Impact of Mode of Display and Message Content of Responsible Gambling Signs for Electronic Gaming Machines on Regular Gamblers

Sally Monaghan · Alex Blaszczynski

Abstract   Harm-minimization strategies aim to reduce gambling-related risks; however, minimal evidence supports the effectiveness of current strategies involving the placement of warning signs in gambling venues and on electronic gaming machines (EGMs). This qualitative replication study evaluated the differential effect of pop-up messages compared to static signs and the content of messages on EGMs on recall, thoughts, and behaviors assessed during the session and at 2-week follow-up. In Study 1, 127 regular EGM gamblers (male = 97, mean age = 20.3) recruited from a university student population attended a laboratory where they were randomly assigned to play a computer-based simulated EGM analogue displaying signs that differed by (a) mode of presentation (pop-up and static) and (b) message content (informative, self-appraisal, and control/blank). In Study 2, an identical methodology was used but included the use of a simulated EGM within an in vivo gaming setting with 124 regular EGM players (male = 81, mean age = 44.1). Results from both studies showed that pop-up messages were recalled more effectively than static messages immediately and at 2-week follow-up. Pop-up messages reportedly had a significantly greater impact on within-session thoughts and behaviors. Messages encouraging self-appraisal resulted in significantly greater effect on self-reported thoughts and behaviors during both the experimental session and in subsequent EGM play. These findings support the effectiveness of pop-up messages containing self-appraisal messages as an appropriate harm-minimization initiative.

Keywords   Responsible gambling · Warning signs · Electronic gaming machines · Pop-up messages · Problem gambling

Introduction

Gambling is a popular recreational activity with annual adult participation rates for Australia, Canada, Europe, Hong Kong, New Zealand, Puerto Rico, South Africa, the UK,

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and US estimated to range from 65 to 95% (Abbott et al. 2004; Azmier 2001; Petry 2005; Shaffer et al. 2004; Volberg and Vales 2002; Wardle et al. 2007; Welte et al. 2002). Gambling participation rates have grown in response to the expansion of gambling opportunities with worldwide legalized gambling revenue predicted to exceed US$100 billion by 2010 (Price Waterhouse Coopers 2005). While the majority of individuals gamble within affordable limits, approximately 1–2% meet criteria for pathological gambling (Productivity Commission 1999; see reviews by Abbott 2007; Petry 2005; Stucki and Rihs-Middel 2007), a condition associated with significant distress and disruption to individuals, families, communities and society.

In response to severe adverse psychosocial consequences of and reported prevalence rates of pathological gambling, governments have recommended codes of conduct and/or legislation designed to promote responsible gambling (Independent Pricing and Regulatory Tribunal of New South Wales 2004; Productivity Commission 1999). Although poorly defined, responsible gambling refers to the concept of consumer protection (harm-minimization) achieved through attempts to restrict a gambler's expenditure of time and money to within affordable limits (Blaszczynski et al. 2005; Breen et al. 2005; Hing 2004). The premise is based on the assumption that community members choose their levels of involvement but governments and gambling operators retain a duty of care or some measure of responsibility in protecting participants from harm (Blaszczynski et al. 2004; Delfabbro 2008).

Research indicates that, similar to alcohol use, there is a continuum of risk associated with gambling with the nature and severity of experienced harm being functionally related to frequency and level of expenditure (Currie et al. 2006; Schaffer 2005). Recent evidence also suggests that problem gambling is not a chronic condition but dynamically shifts across low, medium, problem, and pathological levels over time with high rates of spontaneous remission from problem gambling (Abbott 2007; Abbott et al. 1999; Echeburua et al. 1996; Hodgins and el-Guebaly 2000; Slutske et al. 2003). Therefore, these findings suggest that harm-minimization initiatives targeting the full spectrum of participation are appropriate if the incidence and ultimately the prevalence, of problem gambling and gambling related harm is to be achieved.

Electronic gaming machines (EGMs; reel based slot-machines, poker-machines, VLTs, and card-based video-draw-poker and blackjack) have attracted special consideration as priority targets for responsible gambling policies. This is because inherent EGM structural features are found to allow rapid continuous play, utilize variable ratio schedules of reinforcement that readily induce addictive patterns of play (Breen and Zimmerman 2002). EGMs also foster irrational and superstitious beliefs, erroneous concepts of probability, randomness and mutual independence that contribute to illusions of control and the maintenance of problem gambling (Ladouceur et al. 2001). Finally, EGM play has been found to produce dissociative states (including losing track of time, going into a trance-like state, feeling like a different person, experience blackouts, and feeling 'outside' oneself (Powell et al. 1996) during play. That EGMs have a greater propensity for problem gambling compared to other forms is evidenced by the fact that this form accounts for a disproportionate amount of government gambling revenue (Productivity Commission 1999), and is reported to be the primary source of problems for 75 and 90% of treatment seeking gamblers (Delfabbro 2008; Morgan et al. 1996). In this context, given increased levels of irrational thoughts (Gaboury and Ladouceur 1989; Walker 1992) and disassociation (Powell et al. 1996), strategies aimed at enhancing self-awareness by drawing the gambler's attention to their current situation and encourage appropriate behavioral modification may effectively facilitate responsible gambling.

In an effort to reduce harm, some public health policy decision-makers recommend legislating for the mandatory display of signs on EGMs designed to inform players about probabilities and to warn of potential addictive qualities (Productivity Commission 1999). The rationale is predicated on the purported effectiveness of signs found in other public health lifestyle domains, for example, smoking and alcohol consumption, despite minimal evidence demonstrating the effectiveness of such campaigns in modifying drinking or smoking behaviors (Fischer et al. 1993; Hankin et al. 1993; Krugman et al. 1994; Mazanov and Byrne 2007; Parker et al. 1994). The concept of harm reduction has been increasingly used in responsible gambling strategies for EGMs with various definitions utilized (see Cantinotti and Ladouceur 2008). For the present study, harm-minimization is defined as any strategy that is intended to reduce the risk of negative social and personal consequences associated with EGM play without necessarily requiring abstinence (but without ruling out abstinence in the longer-term, if this is the player's choice) (Blaszczynski et al. 2001).

With respect to gambling, and consistent with the substance use field, available evidence suggests that the majority of community members are aware of problem gambling issues and notice signs displayed in venues (Rodda and Cowie 2005). Hing (2003) found 86% of 954 gamblers surveyed in Australia were aware of risks related to gambling, although fewer (67%) reported noticing signs displayed in the venue; percentages that are similar to that reported in a Canadian study (Focal Research 2004). However, although community members may be aware of and notice signs, there is minimal data describing the extent to which the information shown is retained in memory and its effects on gambling thoughts or behavior (Monaghan 2004; Steenbergh et al. 2004; Williams and Connolly 2006).

In a laboratory-based study using university students only 15.6% of participants were found to be able to freely recall the content of signs displayed on machines immediately following play (Monaghan and Blaszczynski 2007). In Hing's (2003) self-report study, despite the stated awareness of signs and responsible gaming policies, few gamblers indicated that these signs were sufficiently effective in modifying their behaviors. These studies suggest that current responsible gambling signs are not recalled or comprehended, do not influence thoughts, and, as such are ineffective in modifying player behavior or reducing harm.

To be effective, warning signs must engage the gambler's cognitive, emotional, and motivational faculties in a manner that will increase their likelihood of evaluating their duration and intensity of play (Delfabbro 2008). Therefore, there is a need to determine the optimal method and content of messages that will maximize the likelihood that gamblers will not only become more fully informed of attendant risks of gambling but alter behaviors to translate awareness into behavioral change.

At a minimum, responsible gambling signs need to readily and easily attract attention, contain relevant and personally meaningful information, and suggest some course of action or precaution to avoid harm. Research has demonstrated that physical attributes (color, size, and images), display in prominent locations, presence of movement or action, and capacity to interrupt primary tasks that captivate attention, are all features that individually or in combination increase recall of information and impact on cognitions (Bailey et al. 2001; Bartram 2001; Clark and Brock 1994; Johnston and Dark 1990).

Taking these attributes into consideration, it is logical to postulate that moving 'dynamic' signs scrolling across the screen of an EGM, or pop-up boxes similar to that displayed on computer software programs (e.g., Microsoft Windows™), represent an ideal method of attracting attention to responsible gambling messages during actual play. In support, a laboratory study by Monaghan and Blaszczynski (2007) found

dynamic signs presented during but without interrupting play were freely recalled by 83.0% of participants compared to 15.6% of participants recalling static signs. Similarly, several other venue and laboratory-based studies have reported data suggesting potential positive outcomes of pop-up signs on EGM screens during breaks in play in modifying thoughts and behaviors (see Monaghan 2008; Cloutier et al. 2006; Floyd et al. 2006; Ladouceur and Sevigny 2003; Schellink and Schrans 2002). Following these findings, several jurisdictions including provinces in Canada, Australia and New Zealand have approved the display of pop-up messages on EGMs. However, research to date is limited by non-representative small samples and failure to control extraneous variables resulting in further research being required to evaluate the efficacy of pop-up signs.

A further important attribute of signs, but one that has received limited consideration, is the actual content and personal relevance of the message conveyed. Current messages informing players of odds and probabilities are based on the premise that knowledge in itself is sufficient to influence decision making in gambling. However, research suggests that effectively communicated knowledge does not modify irrational beliefs or erroneous estimations of the chances of winning (Monaghan 2004). These results are also consistent with studies demonstrating that interventions successful in improving participants' statistical understanding of gambling do not result in any changes to gambling behaviors (Steenbergh et al. 2004; Williams and Connolly 2006). An alternative may be to deliver messages that directly encourage the player to self-appraise the time and money spent gambling within a session rather than simply describing probabilities (see Monaghan and Blaszczynski in press). Through self-appraisal, players may be able to evaluate their behavior in a more personally relevant manner resulting in more considered informed decisions to cease or continue sessions of play.

This research therefore aimed to: (a) investigate the effectiveness of pop-up messages appearing on EGM screens during a forced break in play compared to mandated static signs and (b) determine the optimal content for harm-minimization messages by comparing informative messages designed to inform players of the chances of winning or correct irrational beliefs, messages designed to encourage self-awareness, and control signs bearing no messages. The specific objective was to evaluate the impact of harm-minimization signs on immediate and longer-term gambling-related thoughts and behavior of regular EGM players.

To achieve these aims a two-stage research plan was used; the first study was conducted in a laboratory to minimize possible extraneous variables, with the second study conducted in a gambling venue to replicate results and increase external validity.

The following hypotheses were tested:

1. Pop-up messages appearing on screen during a forced break in play would:

   a. Be recalled more often and more accurately than static messages.
   b. Influence thoughts and behavior during play and in subsequent EGM sessions to a greater extent than static messages.

2. Messages encouraging self-appraisal would have a greater impact on thoughts and behavior during play and in subsequent EGM sessions than informative and control messages.

Study 1

Introduction

The first study, conducted in a laboratory, used a sample recruited from an undergraduate population. This study was designed to control for extraneous variables such as the effects of alcohol, peer, and environmental influences. The recruitment of undergraduate students also enabled the impact of harm-minimization strategies on young adults, given that this group has been identified as being at greater risk of the development of gambling-related problems than any other age cohort (Gupta and Derevensky 2000; NSW Office of Liquor, Gaming and Racing 2007; Productivity Commission 1999).

Method

Participants

Participants were 127 regular (at least once every 2 weeks) EGM gamblers. An a priori power analysis showed that for a large effect size, with α error probability of .05 and power of .95, a total sample size of $N = 70$ would be required, indicating the current sample was sufficient to detect large between group differences. A large effect size was desired to ensure that the degree of difference between measured variables was large enough to be of practical significance (Morse 1998). Participants were recruited via two means: 66.9% ($n = 85$) were first year psychology students recruited through a standard university online undergraduate credit course research pool; and a further 33.1% ($n = 42$) were recruited through advertisements placed on university casual employment websites. The latter participants were compensated AUD$40 for their involvement.

The majority of participants were university students (89.8%, $n = 114$), with the remainder in full-time (2.4%, $n = 3$) or part-time employment (7.9%, $n = 10$). Of the sample, 76.4% ($n = 97$) were male and 23.6% ($n = 30$), female. The mean age was 20.3 years (range = 17–29, SD = 2.5). Of the sample, 15.6% ($n = 19$) were classified as problem gamblers on the Canadian Problem Gambling Index (CPGI; Ferris and Wynne 2001). There were no significant baseline demographic differences found between subjects, according to method of recruitment.

Design

The University of Sydney Human Research Ethics Committee approved this study. Upon arriving at a prearranged experimental session at the university, participants completed an initial pre-test questionnaire to obtain a baseline measure of gambling behavior and estimates of chances of winning, and the Gambling Related Cognitions Scale (GRCS; Raylu and Oei 2004). Participants were then requested to play a computer-based simulated EGM displaying one of several warning signs described below. Although no money was used due to ethical constraints, participants were encouraged to play as if using a real EGM, and simulated machines were preloaded with sufficient credit to allow continual play. A 2 × 3 between-subjects factorial design was used as shown in Table 1. Participants were randomly assigned by pre-determined ballot to one of two modes of presentation and one of three message contents:

Table 1 Number of participants in each condition in Study 1

	Content type			Total
	Informative	Self-appraisal	Control	
Mode				
Static	24	27	13	64
Dynamic	26	24	13	63
Total	50	51	26	127

Mode of Presentation

1. *Static messages*: Static messages were placed on the side of the screen in a red-bordered box with message contents written in bold black text. An example of the static informative messages is displayed in Fig. 1.
2. *Pop-up messages*: Pop-up messages appeared in the middle of the screen taking up approximately 2/3 of the screen and remained visible for 15 s during which play was paused. Similar to the static messages, pop-up messages appeared in a red-bordered box and the message written in bold black text. The message appeared approximately once every 3 min between games. An example of the pop-up self-appraisal messages is displayed in Fig. 2.

Message Content

1. *Informative messages:* Informative messages were designed to inform participants of the chance of winning the major prize or the nature of the game. Participants saw either a sign stating "Your chances of winning the maximum prize are generally no better than one in a million" or "All outcomes are randomly determined by chance".
2. *Self-appraisal messages:* Self-appraisal messages were designed to encourage participants to reflect on their current within session behavior, and consider if they needed to take a break. Participants saw either a sign that said "Do you know how long you have been playing? Do you need to think about a break?" or "Have you spent more than you intended? Do you need to think about a break?"
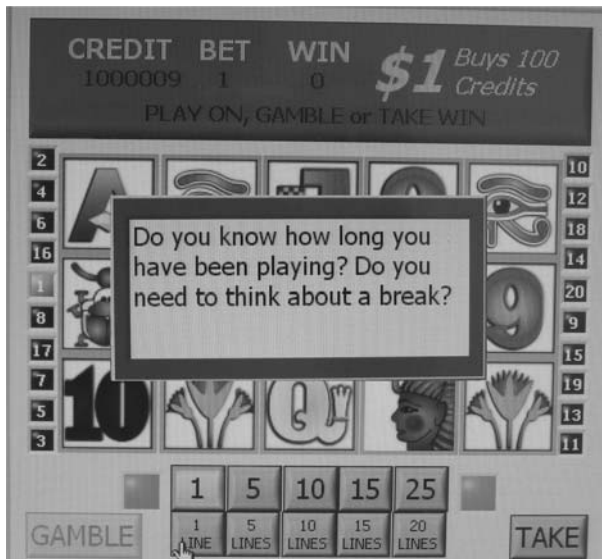

Fig. 1 Static informative message

Fig. 2 Pop-up self-appraisal message

3. *Control messages:* Control signs had the same physical attributes as the experimental signs but contained no text. These blank signs were designed to act as a control to determine whether simple exposure or break in play would modify gambling-related thoughts or behavior.

Analysis showed no significant baseline differences between groups based on pre-test variables indicating that the process of randomization was successful. Participants were instructed to play until they wished to stop, or were stopped by the experimenter after 10 min of play. The majority of participants (85.8%) continued play and no significant differences were found based on this variable.

Participants were given a post-test pencil-and-paper questionnaire on completion of play. This measured free and cued recall by asking participants to write down the content of any messages seen during play (free recall) and to indicate (yes/no) whether they recalled seeing a sign during play and whether they recalled the message content (cued recall). Participants indicated (yes/no) whether the sign had affected their thoughts and behaviors during play and if so, to write down how the sign had affected them. Similarly, participants were asked to estimate whether similar sign displayed on real EGMs would influence their actual play. Participants were then requested again to estimate their perceived chances of winning and completed the GRCS, as in the pre-test questionnaire. Participants were sent a follow-up questionnaire 2 weeks later. This was very similar to the post-test questionnaire and designed to elicit changes in play, free and cued recall, effect of signs on post-experimental EGM play, estimated chances of winning, and the GRCS. At follow-up, participants were also asked to complete the CPGI.

Materials

Baseline Questionnaire The authors designed the baseline questionnaire specifically for this study and its formal psychometric properties have not been evaluated. It was printed

professionally in the form of a colored 12-page, A5 booklet to increase the legitimacy of the research, and was administered as a paper-and-pencil questionnaire. The first nine items consisted of specific questions regarding the participant's EGM play over the 2-week period immediately prior to the experimental session. These included self-report items of how many sessions, total expenditure, wins and losses, time in total and average session length, and average number of breaks per session. Participants were then asked to estimate, by indicating on a 0–100 point Likert scale the chances of winning, losing, breaking even, and winning the maximum prize. The booklet included the GRCS followed by items eliciting demographic information as reported above. The questionnaire took approximately 15 min to complete.

Gambling-Related Cognitions Scale (GRCS; Raylu and Oei 2004)   The 23-item GRCS assesses five types of gambling-related cognitions accounting for 70% of the total variance in scores from a community-based population (Raylu and Oei 2004). The five factors based on previous studies (Toneatto 1999; Toneatto et al. 1997), included illusion of control, predictive control, and interpretive bias as well as those consistent with gambling-related expectancies and perceived inability to stop gambling. The GRCS total score and subscales have the ability to discriminate between non-problem and problem gamblers among non-clinical populations and have demonstrated good psychometric properties (Raylu and Oei 2004).

Post-Test Questionnaire   The post-test questionnaire was similar in design and administration to the baseline questionnaire taking approximately 10 min to complete. Participants were requested to freely recall the sign seen during play, and respond to cued recall questions (yes/no) of whether they recalled seeing the sign, and the content of the sign. Participants were asked (yes/no) whether the sign had any impact on their thoughts or behavior during play, and whether it would affect their play in any way if the sign was present on real EGMs. If they indicated 'yes' they were requested to elaborate on their response. Participants were then asked to indicate (yes/no) whether the sign had influenced specific thoughts (e.g., estimations of winning, awareness of time spent playing) and behaviors (e.g., length of session, likelihood of taking a break). Following these questions, participants were asked again to estimate the chances of winning, breaking even, and losing on an EGM, and to complete the GRCS to assess if any of their gambling-related thoughts had changed during play.

Two-Week Follow-Up Questionnaire   At 2-week follow-up, participants were sent a follow-up questionnaire. The first-year psychology students were emailed the questionnaire, requested to print and complete it using a pen, and return it to the researcher's office while the remaining participants were mailed the questionnaire and asked to return it using a stamped, self-addressed return envelope. The emailed version was a PDF file of the booklet and the mailed version was similar to the design of the previously completed questionnaires. As in the baseline questionnaire, participants were asked to complete self-report items regarding their EGM play over the previous 2 weeks. The questionnaire was similar to the post-test questionnaire in all other respects. Participants were asked to indicate whether they recalled the sign, and whether it had any impact on thoughts and behaviors in subsequent gambling sessions during the 2 weeks following their experimental session. Participants were again asked to estimate the chances of winning, to indicate any strategies they used, and complete the GRCS as in the previous

questionnaires. The post-test questionnaire took approximately 15 min to complete and was returned by 91.0% of participants in Study 1.

Canadian Problem Gambling Index (CPGI; Ferris and Wynne 2001)   Participants were given the nine-scored items of the CPGI. This questionnaire was completed as a paper-and-pencil questionnaire either emailed or mailed to participants. A 12 months time frame was used. Total score distinguish no risk, low risk, moderate risk, and problem gambling groups. In an independent survey of 8,479 Australian adults (McMillen and Wenzel 2006), the CPGI demonstrated the best measurement properties as compared to the Victorian Gambling Screen (VGS) and the South Oaks Gambling Screen (SOGS). These findings have been confirmed by a national review of research on problem gambling measures (Neal et al. 2004), which found the CPGI had excellent reliability, dimensionality, external/criterion validation, item variability, practicality, applicability and comparability.

Results

Mode of Presentation

Differences based on mode of presentation are summarized in Table 2. At post-test, when cued to indicate (yes/no) whether they recalled seeing a sign and its content, participants recalled seeing the sign; $\chi^2(1, N = 127) = 7.69$, $p < .005$, and recalled the content, $\chi^2(1, N = 127) = 6.10$, $p < .047$, significantly more often for pop-up than static messages. These qualitative responses were coded as: "Not accurate" (no recall or incorrect recall of message content and wording), "Somewhat accurate" (accurate recall of content of

Table 2 Percentage of participants in each mode of presentation that answered affirmatively to each item and associated chi-square analysis in Study 1

	Static (%)	Pop-up (%)	Chi-square analysis
Post-test			
Recall (yes) seeing sign	68.8	88.9	$\chi^2(1, N = 127) = 7.69$, $p < .005$**
Recall (yes) message content	44.4	79.4	$\chi^2(1, N = 127) = 6.10$, $p < .047$*
Very accurate free recall of message	39.1	66.7	$\chi^2(2, N = 127) = 13.65$, $p < .001$**
Reported impact on within-session thoughts	29.7	54.0	$\chi^2(1, N = 127) = 7.68$, $p < .005$**
Reported impact on within-session behavior	18.8	44.4	$\chi^2(1, N = 127) = 9.72$, $p < .002$**
Reported presumed impact on real EGM play	34.9	69.8	$\chi^2(1, N = 127) = 15.40$, $p < .0001$**
Indicated messages were 'very disruptive'	3.1	28.6	$\chi^2(2, N = 127) = 56.55$, $p < .0001$**
Messages would influence awareness of time	33.3	63.5	$\chi^2(1, N = 127) = 11.19$, $p < .001$**
Messages would influence session length	43.3	65.1	$\chi^2(1, N = 127) = 5.86$, $p < .012$*
Follow-up			
Recall (yes) seeing sign	63.2	86.0	$\chi^2(1, N = 114) = 7.82$, $p < .005$**
Very accurate free recall of message	34.5	49.1	$\chi^2(2, N = 113) = 7.92$, $p < .019$*

* Indicates statistical significance at $p < .05$

** Indicates statistical significance at $p < .01$

message, main themes, and relatively accurate wording), or "Very accurate" (accurate recall of message content and wording).

Participants were significantly more accurate in their post-test free recall of message content for pop-ups than static messages, $\chi^2(2, N = 127) = 13.65$, $p < .001$. Furthermore, at the 2-week follow-up significantly more participants freely recalled the pop-up sign with a higher degree of accuracy (49.1%, $n = 28$) than the static sign (34.5%, $n = 20$), $\chi^2(2, N = 113) = 7.92$, $p < .019$. At follow-up, the static sign was unable to be recalled by 36.8% ($n = 21$) as compared to 14.0% ($n = 8$) of participants in the dynamic condition, $\chi^2(1, N = 114) = 7.82$, $p < .005$.

At post-test, participants in the pop-up condition reported that messages affected thoughts during play significantly more (54.0%, $n = 34$) than in the static condition (29.7%, $n = 19$), $\chi^2(1, N = 127) = 7.68$, $p < .005$. Qualitative responses indicated that pop-up messages made participants reflect on the amounts of money spent, consider whether they needed a break, that the message broke their focus on play and that they felt frustrated or annoyed. The pop-up messages also had a greater reported effect on within-session behavior (based on post-test self-report; 44.4%, $n = 28$) than static messages (18.8%, $n = 12$), $\chi^2(1, N = 127) = 9.72$, $p < .002$. Quantitatively, player self-report indicated that pop-up messages made more participants finish their session earlier, slow their rate of betting, and placed smaller bets.

At post-test participants indicated that if real EGMs had pop-up messages it would affect play significantly more (69.8%, $n = 44$) than static signs (34.9%, $n = 22$), $\chi^2(1, N = 127) = 15.40$, $p < .0001$. Furthermore, participants indicated that pop-up messages would significantly influence awareness of time spent playing, $\chi^2(1, N = 127) = 11.19$, $p < .001$, and length of sessions, $\chi^2(1, N = 127) = 5.86$, $p < .012$, as compared to static messages. Qualitative responses indicated that pop-up messages on real EGMs would result in their having shorter sessions, taking more breaks, and having fewer sessions overall. Some participants also indicated they would change machines, which is consistent with the perception that pop-up messages were more disruptive that static messages. No differences in irrational beliefs assessed by the GRCS were found between groups, at post-test or follow-up, or between self-reported gambling behaviors at follow-up by mode of presentation.

Message Content

There were no significant differences in recall between informative or self-appraisal messages. Recall of control messages was not included in the analysis, as these signs contained no information to recall. Differences based on message content are displayed in Table 3. As observed in this table, reported impacts of control messages were markedly lower for each measure of the message impact on thoughts and behavior.

At post-test, participants reported self-appraisal messages had a significantly greater effect on thoughts during play as compared to informative or control messages, $\chi^2(2, N = 127) = 6.66$, $p < .036$. Qualitative responses confirmed self-appraisal signs affected participants' within session thoughts by encouraging them to consider taking a break and to reflect on amounts of money spent. Furthermore, participants reported that if the self-appraisal message was displayed on real EGMs it would influence their awareness of the time they had been playing, $\chi^2(2, N = 127) = 8.27$, $p < .016$, length of sessions, $\chi^2(2, N = 127) = 17.53$, $p < .0001$, and likelihood of taking a break, $\chi^2(2, N = 127) = 9.56$, $p < .008$, significantly more than informative or control messages.

Table 3 Percentage of participants in each message content that answered affirmatively to each item and associated chi-square analysis in Study 1

	Informative (%)	Self-appraisal (%)	Control (%)	Chi-square analysis
Post-test				
Reported impact on within-session thoughts	36.0	54.9	26.9	$\chi^2(2, N = 127) = 6.66$, $p < .036*$
Messages would influence awareness of time	44.0	63.3	29.2	$\chi^2(2, N = 127) = 8.27$, $p < .016*$
Messages would influence session length	40.0	77.6	37.5	$\chi^2(2, N = 127) = 17.53$, $p < .0001**$
Messages would influence likelihood of taking a break	40.0	61.2	25.0	$\chi^2(2, N = 127) = 9.56$, $p < .008**$
Follow-up				
Messages would influence awareness of time	19.1	46.7	29.6	$\chi^2(2, N = 115) = 10.41$, $p < .006**$
Messages would influence session length	27.7	45.4	17.4	$\chi^2(2, N = 114) = 6.27$, $p < .044*$
Messages would influence likelihood of taking a break	17.0	38.6	4.3	$\chi^2(2, N = 114) = 11.61$, $p < .003**$
Message influenced estimation of chance of winning max prize	34.0	11.1	8.7	$\chi^2(2, N = 115) = 9.85$, $p < .007**$

* Indicates statistical significance at $p < .05$

** Indicates statistical significance at $p < .01$

These findings were maintained at follow-up as participants reported self-appraisal messages had influenced their awareness of time during play, $\chi^2(2, N = 115) = 10.41$, $p < .006$, length of sessions, $\chi^2(2, N = 114) = 6.27$, $p < .044$, and likelihood of taking a break during subsequent EGM play, $\chi^2(2, N = 114) = 11.61$, $p < .003$, significantly more than those in the control or informative condition.

When asked to estimate the chances of winning following play, participants who saw the self-appraisal sign were significantly more likely to be accurate in their estimations than other participants, $\chi^2(2, N = 127) = 6.304$, $p < .043$. At follow-up participants exposed to self-appraisal messages were significantly more likely to be accurate in their estimations of the chances of losing compared to informative and control messages, $\chi^2(2, N = 115) = 11.83$, $p < .019$. Participants exposed to informative messages stated at follow-up that this message had influenced their estimation of the maximum prize significantly more than those in the other conditions, $\chi^2(2, N = 115) = 9.85$, $p < .007$; however, there was no significant difference between groups in participant's estimation of the maximum prize using a Likert scale. Despite the reported effect of messages on thoughts and behavior, the results did not detect any significant changes in gambling behavior as measured by self-reported gambling behavior at follow-up or irrational beliefs as measured by responses to the GRCS, between participants.

Mode of Presentation by Message Content

Results were analyzed based on mode of presentation and message content. Immediately following play both informative, $\chi^2(2, N = 127) = 4.61$, $p < .04$, and self-appraisal, $\chi^2(1,$

$N = 127) = 4.65$, $p < .04$, messages had a significantly greater impact on thoughts when displayed as pop-up rather than static messages. Similarly, pop-up signs had a significantly greater impact on behavior during play than static signs for informative, $\chi^2(1, N = 127) = 4.99$, $p < .03$, and self-appraisal signs $\chi^2(1, N = 127) = 5.55$, $p < .02$, with no difference based on mode of presentation for control messages. Participants also stated that pop-up signs would affect play on real EGMs significantly more often than static messages in both informative $\chi^2(1, N = 127) = 6.443$, $p < .01$, and self-appraisal conditions $\chi^2(1, N = 127) = 11.24$, $p < .01$.

Both self-appraisal and informative messages had a significantly greater impact on participants' awareness of time during play for pop-ups than static messages, although this effect was more pronounced for self-appraisal (40.8% vs. 22.4%), $\chi^2(1, N = 127) = 8.15$, $p < .01$, than informative messages (30.0% vs. 14.0%), $\chi^2(1, N = 127) = 4.12$, $p < .05$. Furthermore, only self-appraisal messages resulted in participants stating that pop-up messages had a significantly greater impact that static signs on:

- the length of EGM sessions (44.9% vs. 32.7%), $\chi^2(1, N = 127) = 5.38$, $p < .03$;
- the likelihood of taking a break (38.8% vs. 22.4%), $\chi^2(1, N = 127) = 6.38$, $p < .02$;
- the likelihood of cashing out (34.7% vs. 20.4%), $\chi^2(1, N = 127) = 4.71$, $p < .03$.

At the 2-week follow-up, self-appraisal signs were recalled somewhat or very accurately by significantly more participants in the pop-up (44.5%) as compared to the static display (20%), $\chi^2(1, N = 127) = 17.23$, $p < .01$.

Problem Gamblers

Based on their responses to the CPGI, only 11.5% of the sample had no problems with gambling (CPGI score 0); 7.0% were at low (CPGI score 1–2) and 53.5% were at moderate levels of risk (CPGI score 3–7), and 15.6% were classified as problem gamblers (CPGI score 8–27)). Across all participants, problem gamblers were significantly less likely to report that signs affected thoughts (11.5%, $n = 14$) than non-problem gamblers (32.0%, $n = 39$), $\chi^2(1, N = 122) = 8.38$, $p < .004$, and behavior during play (9.0%, $n = 11$) than non-problem gamblers (22.1%, $n = 27$), $\chi^2(1, N = 122) = 7.51$, $p < .008$. However, problem gamblers were significantly more likely to indicated that signs would influence the number of breaks taken, $\chi^2(1, N = 118) = 4.69$, $p < .028$.

Study 2

Introduction

The second study was a replication of Study 1, conducted in gambling venues with participants recruited from venue patrons. The intention of the second study was to replicate the results of Study 1 and increase the external validity of the results. Although gamblers would still play a simulated EGM given the reluctance of ethical committees to approve studies involving requests for participants to gamble with their own money, they would be exposed to the same sights and sounds as if playing real EGMs and the sample would be more representative of regular gamblers, thus allowing some extraneous variables to be controlled for while increasing the external validity of the results.

Method

Participants

Participants were 124 regular EGM gamblers defined as playing EGMs at least once every 2 weeks, recruited from a population of patrons attending two gambling club venues in Sydney. Participants were offered two movie vouchers in acknowledgement of their time and effort in completing tasks. Of those eligible, 55.9% agreed to participate.

The mean age of the participants was 44.1 years (SD = 20.8; range 18–65) and almost three quarters (71.8%) were male. Of the participants, 46.0% were single, 36.3% married, 9.8% divorced or separated, 4.8% in a common-law or de facto relationship (living together), and 2.4% widowed. Only 6.5% had no schooling, while 33.3% completed School Certificate (Grade 10), 22.0% Higher School Certificate (Grade 12), 24.2% had technical or trade training, and 13.8% held university degree qualifications. Forty-four percent were in fulltime employment, 17.7% retired or on a government pension (16.1%), and 6.1%, students. The remainder were part-time workers (8.9%) or unemployed (6.5%). One participant declined to indicate their marital, education and employment status.

In respect to annual household income, 16.9% listed their income as less than AUD$20,000, and 29.8% indicated they were in the range of AUD$20,000–49,999, 17.7% AUD$50,000–79,999, 8.1% AUD$80,000–119,999, and 8.9% greater than AUD$120,000, respectively. This question was optional and 18.6% of participants chose not to respond. Of the 124 participants who completed the initial experimental session, 77 (62.1%) returned follow-up questionnaires.

Design

The University of Sydney Human Research Ethics Committee approved this study. The research design was identical to that described above. Participants were recruited in gambling venues at a time when they were not engaged in gambling, a stipulation of the venues to ensure that club patrons were not overtly disturbed. Participants were taken to an area of the gambling floor of the venue where they were still clearly exposed to the sights and sounds of EGMs, although, as in Study 1, participants completed paper-and-pencil questionnaires and used a computer simulated gaming machine.

As in Study 1, analysis showed no significant baseline differences between groups indicating that the process of randomization was successful. The majority of participants (68.5%) stopped play of their own accord and there were no significant differences between participants based on continuation of play. The number of participants in each condition is displayed in Table 4.

Table 4 Number of participants in each condition in Study 2

	Content type			Total informative
	Informative	Self-appraisal	Control	
Mode				
Static	23	27	11	61
Dynamic	28	24	11	63
Total	51	51	22	124

As not all participants had email addresses, follow-up questionnaires were mailed to participants 2-weeks following their experimental session, with instruction to return the completed forms using an enclosed stamped self-addressed envelope. The 2-week follow-up response rate for Study 2 was 62.1%. All other aspects of the experimental design were identical to that in Study 1.

Results

An a priori power analysis indicated that to detect a large effect (d = 0.8) between two independent groups using a two-tailed analysis with significance set at 0.05, a total sample size of 84 participants would be sufficient.

Mode of Presentation

There was a significant association between the mode of message presentation and accuracy of free recall $\chi^2(2, N = 124) = 22.72, p < .0001$. Based on the odds ratio, it appeared that participants were 5.3 times more likely to recall the message content accurately if they were exposed to pop-up messages (44.4%) than if exposed to static messages (22.2%). Participants were also significantly more confident in the accuracy of their recall for pop-up messages compared to static messages $t(122) = -3.32, p < .001$. When asked whether they recalled seeing signs, significantly more participants reported remembering pop-up (87.3%) than static messages (44.3%), $\chi^2(1, N = 124) = 25.63, p < .0001$, and being able to recall the message content for pop-up messages (63.5%) than for static messages (24.6%), $\chi^2(1, N = 124) = 19.00, p < .0001$.

At follow-up, participants were significantly more likely to remember seeing pop-up (78.0%) than static message (50.0%), $\chi^2(1, N = 77) = 6.62, p < .010$. Additionally, participants were 11.3 times more likely to be somewhat or very accurate in their free recall of pop-up messages (15.9%) than static messages (1.6%) 2 weeks following the experimental session $\chi^2(1, N = 77) = 7.90, p < .019$.

Responses revealed that pop-up message were perceived as being more likely to influence thoughts during future play than static messages. This represents a significant difference (7.15 times) between the effect of pop-up messages (27.0%) and static messages (4.9%) on thoughts during play $\chi^2(1, N = 124) = 11.16, p < .001$. Qualitative responses indicated that participants viewing pop-up messages were significantly more likely to indicate signs had made them consider stopping or taking a break, be more aware of the amount of money they were spending, change their betting pattern, and be irritated by disruption to play.

Pop-up signs also had greater influence on within-session behavior (14.3%) than static messages (3.3%), $\chi^2(1, N = 124) = 4.65, p < .031$. Players in the pop-up condition were more likely to report taking a break during play and changing their betting pattern than players viewing static signs. When asked how disruptive signs were, participants indicated that pop-up signs were very disruptive significantly more often (17.5%) than static signs (1.6%), $\chi^2(2, N = 124) = 34.54, p < .0001$.

Participants reported that if real EGMs contained pop-up messages, they would anticipate these to be significantly more likely to influence players (47.6%) that static signs (8.2%), $\chi^2(2, N = 124) = 24.99, p < .0001$. When prompted, participants indicated that if real EGMs had pop-up messages these would be significantly more likely to influence a range of player variables as shown in Table 5, including:

a. estimations of winning the maximum prize;
b. estimations of winning or losing;
c. understanding of play;
d. awareness of time;
e. awareness of money spent;
f. the length of their session of play;
g. likelihood of taking a break;
h. likelihood of cashing out;
i. likelihood of leaving the venue, as compared to static messages.

Message Content

Recall of control messages was not included in the analysis, as these signs contained no information to recall. Following play there were no significant differences in recall based on message content. However, at the 2-week follow-up self-appraisal messages were recalled 'somewhat' or 'very accurately' by significantly more participants (25.5%) than informative messages (5.9%), $\chi^2(2, N = 77) = 9.66$, $p < .008$. The only other significant difference between groups based on message content was that at the follow-up, significantly more participants (68.4%) stated that viewing self-appraisal messages had influenced their awareness of time during EGM sessions than participants in the informative (31.6%) and control (0%) conditions $\chi^2(4, N = 76) = 8.17$, $p < .017$. These results are displayed in Table 6.

Mode of Presentation by Message Content

Results were analysed based on mode of presentation and message content. Immediately following play, participants viewing the self-appraisal messages stated they recalled the sign's content significantly more for pop-up messages (80.0%) than static messages (20.0%), $\chi^2(1, N = 124) = 21.36$, $p < .001$, with no significant difference found between recall of pop-up and static signs for the informative message. The sign's impact on thoughts during play was significantly different only between pop-up and static messages in the self-appraisal condition, $\chi^2(1, N = 124) = 15.78$, $p < .001$.

When the impact of message content was analyzed by examining the difference between informative, self-appraisal and control messages, no significant differences in gambling-related thoughts or behaviors were found between static and pop-up messages with no message content (control).

At follow-up, there was a significant difference between pop-up and static signs for recall of message content only in the self-appraisal condition $\chi^2(1, N = 124) = 5.11$, $p < .03$, with no significant difference in recall between static and pop-up messages found for informative messages.

Problem Gambling

Based on their responses to the CPGI, only 17.7% of the sample had no problems with gambling; 23.4% were at low and 14.5% at moderate levels of risk, and 5.6% were probable problem gamblers. However, 38.7% of participants failed to return their CPGI. There were no significant differences of reported impact of signs between participants based on risk of developing or having gambling problems; however, due to the low

Table 5 Percentage of participants in each mode of presentation that answered affirmatively to each item and associated chi-square analysis in Study 2

	Static (%)	Pop-up (%)	Chi-square analysis
Post-test			
Recall (yes) seeing sign	44.3	87.3	$\chi^2(1, N = 124) = 25.63, p < .0001**$
Recall (yes) message content	24.6	63.5	$\chi^2(1, N = 124) = 19.00, p < .0001**$
Accurate free recall of message	22.2	44.4	$\chi^2(2, N = 124) = 22.72, p < .0001**$
Reported impact on within-session thoughts	4.9	27.0	$\chi^2(1, N = 124) = 11.16, p < .001**$
Reported impact on within-session behaviour	3.3	14.4	$\chi^2(1, N = 124) = 4.65, p < .031*$
Reported presumed impact on real EGM play	8.2	47.6	$\chi^2(2, N = 124) = 24.99, p < .0001**$
Indicated messages were 'very disruptive'	1.6	17.5	$\chi^2(2, N = 124) = 34.54, p < .0001**$
Messages would influence estimations of wining the maximum prize	3.3	15.9	$\chi^2(1, N = 124) = 5.62, p < .017*$
Messages would influence estimations of winning or losing	4.9	17.7	$\chi^2(1, N = 124) = 5.01, p < .024*$
Messages would influence understanding of play	3.3	23.8	$\chi^2(1, N = 124) = 11.04, p < .001**$
Messages would influence awareness of time	8.2	42.9	$\chi^2(1, N = 124) = 19.45, p < .0001**$
Messages would influence awareness of money spent	8.2	42.9	$\chi^2(1, N = 124) = 19.45, p < .0001**$
Messages would influence session length	11.5	38.1	$\chi^2(1, N = 124) = 11.71, p < .001**$
Messages would influence likelihood of taking a break	8.2	47.6	$\chi^2(1, N = 124) = 23.78, p < .0001**$
Messages would influence likelihood of cashing out	8.2	46.0	$\chi^2(1, N = 124) = 22.92, p < .0001**$
Messages would influence likelihood of leaving the venue	6.6	28.6	$\chi^2(1, N = 124) = 10.29, p < .001**$
Follow-up			
Recall (yes) seeing sign	50.0	78.0	$\chi^2(1, N = 77) = 6.62, p < .010**$
Accurate free recall of message	1.6	15.9	$\chi^2(1, N = 77) = 7.90, p < .019*$

* Indicates statistical significance at $p < .05$

** Indicates statistical significance at $p < .01$

Table 6 Percentage of participants in each message content that answered affirmatively to each item and associated chi-square analysis in Study 2

	Informative (%)	Self-appraisal (%)	Control	Chi-square analysis
Follow-up				
Accurate free recall of message	5.9	25.5	n/a	$\chi^2(2, N = 77) = 9.66, p < .008**$
Messages would influence awareness of time	31.6	68.4	0%	$\chi^2(4, N = 76) = 8.17, p < .017*$

* Indicates statistical significance at $p < .05$

** Indicates statistical significance at $p < .01$

percentage of problem gamblers there may not have been sufficient power to detect differences between problem and non-problem gamblers.

Discussion

Consistent with our hypothesis, pop-up messages were recalled significantly more frequently and more accurately than static messages immediately following play and at 2 weeks follow-up. This suggests that pop-up messages are more effective than static signs in capturing player attention and increasing message comprehension with players noticing the sign, processing information, and storing it for later recall to a greater extent.

Pop-up messages had a significantly greater self-reported effect on participant's within-session thoughts and behaviors than static messages. The results suggest that responsible gambling strategies utilizing pop-up messages would be more effective than static signs in facilitating player awareness of the time they spent playing. In addition, pop-up messages may also effectively modify gambling behavior as participants indicated they perceived that these messages would influence the length of their gambling sessions. Importantly, players also indicated that pop-up messages would have a greater effect than static messages if displayed on real EGMs. These results are consistent with previous research findings that pop-up messages are associated with reductions in session length and potentially decreased gambling expenditure (Floyd et al. 2006; Ladouceur and Sevigny 2003) and importantly extend previous findings by demonstrating an impact on actual gambling behavior, which supports the implementation of pop-up messages as an effective mechanism to facilitate responsible gambling.

Increased recall of pop-up messages indicates these messages were seen, read and comprehended, to be transferred to longer-term memory to be successfully recalled at a later stage, which suggests that pop-up are more likely to influence on subsequent gambling behavior. This is supported by reports of the increased impact of signs on thoughts during, and following play. For example, contrary to the reported minimal effects of previous tobacco warning labels, a Canadian study found that for smokers who reported having read redesigned warning labels for cigarette packages which contained disturbing graphics and demonstrated a thorough knowledge of their content, a strong positive relation was observed between a measure of cognitive processing—the extent to which smokers reported reading, thinking about, and discussing the new labels—and smoker's intention to quit (Hammond et al. 2003). Importantly, cognitive processing predicted cessation of behavior at follow-up demonstrating the potential impact of successful harm-minimization signage. These findings confirm that increased recall and cognitive processing of warning signs is associated with behavioral modification in the desired direction, indicating that the increased recall of pop-up as compared to static messages may increase the effectiveness of harm-minimization signs in facilitating responsible gambling behavior.

Both hypotheses were supported as self-appraisal messages had a significantly greater self-reported effect on thoughts and behaviors than informative and control messages. Self-appraisal messages reportedly facilitated player's within-session awareness of the time spent playing, likelihood of taking a break and length of gambling sessions. Importantly, these findings were also reported to have occurred in subsequent EGM sessions in the 2-weeks following the session. This is a highly significant finding as it shows that even though signs used in an experimental context with no instructions given for players to remember their content, sign were still effective in significantly influencing thoughts and behaviors in subsequent sessions.

Although self-appraisal messages did not provide statistical information regarding the chances of winning on EGMs, participants became more accurate in their estimations of the probability of winning, compared to other participants. This suggests that self-appraisal messages encouraged players to have more realistic thoughts regarding gambling and the chances of winning. However, as there were no corresponding changes in irrational beliefs as measured by the GRCS, it may imply a distinction between possession of irrational beliefs and objective knowledge of odds of winning. This anomalous finding warrants further research. Nonetheless, the increased accuracy of player's perceptions following exposure to the self-appraisal message highlights its effectiveness, particularly compared to the finding that while participants in the informative condition reported this sign had affected estimates of winning, they were not more accurate in their estimates.

Although in Study 2, the informative messages reportedly had a greater effect on player's awareness and comprehension of messages regarding randomness and probabilities, there was no corresponding behavioral change, suggesting that modifying knowledge is insufficient to alter gambling behavior. Furthermore, despite reported effects of informative messages on cognitions, there were no significant differences between players in their estimations of the odds. This suggests that despite informative signs including a statement of the chance of winning the maximum prize, knowledge does not modify a player's thoughts. The results confirm previous findings that messages providing information designed to correct irrational or erroneous thoughts do not result in behavioral changes (Ladouceur et al. 2001; Steenbergh et al. 2004; Williams and Connolly 2006).

Although pop-up messages were reported to have a significant impact on thoughts and behaviors, it is concluded that merely providing players with a break in play is insufficient to modify thoughts and behavior. Pop-up signs containing self-appraisal messages appeared to be more effective than those with informative content or no messages, suggesting the combined message and enforced break in play is the most successful method. These results suggest that pop-up signs containing messages encouraging players to be aware of their behavior and take breaks when necessary would effectively minimize harm by increasing responsible gambling behavior.

Harm-minimization strategies aim to target all recreational (non-problem gamblers) and are intended to reduce the incidence of problem gambling by facilitating responsible gambling behavior. As such, these signs are intended as a preventative as opposed to tertiary strategy and are not expected to address the serious difficulties faced by problem gamblers who have significantly entrenched irrational beliefs and associated disruptive behaviors that require more intensive treatment interventions. The findings suggest that the harm-minimization signs were significantly less effective for problem gamblers who were less likely to report that messages influenced their thoughts or behaviors. As the signs do not attempt to target this population these results are unsurprising. Interestingly, more problem gamblers indicated that messages would influence the likelihood of taking a break during play. This may suggest that appropriate signage may influence this population, which may be an important area for future research, with a larger sample of problem gamblers.

Pop-up messages were described as being more disruptive and caused players to feel more frustrated and annoyed than static messages. However, less than one-fifth of regular gamblers in the venue study indicated the pop-up signs were very disruptive while others indicated that this break was useful as it interrupted their "trance" and made them more aware of time spent playing. Harm-minimization strategies aim to reduce harm, without overtly interfering with recreational gamblers. The frequency of pop-up messages in this experiment was greater than would be used if implemented in venues, and further research

is needed to identify the optimal frequency for pop-up messages to effectively communicate information without causing excessive frustration.

It is also possible that the novelty of pop-up messages temporarily enhanced player's recall and that over time this effect would decrease. The use of self-appraisal messages may lessen this effect as, rather than providing the same information repeatedly, the message encourages players to reflect on their immediate situation. In this manner, the signs are designed to focus attention on expenditure levels and thus motivate players to modify patterns of play toward more responsible limits.

The results replicate and extend previous research findings. Similar to previous empirical laboratory studies (Cloutier et al. 2006; Floyd et al. 2006; Ladouceur and Sevigny 2003) pop-up messages appear to be superior to static signs in enhancing message recall and influencing thoughts. However, this study advances the knowledge base by demonstrating the impact of pop-up messages on within-session thoughts and behaviors, and predicted future gambling behavior with a both young adult regular EGM players and more representative sample of regular EGM gamblers.

These studies have several methodological limitations that constrain the conclusions drawn. In Study 1, a laboratory-based setting was used with computer-based simulated EGMs and in both studies participants did not play with real money. Although participants were instructed to play as they normally would, they may not have played in a realistic way or paid the same attention to signs as in an actual gambling situation. However, a significant proportion of participants still reported that signs affected their thoughts and behavior during play, suggesting some success of the simulation. The use of self-report data may weaken the reliability of results as participants may not accurately describe their behavior, thus reducing the ability to detect small behavioral changes. This may explain the lack of significant differences in gambling behavior found between conditions and future studies should attempt to include more accurate behavioral measures, such as tracking within-session gambling behavior. Study 1 utilized an undergraduate university population of regular gamblers which limits the extent to which findings can be generalized to other gamblers. However, it does provide important information regarding the effectiveness of harm-minimization strategies for this cohort that is at high-risk of developing gambling-related problems.

Study 2 utilized a population of regular EGM players recruited from a gambling venue to provide insights into the effect of signage on this population. However, this study had a lower response rate in return of follow-up questionnaires compared to Study 1, limiting the final sample size and the ability to detect significant differences between groups at the 2-week follow-up. The response rate of 62.1% is lower than that of a follow-up telephone survey with gamblers (76%; Hodgins et al. 1999) but comparable to a follow-up of treatment seeking co-morbid pathological gamblers and substance abusers (63%; Steinberg et al. 1992). While efforts were made to recruit a representative sample of regular gamblers, due to availability constraints, only two clubs were used for recruitment thereby limiting the extent to which the sample is representative of all regular gamblers. Additionally, in accordance with ethics guidelines, participants were only offered a small token in the form of compensation, resulting in participants effectively volunteering to be involved in the study, and thus, creating a self-selected sample that may not be representative of regular EGM gamblers. This is confirmed by the small number of problem gamblers (5.6%) as compared to previous research demonstrating that between 9 and 23% of weekly EGM gamblers have gambling problems (Productivity Commission 1999).

Conclusions

This study provides data into the usefulness of this responsible gambling strategy. Results indicate that pop-up messages may be an appropriate mode of presentation for harm-minimization signs on EGMs. They appear to effectively capture attention and facilitate message comprehension with an immediate and longer-term reported effect on gambling-related thoughts and behaviors.

The study demonstrates that self-appraisal messages had the greatest reported impact on a player's thoughts and behavior. These messages were perceived to be significantly more effective in modifying player thoughts and behaviors in accordance with the aim of responsible gambling strategies. Further research into the effectiveness of pop-up messages and the most appropriate content of harm-minimization messages is needed for conditions of actual EGM gambling, how frequently pop-ups should be displayed and over what period of time. Additionally, the elements of successful signage should be examined more closely to reveal which components have the greatest impact on gambling behavior.

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