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The Interaction of Gambling Outcome and Gambling Harm-Minimisation Strategies for Electronic Gambling: The Efficacy of Computer Generated SelfAppraisal Messaging

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The Interaction of Gambling Outcome and Gambling Harm-Minimisation Strategies for Electronic Gambling:

The Efficacy of Computer Generated Self-Appraisal Messaging

Harris A., & Parke, A.

Abstract

It has been argued that generating pop-up messages during electronic gambling sessions, which cause a player to engage in self-appraisal of their gambling behaviour, instil greater control and awareness of behaviour (Monaghan, 2008). Consideration for the potential interaction between the messaging's efficacy and gambling outcome (winning or losing) is lacking however. Thirty participants took part in a repeated-measures experiment where they gambled on the outcome of a computer-simulated gambling task. Outcome was manipulated by the experimenter to induce winning and losing streaks. Participants gambled at a significantly faster speed and a higher average stake size, which resulted in a greater betting intensity in the Loss condition compared to the Win condition. Computer generated selfappraisal messaging was then applied during the gambling session, which was able to significantly reduce the average speed of betting in the Loss condition only, demonstrating an interaction effect between computer generated messaging and gambling outcome.

Key Words: electronic gambling; fixed-odds betting terminal; harm-minimisation; selfappraisal; betting intensity.

Electronic Gambling Machines, referred to as Fixed-odds betting terminals (FOBTs) in the UK, are attracting ever increasing political and media attention in the UK, due to uncertainty surrounding these gambling platforms regarding their contribution to gambling-related harm. Approximately 13% of those who gamble on FOBTs in the UK are classified as problem gamblers, one of the highest rates

among all forms of gambling (Responsible Gambling Strategy Board; RGSB, 2013). Critics have even gone as far as to label such machines the "crack cocaine" of gambling (The Guardian, 2013). Indeed, the RGSB (2013) has advised The Gambling Commission of a number of significant knowledge gaps needing to be filled regarding such machines and their potential contribution towards disordered gambling.

Problem gambling behaviours occur when an individual gambles in a manner that exceeds their means, such as gambling more time and money than they can afford, which causes significant distress and deleterious effects on their lives, for example, neglecting family, health, hygiene, and employment (Monaghan, 2009). This highlights problem gambling as not only an issue at the individual level, but also for wider society.

Problematic Features of FOBTs

FOBTs are interactive, computerised, gambling platforms found in many licensed betting offices, casinos, and other leisure facilities (Reed, 2013). They possess inherent structural features that facilitate rapid and continuous play, as well as adopt variable ratio schedules of reinforcement that subject a player to addictive patterns of gambling behaviour (Breen & Zimmerman, 2002). In addition, FOBTs have been shown to instil and maintain irrational and superstitious beliefs, as well as distort concepts of probability and randomness that can contribute to illusions of control, which in turn act to maintain problem gambling (Ladouceur et al., 2001). Combining such features with the high maximum stakes FOBTs offer (for review see Parke & Parke, 2013), and the fact that accessibility is in abundance on the high-street (Reed, 2013), means even inexperienced and leisure gamblers are at risk of increased rate and volume of loss, irrespective of whether they would be classed as a problem gambler or not.

A variable ratio schedule of reinforcement, large stake size/prize size, as well as ease of accessibility, are not unique to FOBTs however. Indeed, maximum bet sizes and prizes in casino play and online gambling often far exceed those available on FOBTs, and a variable ratio schedule of reinforcement is applicable to almost all forms of gambling. Also, in terms of accessibility, the invention of smart

phone gambling and abundance of gambling available on the internet means accessibility is not a unique characteristic of FOBTs. Which leaves rapidity of speed of play as a stand-out feature of FOBTs when compared to 'live' gambling, which may contribute to problem gambling behaviours.

A rapid speed of play provides fewer opportunities between bets to break trancelike dissociative states that gamblers experience (Blaszczynski, Ladouceur, & Shaffer, 2004), as well as less time to consider ones decisions in an informed and controlled manner. The rapid event cycle in FOBT play also allows for a high rate and volume of loss, which is allowed to further exacerbate if one engages in loss-chasing behaviour- a core characteristic of PG (Gainsbury, Suhonen, & Saastamoinen, 2014). Loss chasing may not however, be limited to problem gamblers and there is potential for the fastpaced characteristics of FOBT play to negatively impact on recreational and less experienced gamblers.

Empirical Basis for the use of Self-Appraisal Messaging as a Harm-Minimisation Strategy

Whilst conclusive evidence is still lacking, there is a growing body of research that supports the use of pop-up messaging during play on FOBTs as an effective harm-minimisation strategy. Such messages appear on screen, deliver responsible gambling-related content, and interrupt play during a gambling session, which is why they are often referred to as 'dynamic messages' (Monaghan & Blaszczynski, 2007). This is a strikingly different approach to 'static messaging', which are messages that are fixed to the gambling-terminal itself, or require players to access a different screen to get the responsible gambling information (Monaghan & Blaszczynski 2007).

Speir and colleagues (1997) found empirical evidence that interruptions during simple tasks improves performance by focusing attention. Monaghan (2009) applied this in the context of gambling and argued electronic gambling terminals create a narrowing of attention and time disorientation and that pop-up messages may be able to draw a player's attention away from the game and allow them to better focus on other important tasks such a self-awareness during gambling and the consequences of their play. Monaghan also argued that the interruptions the pop-up messages provide means that players have an increased cognitive capacity to process the content of the message i.e. their attention is not split between the game and the message, as is the case with static messaging.

This was supported empirically by Monaghan and Blaszczynski who (2007) investigated the ability of undergraduate students to recall static and dynamic message content during a laboratory electronic gambling session. With a sample size of 92, they found 83% of participants were able to freely recall the dynamic message content compared to 15.6% for the static message content. Cued recall was also

significantly greater for the dynamic message (85.1%) compared to the static message content (24.4%). This evidence led the authors to conclude that using a dynamic mode of display would maximise the effectiveness of responsible gambling messages by allowing their content to be better processed by gamblers.

Ladouceur and Sevigny (2003) investigated the effects of forced pauses and messages which corrected erroneous beliefs relating to the chances of winning and illusions of control, in terms of their impact on gambling behaviour on video lottery terminals. Occasional gamblers were assigned to a forced pause, correcting message, or control group. They found that players who experienced pauses or correcting messages every 15 minutes played significantly fewer games during a gambling session compared with participants in the control group. This was the first study to confirm the effect of correcting messaging on persistence to gamble. The study did not however, show any differential effect between messages and pauses, and did not measure the message's impact on erroneous beliefs.

Steenberg et al's. (2004) research however, did show that delivering warning messages pertaining to erroneous thinking in an electronic roulette session, did in fact reduce erroneous beliefs in occasional gamblers, but it did not reduce the amount of money gambled. Cloutier, Ladouceur and Sevigny (2006) also showed that correcting messages, compared to pauses in play, significantly reduced erroneous thinking, but no group level effects were found in terms of the message's or pause's ability to influence gambling-related behaviour. Benhsain, Taillefer, and Loudouceur (2004) did however, simultaneously demonstrate the impact of corrective messaging on both erroneous beliefs and gambling-related behaviour. They reported that electronic roulette players, who received messages reminding them of the independence of game outcomes, showed fewer erroneous verbalisations during play *and* showed less motivation to continue to play compared to gamblers who did not receive such messages.

Recognising the large inconsistencies with messaging containing informative content pertaining to odds and statistics, in terms of their ability to actually influence in-session gambling behaviour,

Monaghan and Blaszczynski (2010, pp. 71) argued that 'interventions successful in improving participants' statistical understanding of gambling do not result in any changes to gambling behaviour'. As a potentially effective alternative, they suggested that delivering messages that directly encourage a player to self-appraise the time and money spent gambling within a session, rather than simply describing probabilities, may cause them to evaluate their behaviour in a more personally relevant manner, resulting in more considered and informed decisions relating to their gambling.

This proposition for the use of self-appraisal messaging has high face validity, particularly when considering the factors that contribute to problem gambling behaviour. Gamblers are often reported as experiencing dissociation from reality and absorption in the gambling task during gambling, which results in losing track of time and the experience of feelings of being outside of oneself (Monaghan, 2009). Gamblers also appear to be slower to respond to external stimuli and dissociate from previous thoughts and moods (Diskin & Hodgins, 1999). This overall lack of self-awareness can cause players to act in ways not previously intended, such as chasing losses and spending more money and time than they can afford (Monaghan, 2008). Measures aimed at increasing self-awareness thus appear to be a rational approach in combating and preventing problem gambling behaviours.

The effectiveness of applying self-appraisal messaging to FOBTs has received some but limited empirical support. Monaghan and Blaszczynski (2007) had participants play a lab-based, computersimulated electronic gaming machine, and participants were exposed to signs prompting them to selfreflect on time and money spent. Participants reported that these signs had a significant influence on their thoughts and behaviours and reportedly increased their awareness of how long they had been playing. Participants also stated that overall, if such messages were applied to real gaming machines they would have a similar impact. A similar study was conducted by Monaghan and Blaszczynski (2010) which examined the efficacy of self-appraisal message content in terms of its effect on selfreported gambling behaviour, and compared it to other forms of messaging. The pop-up messages in their study consisted of asking self-reflective questions such as "Do you know how long you have been playing? Do you need to think about a break?" In support of their hypotheses,

Monaghan and Blaszczynski (2010) found that self-appraisal messages, compared to informative messages and control messages, had a significantly greater self-reported effect on influencing participants' thoughts, behaviours, and awareness of time spent during a gambling session.

Asymmetrical Impact of Gains and Losses on Cognition and Behaviour

It is clear that research investigating the efficacy of self-appraisal pop-up messaging on FOBTs is extremely limited and suffers from several methodological limitations. Most notably is the use of self-report and lack of objective measurement, as self-report is often inaccurate, incongruent with actual behaviour, as well as influenced by demand characteristics (Donaldson & Grant-Vallone, 2002). Also, self-appraisal pop-up messages in these studies are often time-cued to appear every 60 minutes; a questionable policy given the fact that the intense speed of play and high-stakes FOBTs offer allows for a high volume of loss in a very short period of time.

In addition, to our knowledge, no research investigating the effectiveness of FOBT harm minimisation measures, including self-appraisal messaging, has considered the often reported differential effects outcome (winning or losing) has on affect and arousal (e.g. Leith & Baumeister, 1996), as well cognitive capacity and decision making (e.g. Yechiam & Hochman, 2013), all of which could ultimately impact on gambling behaviour. Given that various studies within psychology have shown a large asymmetry in individual's subjective responses to gains and losses (for review see Vaish, Grossman, & Woodward, 2008), it is possible an interaction effect may occur between FOBT selfappraisal messaging and outcome, in terms of their ability to influence gambling behaviour, which would have important implications for the delivery of such harm-minimisation strategies.

It is an intuitively reasonable deduction that wins and losses have opposing influences on an individual's mood and subsequent behaviour. In support of this, Isen and Geva (1987) showed that inducing positive affect made participants less willing to gamble, unless they had a very high expectation of winning. Isen, Nygren, and Ashby (1988) found that positive affect caused participants to be extra sensitive to the prospect of losing, causing them to act in ways which minimised losses as opposed maximising gains, even when the likelihood of winning was equal to that of losing. This

pattern of behaviour Isen and colleagues (1988) called 'risk aversion'. Conversely, in a series of studies, Leith and Baumeister (1996) demonstrated that bad moods accompanied by high arousal lead to impaired self-regulation, which manifested as an increase in risky and self-defeating behaviour.

McGraw, Larsen, Kahneman, and Schkade (2010) showed that participants who were instructed to imagine scenarios where they had lost or gained an amount of money, reported higher retrospective distress about losing than excitement about winning. Diary studies, such as David, Green, Martin, and Suls' (1997), also support this finding. They found greater effects of negative than positive daily events on subsequent mood the next day.

In an applied field study, Ganzach and Karsahi (1995) sent letters out to credit card owners who did not use the card for an extended period of time. The letter was either framed in terms of a loss or gain of benefits by using the card, e.g. 'If you do not use your card you will miss out on the following benefits…', versus 'using this card entitles you to the following benefits…'. Their results showed that the loss-framed letter resulted in twice as many customers starting to re-use the card compared to the gain-framed letter. This pattern of findings of the stronger effect losses have on behaviour compared to gains is robust and applicable to many forms of human behaviour, and often referred to as the 'negativity bias' (Baumeister et al., 2001).

This phenomenon is not limited to conscious psychological processes, as it has been demonstrated that losses, compared to equivalent wins, have larger effects on physiological arousal (Hochman & Yechiam, 2011). Hochman and Yechiam (2011) reported significantly larger pupil diameter and increased heart rate in response to losses compared to equivalent sized wins. Recent MRI evidence from Dong, Lin, Hu, and Lu (2013) found that the experience of loss, compared to wins in a gambling task, caused more intense activity in the right superior temporal gyrus, bilateral superior frontal gyrus, bilateral anterior cingulate, bilateral insula cortex, and left orbitofrontal cortex; areas associated with the reward system in the brain (Dong, Lin, Hu, & Lu, 2013). Of note, the increased activation in the insula is correlated with increased accuracy in subjective sense of negative emotional experience (LeDoux, 2000). Disadvantageous loss situations accompanied with negative emotion also affects the

experience of subsequent reward/punishment (Buhle & Wager, 2010), which has important implications in gambling situations in that smaller wins may fail to impact on individuals who are in losing situations, which could result in escalation of betting amounts in pursuit of that 'big' win.

As a result of such findings, Yechiam and Hochman (2013) have proposed that losses act as modulators of attention. The fact that losses are given more weighting in our decision making led Yechiam and Hochman (2013) to argue that losses create an orientating response, which is characterised by an increase in arousal that directs attention to on-task events. This could explain the robust series of findings by Leith and Baumeister (1996), that increased arousal led to destructive patterns of behaviour in loss conditions. It may have been the case that this increase in on-task attention causes the individual to consider fewer alternatives outside of the realm of the current task, and combining this high arousal with negative affect may cause individuals to act in ways that serve to provide immediate escape of negative mood-state, which in gambling would include chasing losses and escalation in betting amounts to 'get even' in the game.

This deduction is in line with work by Broadbent (1971), who showed that high-arousal narrows the attentional field and restricts information processing of peripheral information, which thus, has a negative impact on overall decision making. This cognitive narrowing, known as the 'tunnelling hypothesis', has been echoed by numerous investigations (e.g. Williams, Tonymon, & Anderson, 1990).

An additional explanatory framework that would support the prediction that outcome will have differential effects on self-appraisal efficacy is the capacity-resource theory (Chajut & Algom, 2003), which suggests that when stress occurs, attention is narrowed to the direction of whatever information is most proximal, accessible, or automatic. Thus, if losses lead to increased arousal and an orientating response, and self-appraisal messaging is made salient and the primary task by interrupting the gambling session, then it should receive more attention in periods of loss than periods of less arousing wins. So while losing may be problematic in that it narrows attention at the cost of impairing

consideration of alternative behaviours, self-appraisal messaging may be more efficacious in loss situations when processing the pop-up message becomes the main focus of attention.

Current Investigation

The current research will analyse if winning and losing cause differential effects on electronic gambling behaviour and assess the efficacy of self-appraisal pop-up messaging for differential outcome conditions. If it is found that gambling behaviour varies according to outcome and that selfappraisal messages are more effective depending on the gambler's current winning/losing experience, then rather than implementing time-cued pop-up messages on FOBTs that aim at increasing gamblers' self-awareness, as is the current proposal by the Association of British Bookmakers (ABB; 2013), it may be more effective to use algorithmic software on FOBTs that detect periods of abnormal wins/losses and implement self-appraisal messaging accordingly.

The independent variable for the initial assessment of gambling behaviour is outcome condition, which will be manipulated at two levels, Win and Loss group. The dependent variable being measured is gambling behaviour, which consists of speed of betting (measured as average number of bets placed per minute; BPM), average stake size (the average amount bet per round of gambling), and betting intensity, where betting intensity is the total amount bet on average per minute and is calculated by multiplying average stake size by BPM. These dependent variables were chosen as speed and size of betting have been used in previous investigations of pop-up messaging's impact on gambling behaviour and are often highly correlated with levels of problem gambling (e.g. Monaghan & Blaszczynski, 2010), and a measure of betting intensity allows a clear analysis of how these two components interact and gives an overall indication of potential gambling-related harm. Following initial assessment of gambling behaviour in different outcome conditions, efficacy of pop-up messaging will be assessed for the Win and Loss conditions. This will be done by comparing pre pop-up gambling behaviour and post pop-up gambling behaviour (independent variable) separately for the two outcome conditions. Gambling behaviour for this analysis is defined as the same as in the initial analysis. The following hypotheses will be tested:

H1- There will be a significant, positive correlation only in the Loss condition between round number and average stake size.

This prediction is made on the premise that negative affect will cause reckless loss chasing behaviour as the participant attempts to escape negative mood-state whilst neglecting alternative and more rational decisions. The Win condition should show a more consistent stake sizing, as participants have more control over their decisions and positive affect provides no motivation to alter behaviour.

H2- Participants will have a significantly higher speed of play in the Loss condition compared to the Win condition.

Participants will bet faster to attempt to recoup losses quickly and spend less time considering their actions between bets in the Loss condition.

H3- Participants will have a significantly higher average stake size in the Loss condition compared to the Win condition.

A higher stake size has the potential to cause more gambling-related harm and losing will cause participants to bet more in an attempt to recoup losses and escape negative mood.

H4- Participants will have a significantly higher betting intensity in the Loss condition compared to the Win condition.

Betting intensity is calculated as speed of betting multiplied by average stake size (see H2 and H3).

H5- Pop-up message will cause significant reduction in speed of play for Loss condition and not for the Win condition.

Self-appraisal reduces gambling absorption and allows alternative decisions to be considered, instilling a greater degree of control and thus, reduction in speed of play. Participant already has a greater degree of control in the Win condition, so pop-up will have less of an impact on behaviour.

H6- Pop-up message will cause significant reduction in average stake size in Loss condition and not for the Win condition.

Self-appraisal will cause participants to become aware of reckless bet sizes in Loss condition and thus reduce the average amount staked. If participants are already making sensible and safer bets in the Win condition, pop-up message will have less impact in reducing bet sizes.

H7- Pop-up message will cause significant reduction in betting intensity in Loss condition and not for the Win condition.

Prediction made based on those in H5 and H6.

Method

Participants

A sample size of N=30 was obtained for the repeated-measures experimental design. Participants were recruited via social media platforms including Facebook and Twitter. It has been consistently reported that significantly more males play FOBTs compared to females and that the modal average age category for FOBT participation is 16-24 (see British Gambling Prevalence Survey, 2007; 2010). Both of these criteria were met using the stratified sampling method, with 18 males compared to 12 females being recruited and the mean participant age was 23.8 (SD=5.81). All participants had English as their first language and had normal or corrected to normal vision. Inclusion criteria meant participants had to have experienced playing electronic gambling machines within the previous six months prior to participation. In addition, participants were all informed that the overall 'winner', which was stated as the individual with the highest score after the experiment had finished, would receive an additional £20 high-street retailer voucher.

P*rocedure and Apparatus*

Upon arrival at the laboratory, participants were told they would be taking part in two separate sessions in a gambling game, which would consist of risking their counters on the outcome of a computer simulated coin-toss. They were informed that the coin-toss outcome was randomly generated by the computer software, and at this point participants were shown a demonstration of the randomness of the coin-toss using the tool available on www.random.org, but this software was in fact not connected to the risk-taking game software. The purpose of this demonstration was to strengthen

the illusion that the gambling game was 'fair', whereas in fact the series of wins and losses the participant would experience were preprogramed by the experimenter.

Participants were randomly placed in the Win or Loss condition first, which was counterbalanced, and then were in the opposite condition for their second session. Both conditions started with a win, loss, win, loss pattern of outcome in the first four rounds to strengthen the illusion that they were playing a 'fair' game. Following this, the Win condition was pre-set to produce a 75% winning outcome, the Loss condition was pre-set to produce a 75% losing outcome.

Participants were given 100 counters and told they could risk any whole number amount between one and 100 on any trial and that they could vary their amount risked as they wished on any subsequent trials. Guessing the coin-toss correctly resulted in the amount risked being matched and added to their running total, guessing incorrectly resulted in the amount risked being deducted from their score. Their running score was read aloud by the experimenter after each trial but before the participants were asked if they would like to play again. They were told that no matter what their running score was (including a negative number) they were always allowed to risk anywhere between one and 100 counters on any trial. This was to resemble real FOBT play where a player can reload the machine with money as they see fit before the next round of betting, also to ensure that those in the Loss condition where not restricted on their maximum bet as a result of having fewer counters in front of them. Participants were informed that the two experimental sessions would be independent of the other, that is, all running scores would be reset to the original starting total of 100 counters upon start of the second session. Importantly, it was stressed that the individual with the highest score from any one session would win a £20 jackpot which would be paid in the form of high-street retailer voucher. This was to both instil within session motivation for play and motivation to return to complete the second session.

The risk-taking game was created using Superlab 4.5® software (Figure 1 below illustrates game structure). After the 16th trial, a self-appraisal pop-up message appeared on screen for a duration of 15 seconds before the next trial cycle was generated (see Figure 2 for message format). The game

played a constant sound track of casino-related noises, such as crowd ambience and the sound of slot machine bells, to better resemble a gambling environment.

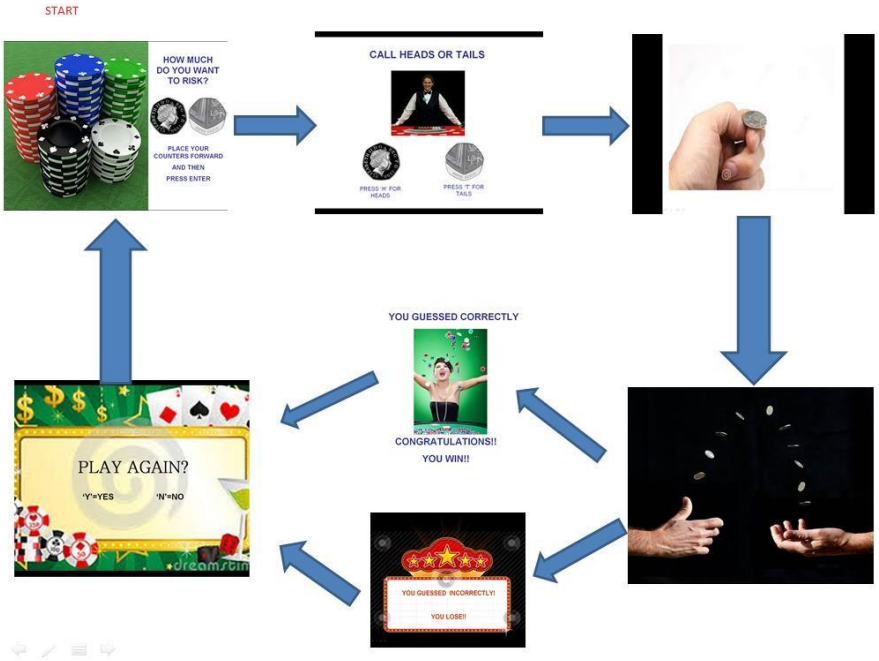

Figure 1.

Figure 2.

Throughout the game the experimenter was recording the amount of counters the participant risked in each trial, as well as recording the session duration using a stop-watch. The elapsed time was recorded both at the point the participant reached the pop-up message and/or the time elapsed when the participant chose to end the game. These recordings were used to calculate betting speed and

average stake before and after the pop-up message. Once the participants had chosen to end the game after the first session, they were asked to book in for the second session between seven and 21 days. After completion of the second session, participants were awarded their five course credit points and/or their £5 voucher. After both experimental sessions, it was stressed that participants should not communicate their score to any one they knew who was also taking part in the study, as this could affect how the other person plays and ultimately harm their chance of winning the £20 jackpot.

Results

Analyses of Gambling Behaviour by Outcome

Initially, gambling behaviour variables were assessed and compared across the Win and Loss conditions for the first 16 trials i.e. before any pop-up message was seen by a participant. This was to assess differences in baseline speed of betting and average stake size as a result of gambling outcome. A Pearson product-moment correlation coefficient was computed to assess the relationship between round number and average stake size. As predicted, a significant and strong positive correlation was found between average stake size and round number in the Loss condition, $r = .973$, $n=16$, $p<.001$. Unexpectedly however, a significant and strong positive correlation was also found in the Win condition, $r=.933$, $n=16$, $p<.001$. A scatterplot summarises these results (see Figures 3 and 4).

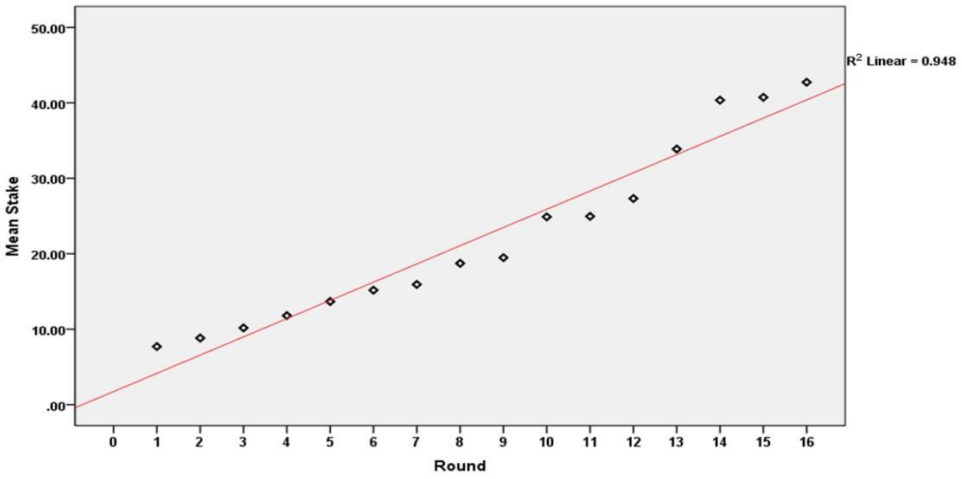

Figure 3.

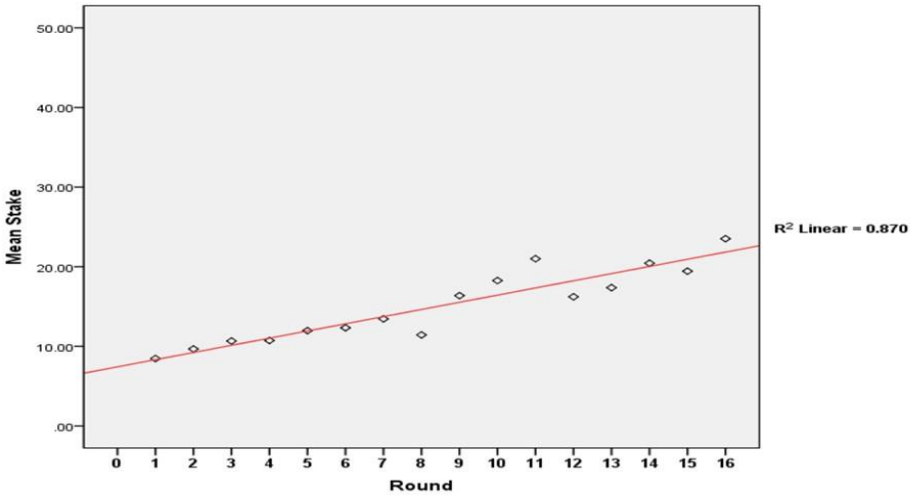

Figure 4.

Due to the repeated-measures experimental design, a series of paired-samples t-tests were conducted to compare pre-pop-up average stake size, speed of play, and betting intensity between the Win and Loss conditions. Results showed that on average, significantly more counters were risked per round in the Loss condition (M=20.76, SD=16.58) compared to the Win condition (M=14.61, SD=8.41), t(29)=2.152, p=.04 (see figure 5).

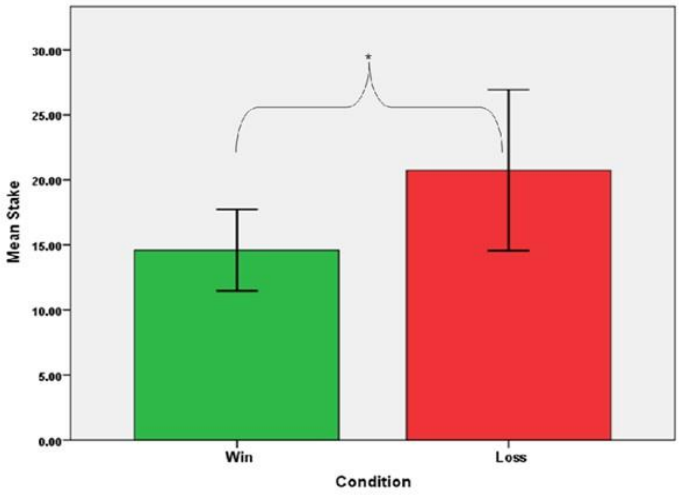

Figure 5.

In addition, results showed participants played significantly faster by placing more bets per minute in the Loss condition (M=2.95, SD=.36) in comparison to the Win condition (M=2.70, SD=.29), t(29)=3.04, p=.005 (see Figure 6).

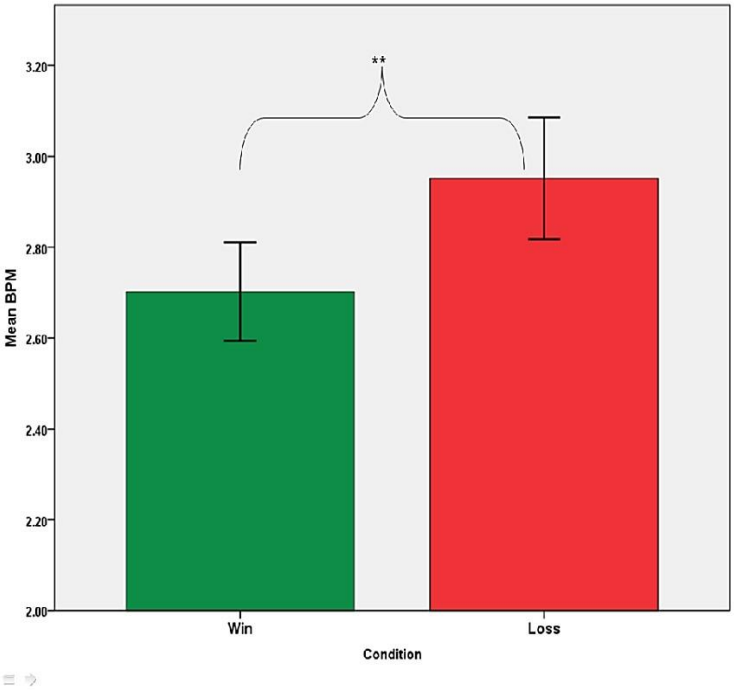

Figure 6.

Given that results showed significantly more counters were wagered on average and a higher speed of play in the Loss condition, it is unsurprising to find that betting intensity, which is a measure of average number of counters risked per minute, was significantly higher in the Loss condition (M=63.46, SD=56.71) compared to the Win condition (M=39.38, SD=22.65), t(29)=2.46, p=.02 (see Figure 7). These patterns of results are in line with the predictions that speed of play, average stake size, and betting intensity will all be significantly higher in the Loss condition compared to the Win condition, indicating more reckless and higher-risk gambling took place during periods of loss.

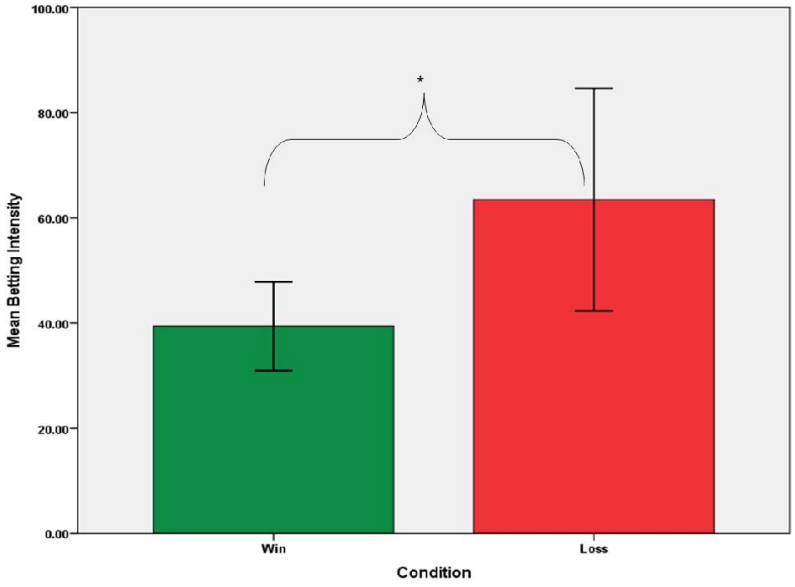

Figure 7.

Impact of Pop-Up Messaging

Following initial assessment of gambling behaviour in differential outcome conditions, the impact of the pop-up message relative to the outcome condition was examined. This required making a comparison between pre-pop-up gambling behaviour and post-pop-up behaviour and looking for

significant changes. This highlighted the impact of the pop-up message in influencing gambling behaviour in the separate Win and Loss conditions. Paired-samples t-tests were again used throughout this stage of analysis. Of note, four participants did not stay in the experiment beyond the 16th round in one or both of the conditions and thus, did not see a pop-up message and failed to provide any post-pop-up behavioural data, meaning their data could not be used to assess pop-up effectiveness, making

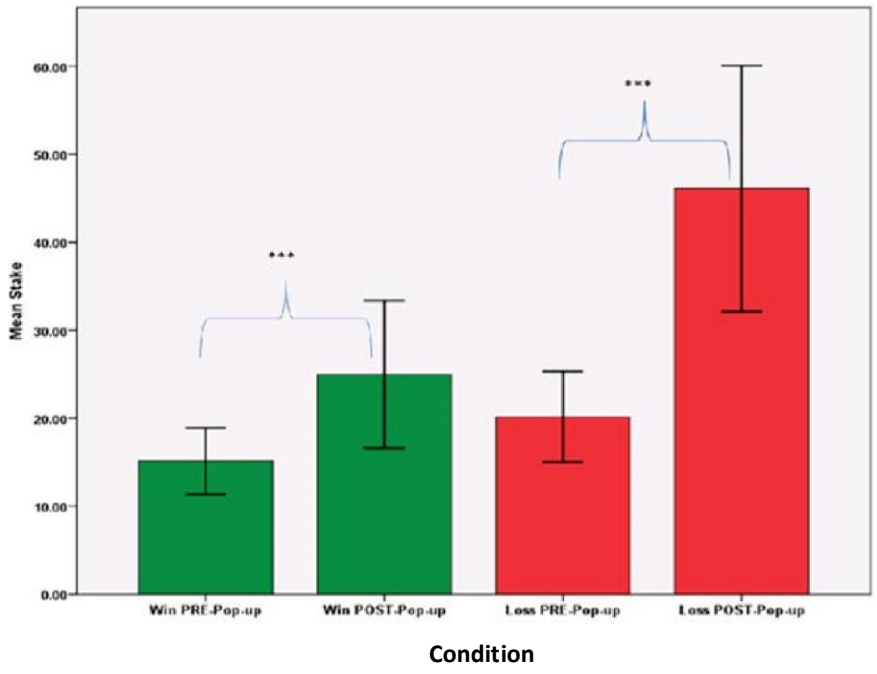

Figure 8.

the new sample size N=26.

First, pre- and post-pop-up average stake sizes were compared. In the Win condition, participants on average chose to place a significantly higher average stake *after* the pop-up (M=24.74, SD=19.86) than before the pop-up (M=14.77, SD=8.84), t(25)=3.605, p=.001. This was also true for the Loss condition, participants on average chose to place significantly higher bets *after* the pop-up message (post-pop-up M=46.67, SD=34.43) than before the message (pre-pop-up M=22.06, SD=17.39), t(25)=5.355, p<.001 (see Figure 8). This pattern of results indicates that pop-up messaging failed to reduce average stake size regardless of outcome, and in fact, average stake size continued to increase following pop-up implementation.

Pre- and post-pop-up speed of play, as indicated by BPM, was then compared for the Win and Loss conditions. A non-significant effect was found in the Win condition (pre-pop-up M=2.65, SD=.27; post-pop-up M=2.54, SD=.37), t(25)=1.647, p=.112. As predicted, a significant reduction in BPM post-pop-up was found in the Loss condition (pre-pop-up M=2.99, SD=.34; post-pop-up M=2.58, SD=.44), t(25)=3.979, p=.001 (see Figure 9). Participants during the Win condition did not change their speed of play upon implementation of the pop-up, but significantly slowed their speed of play in the Loss condition upon implementation of the pop-up.

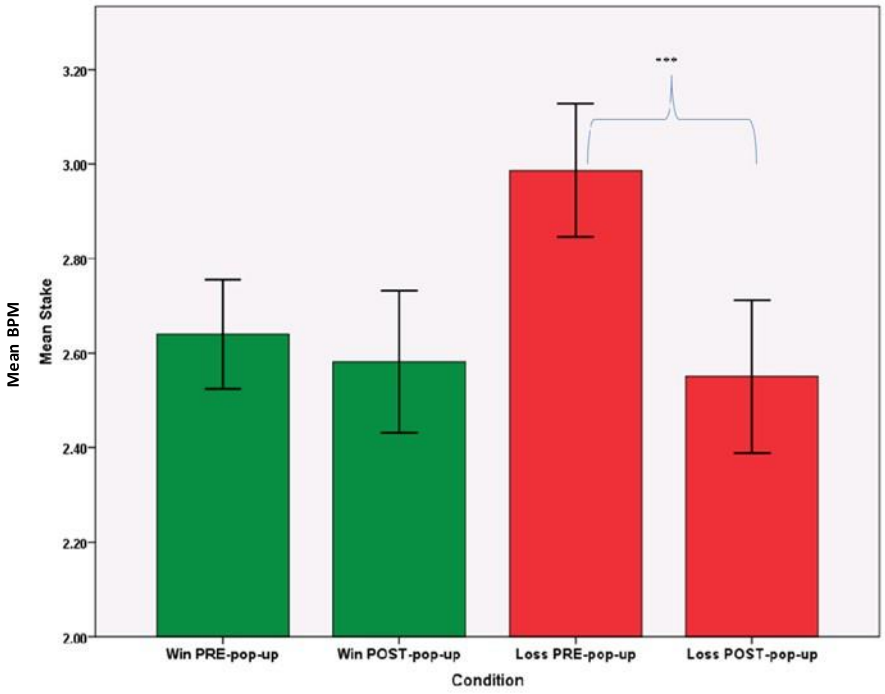

Figure 9.

Betting intensity significantly increased in both the Win and Loss condition following pop-up implementation. In the Win condition, pre-pop-up mean betting intensity was 39.08 (SD=23.36) and post-pop-up mean betting intensity was 59.92 (SD=43.55), t(25)=3.432, p=.002. In the Loss condition, pre-pop-up mean betting intensity was 68.26 (SD=59.38) and post-pop-up mean betting intensity was 121.44 (SD=100.64), t(25)=4.387, p<.001 (see Figure 10).

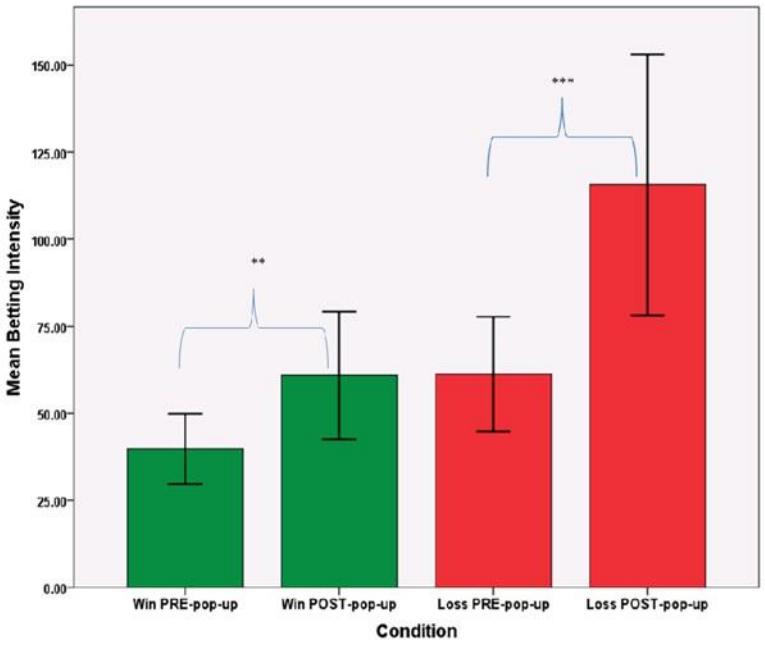

Figure 10.

Post Hocs

After initial investigations, further analysis was conducted to assess whether the amount of time spent in the game following a pop-up message varied significantly as a function of outcome group. This analysis required participants to have stayed beyond the 16th trial in both the Win and Loss condition. Six participants failed to meet this criteria, meaning the new sample size for this analysis was N=24. A paired-samples t-test showed that participants stayed significantly longer in the game following a pop-up in the Win condition (M= 6.22 minutes, SD= 2.98) compared to the Loss condition (M= 3.94 minutes, SD=3.73), t(23)=3.322, p=.003. However, due to the lack of a control (no pop-up) condition, the time stayed in the game cannot be attributed to the effect of the pop-up message itself, only to the experience of being in a particular condition.

Discussion

Key Findings

It was correctly predicted that in the Loss condition, participants would demonstrate an escalation in bet sizes over time in an attempt to chase losses. This was indicated by a strong positive correlation between round number and stake size. Chasing losses is one of the

defining characteristics of problem gambling (American Psychiatric Association, 1994), and the fact that such behaviour was clearly present in the Loss condition, despite the laboratory conditions and the possibility of participants being less emotionally involved than they would have been if they were losing real money, indicates a strong need for effective gambling intervention to prevent such behaviour when real money is involved.

The same pattern of behaviour was also, unexpectedly, found in the Win condition. It was predicted that participants would show a more consistent stake sizing, indicating a greater degree of control in their decision making during the Win condition. Hypothesis 1 is thus, not fully supported. The fact that the same patterns of behaviour were found regarding bet size escalation in both outcome conditions, suggests different mechanisms are working to produce the same behaviour. Whereas escalation in the Loss condition can be attributed to chasing losses, this is clearly inapplicable to those in the Win condition.

One explanation is that the high rate of wins experienced by participants in the Win condition caused later wins to provide diminishing returns. This is applicable to other appetitive behaviours outside of gambling such as drug taking or eating for example, where the initial dose of the drug or mouthful of food is much more rewarding that subsequent consumption (Orford, 2001). Frequent winning in gambling may reduce an individual's sensitivity to the same level of reward, which would lead to escalation in betting amounts in an attempt to receive a greater win just to provide the same level of satisfaction. Therefore, while it has been argued that winning leads to positive affect and less arousal, these factors alone may not predict increased control in gambling behaviour.

The results provide support for hypotheses 2, 3, and 4 in that participants had a significantly higher average stake size, faster speed of play, and greater betting intensity in the Loss condition compared to the Win condition. This highlights losing as having a greater

withinsession potential to produce gambling-related harm, in that individuals are risking more and giving themselves less time to consider their actions in comparison to winning situations. Because of this, effective intervention during periods of loss appears to be more critical than equivalent periods of wins.

Due to the predicted greater intensity of gambling behaviour, increased on-task attention brought about by an increase in arousal ,as well as negative affect induced by the Loss condition, it was predicted that self-appraisal pop-up messaging would significantly reduce size of betting, speed of play, and betting intensity for the Loss condition only, as those in the Win condition would already demonstrate higher levels of control and positive affect, meaning there would be little motivation to change behaviour. While hypothesis 5 was supported, in that a significant reduction in speed of play following the pop-up message was found in the Loss condition only, results failed to support hypotheses 6 and 7, in that average stake size and betting intensity were not reduced following pop-up message implementation in the Loss condition. In fact, both average stake size and betting intensity significantly increased following the pop-up message in both the Win and Loss conditions.

The fact that these two variables significantly increased in both conditions is an unexpected finding, particularly in the Loss condition. This escalation following the pop-up message could mean the message itself inadvertently caused this increase. If this were true however, then one would also expect speed of betting to significantly increase in both conditions. A more likely explanation is that the message failed to impact all aspects of gambling behaviour and did not produce a strong enough effect to curb the positive correlation between bet size and round number in both conditions. This latter explanation may have important implications for conceptualisation of FOBT harm minimisation measures more generally, in that a reduction in speed of play, while an indicator that more time is being taken to make

decisions and that self-appraisal is taking place, does not necessarily result in intentions to change size of risk.

Because speed of betting was significantly reduced in the Loss condition and was maintained in the Win condition, and yet betting intensity significantly increased in both conditions upon implementation of the pop-up message, this indicates that average stake size was the only contributing factor to this increase in betting intensity. This also has important implications for FOBT harm minimisation strategies, in that devising methods of reducing the overall average size of bets may be a more efficient approach in reducing potential gambling-related harm, as opposed to a focus on changing FOBT parameters that aim to decrease the speed of play. Reducing maximum stake sizes on FOBTs would thus appear to be an effective approach in reducing overall betting intensity.

The post-hoc analysis of time spent playing the game following the pop-up message yielded interesting findings. Participants played for 60% longer in the Win condition compared to the Loss condition. While time spent in the game did not reach 'excessive' levels, the trend of results could be exacerbated to problematic levels in 'real world' FOBT play, and so are an important finding given that excessive time expenditure is associated with problem gambling (Monaghan, 2009). It is important that such decisions to stay in the game are well informed and made consciously, as opposed to being a product of other subconscious cognitive processes. Research has consistently demonstrated that positive affect causes the assessment of elapsed time to be shorter (Droit-Volet, Brunot, & Niedenthal, 2004; Gable & Poole, 2012), which in a gambling context would mean those who are winning may spend more time gambling as a result of being impaired in their perception of time. The proposition by the ABB (2013) to implement pop-up messages reminding a player of time spent playing every 30 minutes appears then to be theoretically supported. The current research suggests this

may be especially applicable to those experiencing periods of winning, supporting the use of algorithmic pop-up implementation.

Methodological Limitations

Despite the incentive to compete for a £20 prize, participants were not as financially and thus, as emotionally invested in the game and their choice to gamble was riskless. As a result, the findings lack ecological validity in terms of how they would represent 'real world' gambling. It may be the case that had participants used their own money, then the pop-up message may have signified greater personal relevance and caused a greater level of self-reflection, resulting in a greater difference between pre- and post-pop-up gambling behaviour.

In addition, no information regarding levels of gambling experience was taken from the participants. As a result, it cannot be investigated from the current data set if there were subgroups of experienced and inexperienced FOBT players, and if so, how their baseline levels of behaviour and the effect of the pop-up message differed. It is possible that inexperienced players may pay more attention and be more cautionary towards the pop-up message, which may result in a greater change in behaviour compared to more experienced gamblers.

Finally, there are specific features on FOBTs, unmatched by the gambling game in the current research, that can ultimately influence gambling behaviour. One such factor identified by Parke and Griffiths (2007) is 'playability factor'-features such as bonus games, near misses and interactive/engaging graphics that make a game fun; features that were limited or absent in the current experiment. Also, the current gambling game had much lower volatility characteristics compared to some variations of FOBT games, where volatility is higher as a result of having less frequent but higher value wins (Parke & Parke, 2013).

These two factors alone can dramatically influence the time spent gambling, the level of risk an individual is willing to take, and ultimately produce faster rates of loss and increased harm.

Future Directions

While the methodological factors that limit the current research's external validity have been acknowledged, the findings do indicate a need for in vivo gambling research to investigate if this pattern of results is more widely applicable and indeed, if outcome can affect the efficacy of more harm-minimisation strategies in real gambling situations.

It has been assumed based on previous research findings that losses would increase arousal and thus, on task attention, which would mean the pop-up message would be more effective in loss situations when self-appraisal became the primary task. While this has received some support in terms of a reduction in betting speed during losing outcomes in the current research, arousal is assumed to be an 'inverted U' curve (Yerkes & Dodson, 1908), meaning that the loss (or indeed win) of real money in real gambling environments could have been more emotionally and physiologically arousing, which may cause gamblers, particularly problem gamblers, to surpass the levels of optimal arousal, meaning the pop-up message may scarcely be processed, which would fail to impact future decision making.

This differential effect of outcome on self-appraisal efficacy may thus need to be assessed independently with groups of problem and non-problem gamblers, whose baseline levels of arousal and response to winning and losing may be quantitatively different. Combining and learning from theories of arousal and affect may demonstrate pop-up messaging to be ineffective as a strategy to reduce problem gambling behaviour, and may in fact work better as a prevention tool to stop recreational gamblers developing levels of problematic gambling behaviour. If this is the case, then other strategies may need to be implemented that target those gamblers already demonstrating problematic levels of behaviour. While the ABB

(2013) have proposed the use of pop-up messages that appear when voluntary monetary limits are reached, this may be inefficient if the message is not fully processed and its importance not realised. A more effective strategy may be to allow gamblers to pre-set gambling limits, and instead of reminding them when they have reached such a limit and offering the chance to continue to play, the FOBT could end the session automatically upon exceeding such limits. This proposal is advantageous, as no matter what the gamblers state of arousal and thus, their ability to make informed decisions during the gambling session, the machine takes this decision out of the player's hands.

Conclusion

The current research highlights the differential effects outcome has on gambling behaviour, pointing towards an increased intensity and recklessness during periods of loss compared to wins. This would indicate harm minimisation strategies would be best implemented using algorithmic software that detects such periods of loss as opposed to a time-cued intervention, to help curb escalating trends in betting size and intensity, as well as to instil a greater sense of control in the gambler. However, to a lesser extent, escalating betting trends were also found in winning conditions, and while the participant was not losing, this could instil higher normative levels of gambling in individuals, meaning both extremes of loss and extremes of winning can be problematic, and algorithmic detection of such scenarios could help address both, by implementing harm-minimisation interventions before problematic behaviours occurring.

Self-appraisal messaging however, may be an ineffective means of influencing gamblingrelated behaviour in extended periods of wins and losses. Its only impact was to reduce overall speed of betting during periods of loss, and despite this, failed to reduce overall betting intensity. As a result, it has been suggested that measures that reduce size of maximum stakes may be a more effective means of reducing betting intensity and overall

levels of harm. The current research also supports the use of algorithmic win/loss detection for harm minimisation in that wins were found to keep the gambler playing longer. Thus, pop-up messaging that focuses on time spent during periods of wins may be of greater relevance in such scenarios, indicating a future area of investigation.

Finally, it is important the current research is extended to more ecologically valid situations, that its findings are tested for both problem and non-problem gambling populations, and that its findings that outcome significantly influences behaviour are considered when assessing the effectiveness of harm-minimisation strategies more generally.

All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000 (5). Informed consent was obtained from all patients being included in the sudy.

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Figure 1. Electronic Gambling Game Structure. Interactive coin-toss game consisted of gambling graphics accompanied by sound effects and background ambience. Outcome was manipulated by the experimenter. Game cycle only refreshed if participants selected yes to the prompt 'would you like to play again'?

Figure 2. Self-Appraisal Pop-Up Message Format. After the 16th round, a self-appraisal pop-up message appeared on screen for a duration of 15 seconds. The message took up the whole screen and had a 1inch red boarder with a 2x0.5 inch gold-coloured exclamation mark in the top left hand corner, designed to be attention grabbing and indicate that the message was delivering a 'warning' (measurements taken from 15inch laptop screen). The message was created using Microsoft PowerPoint® and contained size 36, all capital lettered, bold, black, text in Calibri font style . The content of the message was designed to engage

participants in self-appraisal of their risk-taking behaviour.

Figure 3. *Scatterplot Illustrating Correlation Between Average Stake Size and Round Number for Loss Condition.* Line indicates best fit, r = .973, p<.001.

Figure 4. *Scatterplot Illustrating Correlation Between Average Stake Size and Round Number for Win Condition.* Line indicates best fit, r = .933, p<.001.

Figure 5. *Pre-Pop-Up Comparison of Mean Stake Size.* Prior to implementation of pop-up message, on average, significantly more counters were staked in Loss condition compared to Win condition (* indicates significance at .05 level. Error bars signify 95% confidence interval).

Figure 6. *Pre-Pop-Up Comparison of BPM.* Prior to implementation of pop-up message, on average, participants played significantly faster in the Loss condition compared to the Win condition (**indicates significance at .01 level. Error bars signify 95% confidence interval).

Figure 7. *Pre-Pop-Up Comparison of Betting Intensity.* Prior to implementation of pop-up, on average, participants demonstrated a significantly higher level of betting intensity in the Loss condition compared to the Win condition (* indicates significance at .05 level. Error bars signify 95% confidence interval).

Figure 8. *Pre- and Post-Pop-Up Comparisons of Mean Stake Size by Outcome Condition.* Average stake size increased after pop-up implementation regardless of outcome (***indicates significance at .001 level. Error bars signify 95% confidence interval).

Figure 9. *Pre- and Post-Pop-Up Comparison of Mean BPM by Outcome Condition.* Pop-up message had no significant effect on speed of play in Win condition but significantly reduced speed of play in the Loss condition (*** indicates significance at .001 levels. Error bars signify 95% confidence interval).

Figure 10. *Pre- and Post-Pop-Up Comparison of Mean Betting Intensities by Outcome Condition.* In both conditions, following implementation of pop-up message, participants had a significantly higher betting intensity (** indicates significance at .01 level, *** indicates significance at .001 level. Error bars signify 95% confidence interval).