequence of smaller bet sizes, as the other features of play - including speed and persistence - were relatively consistent among conditions.

Limitations

Like all experimental studies, the audience study replicated only some key features of the environment that are thought to be important in real gaming venues. As a consequence, the external validity of the study is only viable if these choices were made appropriately. In this study the audience was presented as "students interested in research methods." This cover-story was intended to give minimal guidance in terms of the expectations that the subjects might have for what constitutes appropriate gambling behaviour. An audience in a real gaming venue, in contrast, may tend to be more or less encouraging of risky or intense betting by their language or behaviour, and thus might produce different outcomes.

Another important distinction in considering the expectations for social facilitation on gambling is accurately defining the concepts of 'dominant response' (in the case of drive theory) and 'salient aspects of performance' (in the case of control theory). An assumption was made that more intense gambling; in terms of larger bet-sizes, faster betting and persistence at gambling; were dominant responses. If the definition of a dominant response is the "more probable" response given peoples' skills (Zajonc, 1965, pg 149), it is not clear that betting larger amounts, gambling faster and being more persistent are necessarily dominant responses for all players. Instead, these are actions that suggest greater activity and commitment to the task. Likewise, the 'salient aspects of performance', as outlined in Carver and Scheier's (1981) Control Theory, lacks a clear means for identifying which aspects of

performance become salient to the gambler. It is a reasonable that players would be concerned to maximize the ‘number of wins’ that they can display to an audience, but this is only an assumption in the present study. Further research is needed to identify whether total wins, or some other aspect of performance, is what players are responding to by reducing bet sizes in the presence of an audience.

Implications and Conclusions

The audience-study provides some preliminary evidence suggesting that non-participating patrons who only *observe* players in a gaming venue do not appear to constitute a hazard that intensifies betting behaviour. In fact, the study suggests that observability may even provide some protection against making large bets, which in isolation tends to limit long-run losses.

The Mere-presence Study

At first glance, gambling on poker machines appears to be an asocial activity, where interaction with the machine is favoured over interactions with other players. Poker machine betting is nevertheless profoundly impacted by social forces (Rockloff & Dyer, 2007; Rockloff & Greer, 2010). Past research has indicated that information about the wins of other players magnifies gambling intensity by increasing the persistence of betting in the face of mounting losses (Rockloff & Dyer, 2007). The co-action study (see pg 11) likewise indicated increased intensity in the presence of other players in the form of gambling-persistence, betting speed and greater total losses. One component leading to the social facilitation effect is the informational content transmitted by the broadcasting of wins within the venue by way of lights and winning bells. More simultaneous players within a venue necessarily means that more wins will be broadcast within any given time period, and thus could potentially alter patrons perceptions about the likelihood of winning. Another component to social facilitation is the audience effect, whereby players are aware that their betting behaviour may be monitored by others, including both other players and non-player observers. Study 2 suggested that audience effect may inhibit rather than encourage intense gambling. Lastly, the drive theory of social facilitation suggests the possibility that the mere-presence of other people may motivate behaviour by raising arousal levels, and thereby facilitating dominant responses (Zajonc, 1965). This third ‘Mere-presence’ study examines the influence that crowds of other people have on poker-machines gambling in the absence of those other people being able to observe the actions of the gambler.

Even if other people in the gaming environment are not betting (and thus providing no information on the likelihood of winning), and cannot observe the betting of the target player (and thus do not contribute to a fear of negative appraisal), the mere-presence of other people in the gaming venue may still act to intensify individual betting behaviour. This study is important on theoretical grounds, but also has a practical interpretation. Foot-traffic unrelated to gambling is common in many commercial gaming venues. This foot-traffic results from patrons moving through the gaming area to access other amenities at the site, including restaurants and live entertainment. If mere presence intensifies betting behaviour, there is a potential to alter the design of gaming floors to limit such non-gambling related foot-traffic.

Mere-Presence

Several theoretical accounts of the social facilitation effect have included some aspects of cognitive mediation; whereby the actor adheres more closely to a salient standard of performance (Carver & Scheier, 1981), or is motivated by a need for social approval (Cottrell, et al., 1968) or is driven by distraction (Baron, et al., 1978). Zajonc, Heingartner and Herman (1969) provided convincing animal evidence that *no* cognitive mechanism is necessary to generate social facilitation effects. Using cockroaches as a model, Zajonc et al. created 'simple' and 'complex' mazes into which a torch (flashlight) was shown into one side of the maze. The cockroaches, as a dominant response, would race to a darkened chamber at the terminal of each maze. Zajonc et al. found that cockroaches ran faster when placed in a simple maze with an 'audience' of other cockroaches being in view through plexiglass. Conversely, cockroaches ran slower in complex mazes in the presence of others. Obviously, cockroaches lack the mental capacity to fear evaluation of their performance by the other animals. According to Zajonc's drive theory (1965), the 'mere-presence' other

conspecifics or members of the same species increased the drive of the animal to produce a dominant response (running to a dark chamber), rather than any more complex cognitively-mediated response.

Evidence for social facilitation effects in humans has proved more difficult, as it is hard to eliminate the possibility that humans might believe themselves to be judged on a performance-related task. Guerin (1986) identified 13 studies that adequately tested for mere-presence effect in people, and concluded that social facilitation only occurred in situations of mere-presence where others were a source of 'uncertainty' for the actor. Thus, for humans, it appears that the mere-presence of other people in the environment can sometimes – but not always - produce uncertainty. The uncertainty, by provoking a state of arousal and drive, facilitates performance on easy or well-learned tasks, and inhibits performance on complex or novel task.

Hypotheses

Gambling is an easy and well-learned task for most regular players. As such, it is reasonable to hypothesize that betting behaviour on poker machines should be intensified by the mere-presence of others, as long as that mere-presence also creates an environment of uncertainty in the gambler. Gambling intensity is defined as any marker or trace of behaviour that would contribute to long-run gambling losses. As the expected return in a commercial gaming venue is always negative, betting larger amounts, playing faster and placing more bets will contribute to greater losses in the long-run. Likewise, final payouts are a direct measure of gambling losses. In the current Mere-presence study, the participants were predicted to gamble more intensively on these measures in the presence of larger crowds of non-evaluative others.

Methods

Participants. One-hundred and thirty-two participants, including 56 males and 76 females, were recruited from newspaper-flyer advertisements in Bundaberg, Australia. The average age of subject was 52.3 years-old (*SD* = 16.7, range 18-71). The cultural background of participant included: 114 (86.4%) Australian, 10 (7.6%) English, 2 (1.5%) Assyrian, and 6 (4.5%) other (unspecified). According to the Problem Gambling Index of Severity (PGSI, Ferris & Wynne, 2001), the problem-gambling status of participants included: 58 (43.9%) non-problem gamblers, 28 (21.2%) low-risk, 31 (23.5%) moderate-risk, 8 (6.1%) problem-gamblers, and 7 (5.3%) unclassified due to incomplete questionnaires.

The Simulated Poker Machine. The study used a laptop simulated poker machine created in Visual Basic by the author (see Figure 2, pg 18). The poker machine was a traditional 3-reel design, with 3 fruits on each reel. The player had the choice of betting 25, 50 or 100 cents on each trial (spin), and payoffs were ten times the amount bet (i.e., $2.50, $5.00 or $10.00, respectively). Starting credits were $20 or 2,000 cents, and the machine was rigged with a short sequence of 5 wins in the first 20 trials (on spins 4, 7, 14, 18 and 20) with losses programmed thereafter. The theoretical maximum payout was $61.50, calculated as: $20 starting bankroll plus $50 maximum wins less $8.50 in minimum bets required. The poker machine produced the typical sounds of play, including the music of spinning reels and winning bells.

Design and Procedure. In the Alone condition, subjects were given $20 compensation, and completed a basic demographic questionnaire as well as the Problem Gambling Index of Severity (PGSI, Ferris & Wynne, 2001). Subjects in the Alone condition proceeded immediately to the poker-machine task (n = 41). By random assignment, other participants were placed in the 6-person mere-presence

condition (5 person video plus 1 live confederate, n = 43) or the 26 person mere-presence condition (25 person video plus 1 live confederate, n = 48). In the 2 mere-presence test conditions, subjects were seating alongside a 1 'live' confederate (a fake subject), who was described as participating in a separate study on 'sensory deprivation.' The experimenter stated that 'I'll be running both studies today.' Both the participant and the confederate were given $20 as compensation for their arrival at the session.

Participants were given brief instruction on how to operate the poker machine, and told that they could quit playing at any time. They were shown how to signal the experimenter from outside the room by pressing a call button fixed to the table (a remote doorbell alarm). Subjects were informed that they would receive any amounts remaining on the poker machine at the conclusion of play, and that they would receive 1 ticket in a $500 grand lottery for each $1 they have remaining on the machine at the conclusion of play.

For the benefit of the subject who was listening, the confederate (see pg 49) was told in a scripted dialog that she would be participating in a study exploring the 'effect that visual and audio sensory deprivation has on tactile tasks.' She was told that she would be wearing headphones and a blindfold so that she could not see or hear anything around her. The task was to thread beads and safety pins from a container filled with rice, and string them onto a short length of fishing line. The confederates' objective (ostensibly) was to thread as many 'beads and pins' on to the line as possible until the experimenter indicated that it was time to stop. The confederate was told that a 'group of participants on the Rockhampton campus (approx. 290 km distant) would also be doing the sensory deprivation experiment at the same time live via video-conference.'

A short questionnaire was completed by both the subject and confederate. The subject's questionnaire contained basic demographic questions as well as the Problem Gambling Severity Index (PGSI, Ferris & Wynne, 2001). The confederate completed her (fake) survey slowly to allow the real subject ample time to finish.

After the completion of the questionnaires and informed consent documents, the experimenter announced that 'we are going to start the sensory deprivation experiment first.' The experimenter told the confederate to place the blindfold over her forehead, and to wait for the experimenter to signal for her to cover her eyes and begin the task. The experimenter instructed the confederate to put on ear-plugs and full ear-covering headphones. Up-tempo classical music ("Cardio Classics – Orchestral Workout!," 2008) was played into the headphones at a volume that allowed the music to seep out. The headphones were specifically chosen to leak audio, and thus create the impression that the music was being played at high volume.

The experimenter started the fake video conference using an AccessGrid Vide-conference system (Wolfgang), which included 1 of 2 pre-recorded videos for the 'remote' site (see Figure 11, pg 49). Each video-conference session included a camera-view of the confederate and subject projected onto the wall (and thus presumably also broadcasted to the remote site). Based on an audio cue embedded in the video (a book drop), the experimenter signalled the confederate to begin the task with hand gestures, while persons in the video also began the fake sensory deprivation task. The experimenter said to the real participant: "I want you to ignore this other experiment. They can't see or hear you."

Panel a: Five in Fake Sensory-deprivation Task	Panel b: Twenty-five in Fake Sensory-deprivation Task
	

Figure 11. Frame capture from pre-recorded videos of 5 and 25 persons participating in a fake sensory-deprivation task.

The $20 compensation was retrieved from the participant, after asking: “Are you ready to gamble with this $20 on the poker machine for the chance to win up to $62 and the possibility of $500 in a jackpot draw?” These instructions were intended to create the (correct) impression that subjects were gambling with their own money. Participants were reminded that the could quit the game at any time, and would receive the full amount remaining on the poker machine in cash, as well as 1 ticket in a $500 jackpot draw for every $1 remaining on the machine. The experimenter left the room after starting the poker machine, which had a 30 second countdown to allow them sufficient time to leave.

Confederates. Due to an unanticipated lack of availability of the first confederate past June 2009, a second confederate was employed to complete data collection. The first confederate was a 44 year-old blonde female, and completed 50 sessions (including of 23 of the six-person crowd, and 27 of the twenty-six person crowd). The second confederate was a 40 year-old blonde female, and completed 41

sessions (including 20 of the six-person crowd, and 21 of the twenty-six person crowd).

Results

Data Analysis. The outcomes of Bet size, Speed of Betting, Total Trials and Final Payouts were analysed with an ANCOVA model. The independent variables included Condition (Alone, 6 person crowd, 26 person crowd) and PGSI gambling status (Ferris & Wynne, 2001), as well as the covariates of Age and Gender. PGSI gambling status was coded as 2 categories for the purposes of the analysis (no problems or 1+ problems), as there were only 8 subjects with severe gambling problems, and this range-limitation prevented a finer analysis of this variable.

Bet Size. There was no significant main-effect for Condition, $F(2,117) = 0.18$, $p = .83$, ns, or PGSI status, $F(1,117) = 1.03$, $p = .31$, ns, on the outcome of Bet Size. However, there was a significant interaction between Condition and PGSI status, $F(2,117) = 3.25$, $p = .04$. Participants with some pre-existing gambling problems bet smaller amounts in the mere-presence of confederates compared to the alone condition. In contrast, participants with no identifiable pre-existing problems bet larger amounts in the mere-presence condition compared to the control. There was *no* significant effect for either Age, $F(1,117) = 1.91$, $p = .17$, ns, or Gender, $F(1,117) = 1.24$, $p = .27$, ns, on the outcome of Bet Size.

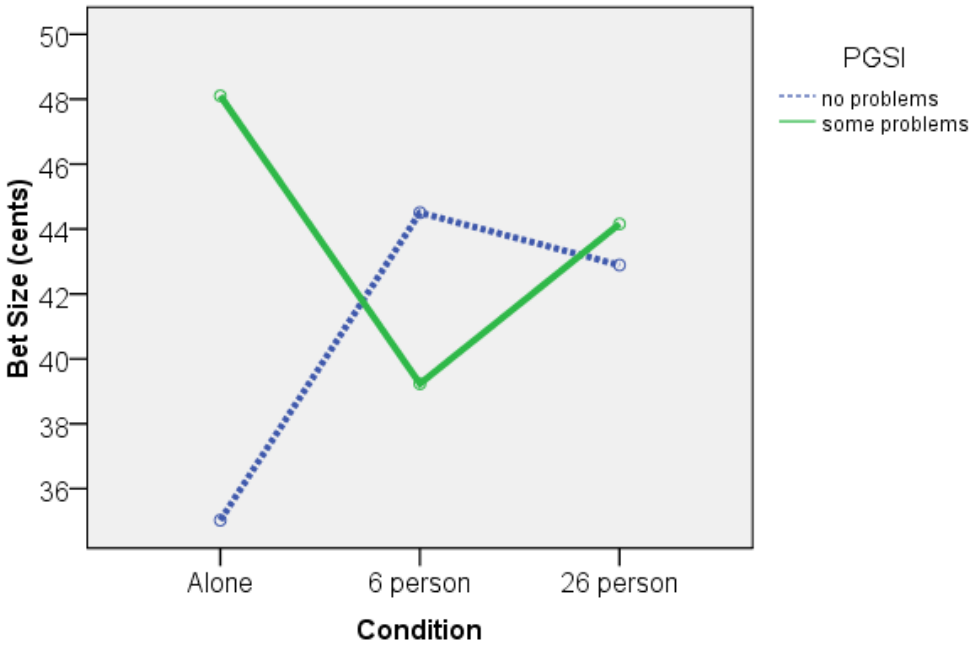

Figure 12. Bet size by Condition and PGSI problem-gambling status.

Speed of Betting. Bets per Minute was a variable calculated as the average number of bets placed by each participant in 1 minute of play, with higher means indicating faster speeds. There was a significant main effect for Condition, $F(2,117) = 5.23$, $p < .01$, on the Speed of Betting (see Figure 13, pg 52). Tests of simple effects revealed a significant increase in bet speed from the alone condition to the 6 persons crowd, $p < .01$, and a significant decrease from the 6 person crowd to the 26 person crowd, $p = .01$. There was *no* significant main effect for PGSI status, $F(1,117) = 0.04$, $p = .85$, ns, and *no* significant interaction between Condition and PGSI status, $F(2,117) = 2.12$, $p = .13$, ns. There was also no significant effects for either Age, $F(1,117) = 0.11$, $p = .74$, ns, or Gender, $F(1,117) = 0.25$, $p = .62$, ns.

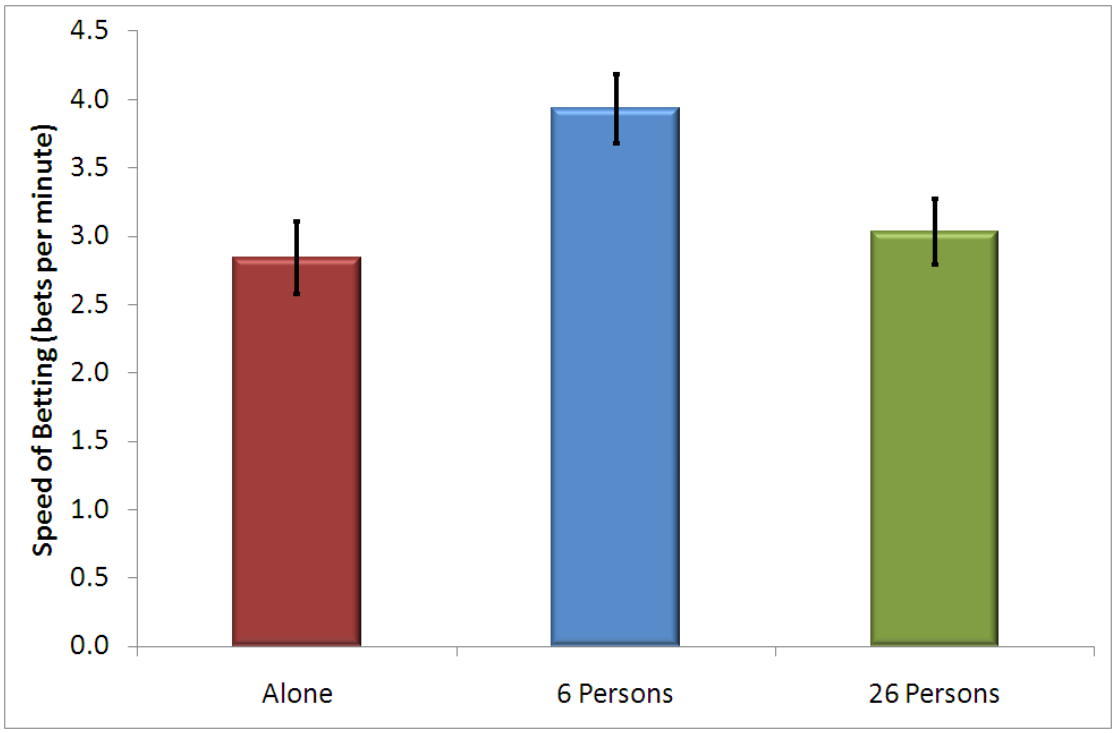

Figure 13. Speed of Betting by Condition

Total Trials. The were *no* main effects for Condition, $F(2,117) = 0.26$, $p = .77$, ns, or PGSI Status, $F(1,117) = 1.03$, $p = .31$, ns, on the Total Trials Played (or bets placed in a session). However, there was a significant interaction between Condition and PGSI status, $F(2,117) = 3.83$, $p = .02$ (see Figure 14, pg 53). Gambling persistence increased for players with some pre-existing gambling problems in the mere-presence of others compared to the Alone condition. Conversely, persistence decreased for players with no identifiable problems in the mere-presence of others compared to the Alone condition. There was a significant effect for Age, $F(1,117) = 7.83$, $p < .01$, such that older players tended to place more bets. There was no significant effect for Gender, $F(1,117) = 0.10$, $p = .76$, ns.

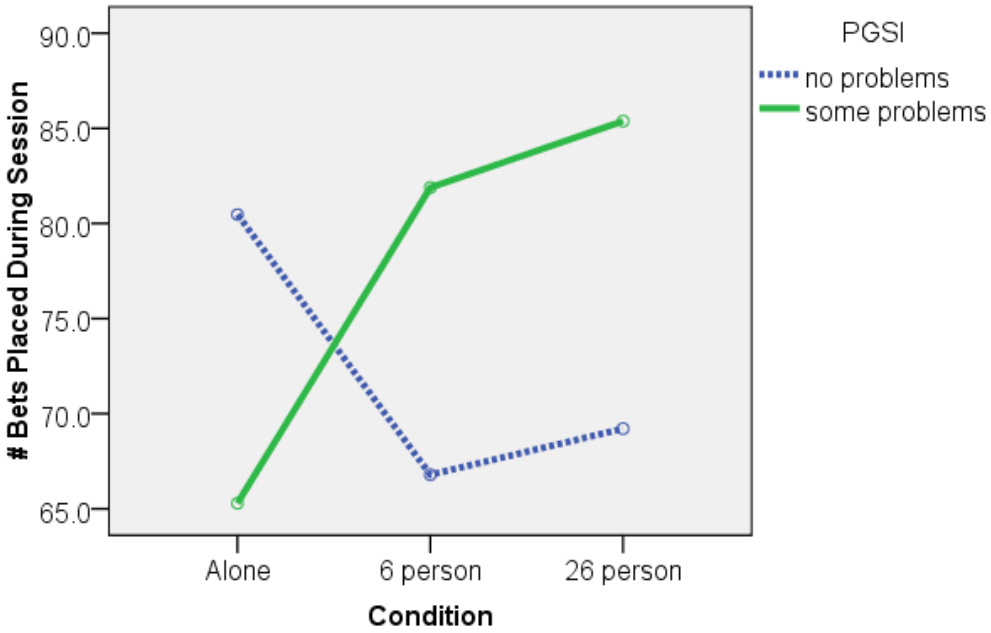

Figure 14. Total Trials by Condition and PGSI problem-gambling status

Final Payouts. There were a total of 60 (45.5%) participants who continued to play the poker machine until there were no credits remaining. As such, the Final Payouts variable was converted into rank-scores to make it amenable to analysis with the ANCOVA model. There were *no* significant effects for Condition, $F(2,117) = 3.26$, $p = .07$, ns, or PGSI status, $F(1,117) = 3.26$, $p = .07$, ns, on Final Payouts, and there was *no* interaction between these variables, $F(2,117) = 1.44$, $p = .24$, ns. However, there was a significant main effect for Age, $F(1,117) = 6.91$, $p = .01$, such that older players had lower payouts. Lastly, there was *no* significant effect for Gender on Final Payouts, $F(1,117) = 0.02$, $p = .90$, ns.

Discussion

The results of the mere-presence study did not conform well to initial predictions. The mere-presence of other people who were falsely presented as

participating in another experiment on sensory deprivation did *not* cause a uniform increase in gambling intensity among the subjects. Prior research on the mere-presence effect suggests that the mere-presence of others can cause 'uncertainty' in the actor in some situations, and that this uncertainty is necessary for social facilitation effects to occur. In the present study, mere-presence clearly had some impact on gambling behaviour, although some of the results were unexpected.

Speed of Betting. As expected, betting speed was higher in the mere-presence of 6 people compared to the alone control, which suggests some 'energizing' or arousing effect created by the mere-presence of others (see Figure 13, pg 52). Unexpectedly, however, the 26 person mere-presence condition failed to show greater speed than the Alone condition. It may be possible that the 6-person condition created more uncertainty in the subjects than the 26-person condition, because the uniformity of their actions (i.e., threading beads and pins on fishing-line) enhanced the impression that no individual would suddenly 'do something' or act out-of-character with the demands of the situation. It is also possible that a larger crowd created a greater feeling of anonymity on the part of the subject, so that the consequence of any imagined disturbance in the 26 person condition would impact on them less than a disturbance in the 6 person condition.

Bet Size. The uncertainty created by the mere-presence of others may be a source of autonomic arousal that influences betting behaviour. The results of bet-size conform well to previous work that specifically investigated the influence of autonomic arousal on bet size. Rockloff, Signal and Dyer (2007) blasted a loud 'white-noise' at players during their betting session on a similarly structured poker-machine task. In this prior study, persons with many gambling problems had lower average bet-sizes in the white- noise condition compared to the Alone control, while

those with few or no problems had higher average bet-sizes. The results of the current Mere-presence study conform closely to these prior findings. Gamblers with pre-existing problems had lower bet sizes in the mere-presence of others compared to the Alone condition, while those with no pre-existing problems had higher bet-sizes in the mere-presence of others (see Figure 12, pg 51). It is likely that a similar explanation is applicable to these results. Mere-presence, much like the white-noise event, creates autonomic arousal that influences gambling. Some of the arousal caused by the mere-presence of others can be misattributed to the gambling task (Schachter & Singer, 1962). In a study investigating imagined gambling sessions, Sharpe (2004) found that social gamblers become more aroused, as measured by Galvanic Skin Response GSR, to imagining situations in which they had won at gambling compared to imagining losses. In contrast, problem gamblers were equally aroused by imagining both wins and losses. Thus, gamblers with pre-existing problems are more likely to associate physiological arousal with losing, and thus moderate their betting accordingly. In contrast, players without problems associate arousal exclusively with winning, and therefore bet larger amounts to capitalize on this assumed luck.

Total Trials. Persistence at gambling, as measured by Total Trials (or bets placed during the session), is another feature of gambling intensity. As the poker machine was rigged with indefinite losses past the 20th trial, this variable captures persistence in the face of mounting losses. For players with pre-existing gambling problems, persistence at betting was greater in the mere-presence conditions than the Alone condition. It is possible that the greater uncertainty, and accompanying arousal, was interpreted as a signal that their luck might soon change for the better as play progressed. Contrarily, for players with no identifiable problems, gambling persistence was lower in the mere-presence conditions compared to the Alone

condition. Initial confidence, as represented by bet size, appears to dissipate with mounting losses, and players without problems quit early in the mere-presence of others.

The results for Total Trials, interpreted in term of intensity, are in opposition to those of Bet Size. Players with pre-existing problems bet small amounts in the mere-presence of others, but failed to quit as losses mounted. In contrast, players without identifiable problems bet large amounts in the mere-presence of others, yet quit early when losses began to accumulate. These two betting styles may be characterized as 'passive/avoidant' (for problem players) or 'active/deliberate' (for non-problem players). Players who bet small amounts are betting passively, and avoid the recognition of their mounting losses. Players who bet large amounts are actively choosing a high-risk option, and thus may feel more enabled to alter their strategy if it proves fruitless.

Age. Older players in the mere-presence study tended to place more bets and lose more money overall. These results were unexpected, as younger players are often cited as betting more intensely and are more likely to have gambling problems. However, the results may only reflect a peculiarity of this sample.

Limitations. As an experiment, there are limits to extending the results of the study to natural environments, such as commercial gaming venues. The abstract nature of the mere-presence condition, being a fake sensory-deprivation experiment, is clearly not representative of the exact situations experienced in real gaming environments. Instead, the research relies on a tradition of experimental realism that has proved successful in past social-psychological research. The fake sensory-deprivation experiment was introduced to create an environment where the subjects could gamble in the presence of other people, without the fear or expectation that

these others would be judging their behaviour. As such, the mere-presence study was intended to be a psychological equivalent of foot-traffic, or crowds, moving though a casino floor but not necessarily attending to the activities of gamblers. This can happen in gaming venues, where patrons move through the gaming-floor space on their way to enjoy other facilities such as dining and live entertainment.

Foot-traffic in real venues may have a larger or smaller effect on actual gambling behaviour in venues. In particular, past research has suggested that mere-presence only has an influence on the social facilitation of behaviour if those 'others' contribute to an environment of uncertainty. Foot-traffic may create larger or smaller effects on the gambler than was present in this experiment due to differences in socially-generated uncertainty.

Implications and Conclusions. Mere-presence has an influence on gambling behaviour, although the influence is not as simple as intensifying gambling on all measure of behaviour. Instead, the effects of mere-presence appear to have different influences on gamblers with- and without pre-existing gambling problems. Gamblers with pre-existing problems display a 'passive/avoidant' style of gambling in the mere-presence of others: whereby they bet smaller amounts, but are resistant to quitting while losing money. In contrast, players without identifiable gambling problems gamble in an 'active/deliberate' style: choosing to bet large amounts, but quitting early in the face of mounting losses. The results of this study suggest that changes in gambling behaviour arising from social facilitation are not solely due to informational effects (from co-actors) or evaluation by others (from an audience), but can be a consequence of the environment of uncertainty caused by the mere-presence of others in the venue who can neither see nor hear the actions of the gambler.

Report Summary

Three experiments explored the effects of social facilitation on poker-machine gambling behaviour. The first study confirmed previous research and theorizing that suggests that the presence of greater numbers of other players intensifies betting in terms of speed and persistence while losing, and thereby magnifies long-term gambling losses. The second audience-study showed that non-players who simply observe gamblers play *do not* contribute to intensification of betting. In fact, an audience may be a protective factor, particularly if players seek to make smaller bets to maximize the number of wins they can 'display' to others. Lastly, the Mere-presence study showed mixed effects on gambling that depended on the prior history of gambling problems experienced by the subjects. Gamblers with some problems played the poker machine in a 'passive/avoidant' style, betting smaller amounts in the mere-presence of others, but also being resistant to quitting as losses accumulated. Gamblers with no identifiable problems, in contrast, bet in an 'active/deliberate' style in the mere-presence of others: betting large amounts, but quitting early when experiencing losses.

Implications. These studies suggest that large gaming venues contribute to player losses, and this effect may chiefly result from the informational effect of broadcasting wins across the gaming floor (cf., Rockloff & Dyer, 2007). Furthermore, the mere-presence of a large numbers of people in a gaming environment may encourage a 'passive/avoidant' betting style in players with gambling problems. Other features of venue design must be considered in making judgements about the ideal size of a gaming venue; including accessibility, geographic distribution and responsible gaming provisions. This report suggests, however, that other factors being

equal, large venues with more patrons heighten individual losses by removing some conscious control over players' betting decisions.

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