



Published in final edited form as:

Psychol Addict Behav. 2009 December ; 23(4): 731–735. doi:10.1037/a0017134.

Cue-Specific Reactivity in Experienced Gamblers

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Abstract

To examine whether gambling cue reactivity is cue-specific, 47 scratch-off lottery players and 47 horse race gamblers were presented with video clips of their preferred and non-preferred modes of gambling, and two control stimuli including an exciting car race and a mental stressor task while heart rates, excitement, and urge to gamble were being measured. Heart rates for both groups of gamblers were highest to the mental stressor and did not differ in response to the other three cues. Excitement for both groups was highest in response to the action cues (horse race and car chase). Urge to gamble was significantly higher for each group to their preferred mode of gambling. A post-hoc exploratory analysis comparing social gamblers ($n=54$) and probable pathological gamblers ($n=40$) revealed a similar pattern of responses. However, pathological gamblers reported overall significantly higher urges to gamble than social gamblers. As urges have been shown to play a pivotal role in addictive behaviors and relapse, the current findings may have implications for the development of gambling problems and relapse after successful treatment.

Keywords

cue-reactivity; gambling; heart rate; excitement; urge

The elicitation of cue-specific response patterns, termed cue reactivity, has been studied extensively in the substance use area (see meta-analytic review by Carter & Tiffany, 1999). However, cue reactivity is not well researched in behavioral addictions such as excessive gambling, although cue-elicited arousal is accorded an important reinforcement function in theoretical models of pathological gambling (e.g., Blaszczynski, Buhrich, & McConaghy, 1985). Much like the euphoria associated with cocaine use, the arousal associated with gambling is thought to strengthen the behavior and to generate the motivation for continued gambling, even in the face of personal harm (Custer, 1982). There is ample evidence in the classical conditioning literature that neutral cues develop both an incentive function and a stimulus function that provides the emotional-motivational state for the addictive behavior (e.g., Robinson & Berridge, 2003). These learning processes are embedded in underlying dopamine-based neurobiological mechanisms that have also been demonstrated for excessive gambling (Potenza et al., 2003). In essence, then, conditioned cues elicit the physiological arousal or “action” that gamblers crave as well as the urges serving as establishing operation (Michael, 2000) to provide the motivation for gambling in addicted individuals (Grusser, Plontzke, & Albrecht, 2005).

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Cue-elicited autonomic arousal, often indexed by HR, has been well documented for a range of gambling activities including video poker (Crawford & Frances, 2005), casino blackjack (Meyer et al., 2000), and horse race betting in real-world (Coventry & Norman, 1997), imaginal (Blanchard, Wulfert, Freidenberg, & Malta, 2000) and laboratory analog settings (Wulfert, Franco, Williams, Roland & Maxson, 2008). Cue-elicited psychological reactions to gambling have also been demonstrated, including heightened excitement to imaginal gambling scenes (Blanchard et al., 2000) and increased urges to gamble both in a casino (Kushner et al., 2007) and a simulated gambling environment (Kushner et al., 2008).

Cue specificity of responding in gambling

Cue-elicited stimulus specificity has been shown in addictive behaviors comparing reactivity to alcohol versus neutral cues such as water (e.g., Kambouropoulos & Staiger, 2001) or reactivity to preferred versus non-preferred alcoholic beverages (Staiger & White, 1991). However, stimulus specificity in the area of gambling remains largely unexplored. To date, only one study has addressed this question. Sharpe, Tarrier, Schotte and Spence (1995) recruited 13 problem gamblers, 12 high-frequency, and 13 low-frequency gamblers and measured skin conductance, HR, and frontalis muscle tension in response to five stimulus conditions, including cues of a preferred and a non-preferred form of gambling. Differences in skin conductance in response to the preferred versus a non-preferred mode of gambling were observed only among the problem gamblers. Other autonomic responses varied between groups depending on tasks and measures of arousal in ways that did not convey an easily discernible pattern, thereby leading the authors to conclude that the “study actually raises more questions than it is able to answer” (p. 1538). The study was likely underpowered for the numerous comparisons and did not include appropriate controls to show that arousal is specific to gambling rather than any arousing stimulus.

In light of the limited research, the purpose of the present study was to elucidate whether HR, subjective excitement, and urge to gamble are cue-specific and elicited by stimuli associated with an individual's *preferred* gambling activity or whether they are generalized and elicited by *any* gambling-related cue. To answer this question, we combined a cross-over response design with an arousal-control design (Robbins & Ehrman, 1992). The former entailed comparing the reactivity of horse race bettors and scratch-off lottery players with non-overlapping preferences to cues of their preferred and non-preferred gambling activity. The latter entailed measuring reactivity to gambling and potentially arousing non-gambling cues (a generic stressor and a generic exciting scene). If both groups respond similarly to the generic stimuli but show specificity to cues of their preferred gambling activity, we can rule out that heightened reactivity to gambling stimuli is simply a sign of a general heightened arousability of gamblers. If both groups respond differentially to the preferred versus non-preferred gambling cues, we have demonstrated cue specificity.

Method

Participants

Ninety-four experienced gamblers (64 men, 30 women) including 47 horse race bettors and 47 scratch-off lottery gamblers were recruited to represent a sample of action versus escape gamblers (Arizona Council on Problem Gambling, 2009). Their mean age was 46 years (range 22–72). Most were Caucasian (47%) followed by African American (33%), Latino (2%), and “other” or “not reported” (18%). All gambled at least three times per week ($M = 4.64$ days, $SD = 1.42$; range 3–7 days). None was in treatment for a gambling problem.

Measures

Aside from demographic data and information about gambling history, participants were assessed with the past-year version of the *South Oaks Gambling Screen (SOGS)*; Lesieur & Blume, 1987), a 20-item yes/no self-report instrument with good psychometric properties. The SOGS classifies gamblers as non-problem (scores 0–2), possible problem (3–4), and probable pathological gamblers (5–20). The past-year version of a diagnostic DSM-IV screen termed NODS (National Opinion Research Council, 1999) was also used. It has good reliability and validity and assesses the ten criteria for pathological gambling, with scores of 5 or more warranting a diagnosis (American Psychiatric Association, 1994).

Stimulus Materials

Gambling stimuli consisted of video clips showing an exciting horse race with a neck-to-neck finish and a scene showing a person scratching off lottery tickets, including a winner. The control stimuli were a generic stressor (counting backwards aloud in 7s from 250) and a generic arousing scene (video clip of an exhilarating car chase).

Procedure

The protocol was approved by the university's institutional review board. Experienced gamblers were recruited via flyers and newspaper advertisements. Gamblers were invited to the laboratory if they passed a telephone screen (minimum age 18, exclusive or predominant horse race gamblers or scratch-off lottery players with non-overlapping preferences, betting at least three times a week, not receiving treatment for a gambling problem during the past year). After obtaining informed consent, the experimenter collected demographic data, administered the SOGS and NODS, and then conducted the cue exposure.

The challenge paradigm was modeled after Blanchard et al. (2000). To minimize interactions with the experimenter, instructions and stimulus presentations were computer programmed and presented in a video-taped sequence on a 27-inch TV monitor. Participants were seated comfortably in front of the TV and fitted with head phones and a portable HR monitor that recorded HR continuously in 5-sec intervals. After sitting quietly for a 5-min *adaptation phase*, participants were instructed to remain seated quietly with their eyes closed for a 2½-min baseline. Next, they were presented with four 2-min stimulus events, each preceded by a 2½ min baseline and followed by instructions to provide ratings of current excitement (On a scale from 0–100, how excited do you feel right now?) and desire to gamble (On a scale from 0–100, how strong is your urge to gamble right now?). The first stimulus was the mental arithmetic task serving as generic stressor; next came the video clips with participants' *preferred* and *non-preferred* gambling activity, presented in counterbalanced order; the final stimulus was the exhilarating car chase serving as a generic exciting cue.

After completing the cue-exposure, participants were debriefed and received a \$20 honorarium and a raffle ticket for a chance to win a \$250 dollar prize in a drawing conducted at the conclusion of the study.

Results

Preliminary Analyses

Assumptions of normality and homogeneity of variance were met satisfactorily for the dependent variables and there were no order effects for the gambling scene presentations. The sample's mean score on the SOGS was 4.85 (SD = 4.45); 42.6% of the participants scored in the normal range, 14.9% were possible problem gamblers, and 42.6% were probable pathological gamblers (SOGS ≥ 5). These scores were consistent with the NODS, which

identified the same 42.6% as meeting DSM-IV criteria for pathological gambling (≥ 5 of 10 symptoms) while 57.4% fell in the normal range (0–4 symptoms).

Correlations between the dependent variables and SOGS, NODS, and demographics were non-significant. Horse race gamblers and scratch-off lottery players were similar in SOGS and NODS scores, age, and education (the latter approached significance with $p = .09$). Significant group differences existed in gender [$\chi^2(1) = 15.82, p < .001$], ethnicity [$\chi^2(3) = 30.41, p < .001$], and household income [$\chi^2(5) = 12.46, p = .029$]. Compared to horse race gamblers, more scratch-off players were women, African American, and had lower incomes. These three variables were used as covariates in the analyses below.

Primary Analyses of horse race versus lottery gamblers

A 2 X 4 repeated measures multivariate analysis of covariance (MANCOVA) was conducted with group (horse race gamblers, lottery gamblers) as between-subjects factor and cue (mental arithmetic, preferred gambling, non-preferred gambling, car race) as the repeated within-subjects factor. The dependent variables were HR corrected for baseline, excitement and urge to gamble. Gender, ethnicity, and income served as covariates. The MANCOVA yielded significant main effects for group [Wilk's Lambda = .892, $F(3, 87) = 3.26, p < .02, \eta_p^2 = 0.11$] and cue [Wilk's Lambda = .742, $F(9, 81) = 3.13, p = .003, \eta_p^2 = 0.26$] and a significant group by cue interaction [Wilk's Lambda = .558, $F(9, 81) = 7.12, p < .001, \eta_p^2 = 0.44$]. An examination of the interaction effect, using Sidak-corrected pairwise comparisons, showed similar HR patterns in the two groups (see Fig. 1). HR elevations in beats per minute (bpm) above baseline of scratch-off lottery gamblers ($M = 8.09, SD = 6.42$) and horse race gamblers ($M = 10.87, SD = 7.29$) were highest ($p < .01$) in response to the mental arithmetic task. HRs to the other cues were significantly lower and did not differ among each other ($p \geq .70$). Both groups also showed the same pattern in regards to excitement (see Fig. 2). Both scratch-off gamblers ($M = 43.91, SD = 24.57$) and horse race gamblers ($M = 25.85, SD = 24.11$) reported the lowest excitement to the mental arithmetic task. The horse race gamblers rated the horse race ($M = 62.02, SD = 23.44$) as more exciting ($p < .001$) than the scratch-off lottery cue ($M = 32.64, SD = 22.17$), though not more exciting ($p = .75$) than the car race ($M = 58.26, SD = 2.59$). The scratch-off lottery players showed the same pattern, also rating the horse race ($M = 70.49, SD = 28.18$) and car race ($M = 64.72, SD = 27.87$) as equally exciting ($p = .99$), and more exciting ($p = .001$) than the scratch-off lottery cue ($M = 54.49, SD = 27.27$). In sum, action cues (horse race and car race) were viewed as more exciting than the other cues. Regarding the urge to gamble (see Fig. 3), both groups reported the highest urge ($p < .01$) when exposed to cues of their preferred gambling activity (scratch-off gamblers $M = 56.26, SD = 4.66$; horse race gamblers $M = 53.38, SD = 4.66$). Urge ratings to the other three cues were all significantly lower ($p \leq .005$), with urges in response to the mental stressor being lowest and urges in response to the non-preferred gambling activity and the car race not differing from each other.

Exploratory analysis of pathological versus social gamblers

As 40 of the 94 gamblers (42.6%) met criteria for pathological gambling on both the NODS and the SOGS, we conducted an exploratory analysis to examine cue reactivity as a function of diagnostic status. F-tests and chi square tests showed that the pathological and social gamblers did not differ significantly in gender ($p = .74$), ethnicity ($p = .47$), education ($p = .07$), household income ($p = .07$), or preferred mode of gambling ($p = 0.49$); and there were no order effects of gambling scene presentation by diagnostic group ($p = .11$). A 2 x 4 repeated-measures MANOVA was conducted with diagnostic group (pathological versus social gambler) as the between-subjects factor and type of cue as the within-subjects factor. Heart rate, excitement, and urge to gamble served as the dependent variables. The analysis yielded significant main effects for diagnostic group [Wilk's Lambda = .850, $F(3, 90) = 5.31, p = .002, \eta_p^2 = 0.15$] and cue [Wilk's Lambda = .428, $F(9, 667) = 30.96, p < .001, \eta_p^2 = 0.25$]. The group X cue

interaction was non-significant [Wilk's Lambda = .945, $F(9, 667) = 1.74, p = .08, \eta_p^2 = 0.02$]. Sidak-corrected follow-up tests showed that the pathological and social gamblers did not differ significantly in heart rate ($p = .66$) or excitement ($p = .23$), but pathological gamblers reported *overall* significantly higher urges ($M = 48.57, SD = 3.72$) than social gamblers ($M = 31.00, SD = 3.20$) [$F(1, 92) = 12.82, p = .001, \eta_p^2 = 0.12$]. Following up the main effect for cue, the pattern of results was similar to the findings reported in the main analysis above: baseline corrected heart rates were significantly higher ($p < .001$) in response to the mental arithmetic task ($M = 9.3$ bpm, $SD = .72$) than to the other three cues ($M_s = 5.1, 6.1$ and $5.5; SD_s = .47, .58, \text{ and } .51$ for preferred, non-preferred, and generic exciting cue, respectively). Excitement to the preferred gambling cue ($M = 58.79, SD = 2.66$) and the car race ($M = 62.57, SD = 2.59$) did not differ ($p = .42$) and both were higher ($p < .001$) than excitement to the non-preferred gambling cue ($M = 51.94, SD = 3.30$) and the mental stressor ($M = 35.13, SD = 2.71$). Regarding urges to gamble, the preferred gambling scenario elicited greater urges ($M = 56.48, SD = 2.92$) than all other cues ($p < .001$). Urge ratings to the other three cues were all significantly lower ($p \leq .001$), with urges in response to the mental stressor being lowest, followed by those to the non-preferred gambling activity and the car race, which did not differ from each other.

In sum, heart rates and excitement ratings of pathological and social gamblers showed similar levels and patterns in response to the four cues, except that excitement was highest to the car race and the *preferred* gambling cue, regardless of whether this was the horse race or the scratch-off scenario. In addition, urges to gamble were overall significantly stronger in pathological gamblers than social gamblers, but both groups showed cue-specificity in that their urges were strongest in response to cues of their preferred gambling activity.

Discussion

The findings from both analyses showed the presence of cue reactivity and clear cue-specific reactions in urge to gamble. The interpretation of the pattern of responses in HR and excitement requires a more careful analysis within the context of the inclusion of a generic stressor and a generic exciting cue as control stimuli.

The finding that HR increases more in response to a mental stressor than to gambling cues has been reported previously (Blanchard et al., 2000). Both, horse race and scratch-off lottery gamblers, as well as pathological and social gamblers, reacted with the same pattern, showing that HR increases more in the face of a stressor than a gambling-related or a generic exciting cue. Perhaps this finding was an artifact created by the specific preparation used in this study because the stressor task involved not only mental but also physical activity (speaking out loud) whereas the gambling cues and the car race only required mental activity (watching); hence HR could have increased from the stress of the mental arithmetic plus counting aloud. Nevertheless, it is important to note that the groups did not respond *differentially* to the stressor task, which allows us to rule out that different types of gamblers (i.e., action versus escape gamblers, or social versus pathological gamblers) show an inherently higher level of arousal under stress. Although the preferred gambling scenario did not elicit cue-specific HR increases above the non-preferred gambling cue and the generic exciting cue (mean HR increases to all three cues were 5 to 6 bpm), this finding is nonetheless consistent with Sharpe et al.'s (1995) findings as well as other laboratory studies. For example, when participants in a lab analogue watched a horse race without wagering (pure cue elicitation condition), their HRs increased an average of 4 bpm; however, when they wagered for a chance to win real money (reinforcement condition), their HRs increased up to 28 bpm (Wulfert, Roland, Hartley, Wang, & Franco, 2005; Wulfert et al., 2008). The latter condition however confounds the effects of cue reactivity and conditioned reinforcement due to an anticipated win. This creates a dilemma because the visual presentation of gambling cues alone may be insufficient to elicit physiological arousal strong enough to determine cue-specificity. Perhaps more sensitive

measures of autonomic arousal (e.g., pupillary response, evoked response potentials) might yield clearer results.

With regard to excitement, there was no cue-specific reaction of horse race and lottery gamblers to their preferred mode of gambling as both found the action cues (horse race, car chase) more exciting than the lottery cue and the mental stressor task. This shows that excitement is a subjective experience that depends on a person's history and the context. In the real world, the excitement of gambling is generated, not by passively watching but actively participating in gambling for a chance of winning money, and it is the expectation of winning money that creates the excitement (Ladouceur, Sevigny, Blaszczyński, O'Connor, & Lavoie, 2003; Wulfert et al., 2008). As no money could be won in the current study, participants rated those scenes as most exciting that, objectively speaking, were exhilarating because of the action involved. Moreover, the car chase as a control cue allowed us to rule out that action and escape gamblers or pathological and social gamblers show inherently different reactions to an exciting event, regardless of whether it is gambling related.

Clear cue-specific reactivity was shown in the urge to gamble. Both horse race and lottery gamblers reported the highest urges when they were exposed to cues of their *preferred* gambling activity. Furthermore, the exploratory analysis revealed that pathological gamblers react with overall significantly higher urges than social gamblers to cues. These findings are consistent with the alcohol and drug abuse literature (e.g., Drobles, 2002) showing that cravings are strongest in response to cues of the specific addictive behavior. They also demonstrate the specific vulnerability of gamblers, and particularly problem gamblers, to chance encounters with stimuli that remind them of their preferred gambling activity. Functionally, such cues are establishing operations (Michael, 2000) that momentarily alter the reinforcing effectiveness of a gambling activity and therefore increase the probability that individuals will act on their desire.

Limitations

One limitation of the study was its analogue nature. Replications in real-life settings are needed to understand gamblers' reactivity to cues of the ambiance of a gambling venue, the presence of other gamblers, and the chance of winning or losing money. A second limitation is the study of only two gambling preferences. Replications should study different preferences (e.g., slot machines, casino table games) and expose participants to more than one non-preferred type of gambling. A careful construction of alternatives would permit us to ascertain whether cue reactivity follows a generalization gradient based on particular physical or functional properties of games. For example, horse race bettors may show greater reactivity to other action games (craps) than escape games (slot machines).

Future Directions

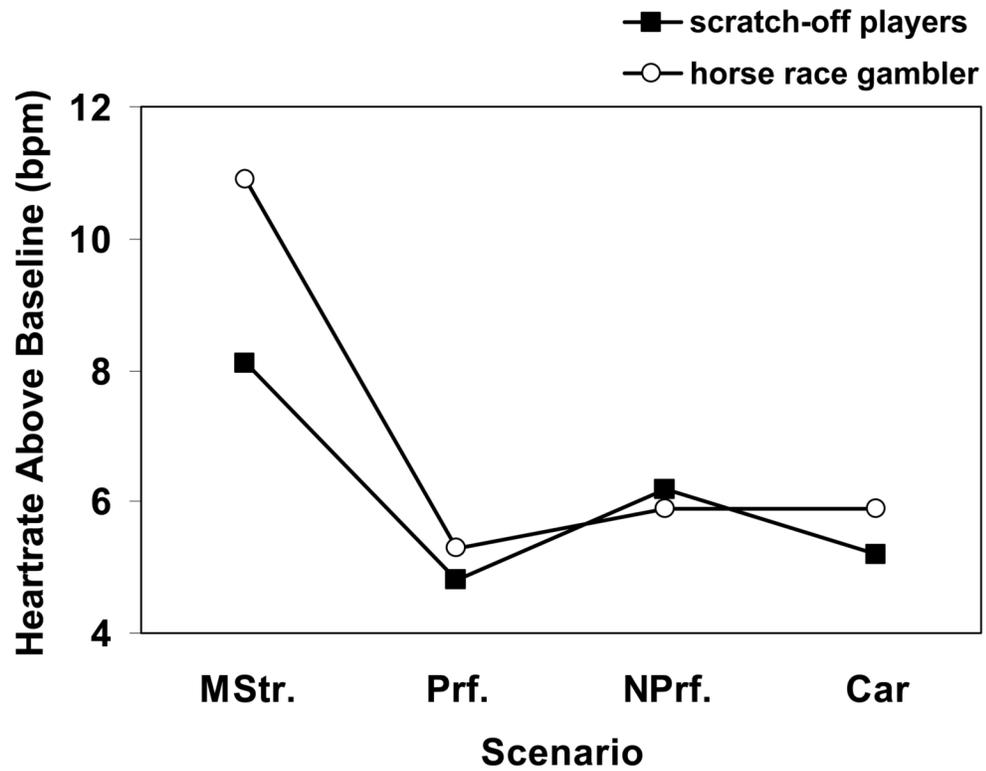
We have shown that the mere exposure to a cue of one's preferred gambling activity in a laboratory setting elicits significant urges to gamble. This finding may have important clinical implications. From the substance abuse literature we know that urges play a significant part in use and relapse. By implication, urges may play a pivotal role in unhealthy gambling behavior. This suggests that gamblers' reactivity to cues should be targeted for extinction. As extinction does not destroy the original learning and can be remarkably context-specific, it is important to optimize extinction learning by including as many relevant contextual cues as possible in the extinction context (Bouton, Woods, Moody, Sunsay, & García-Gutiérrez, 2006). This could occur via therapist-guided in vivo cue exposure in a real-world environment. If this is not practical, another effective method is "bridging." It involves including a contextual cue in extinction trials that will later be encountered in a potential relapse situation and can serve as a retrieval cue for extinction (Bouton et al, 2006). Thus, when patients find themselves in a

tempting situation, they might be able to avoid or lessen the urge to gamble by creating an image of the therapy session or using a verbal cue (e.g., “I can manage this”) that during extinction trials in the therapist’s office was paired with cue-elicited urges. As no such research exists to date in the treatment of pathological gambling, the field is wide open for advancing the field by translating basic conditioning findings from the animal laboratory to the human case.

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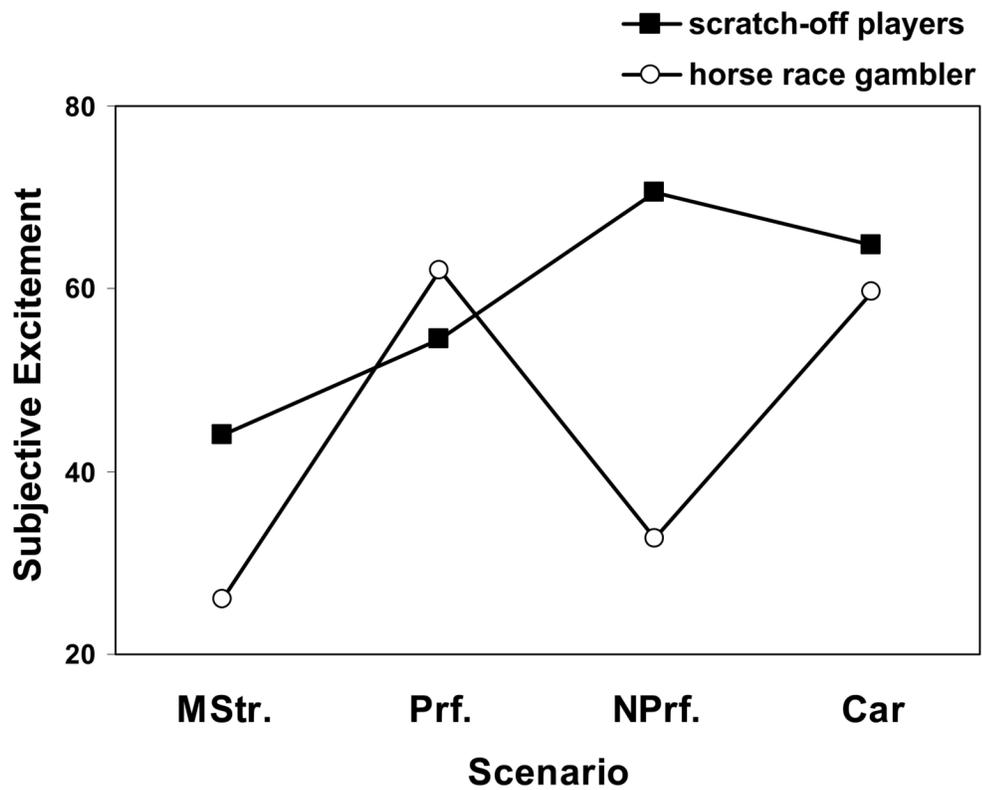
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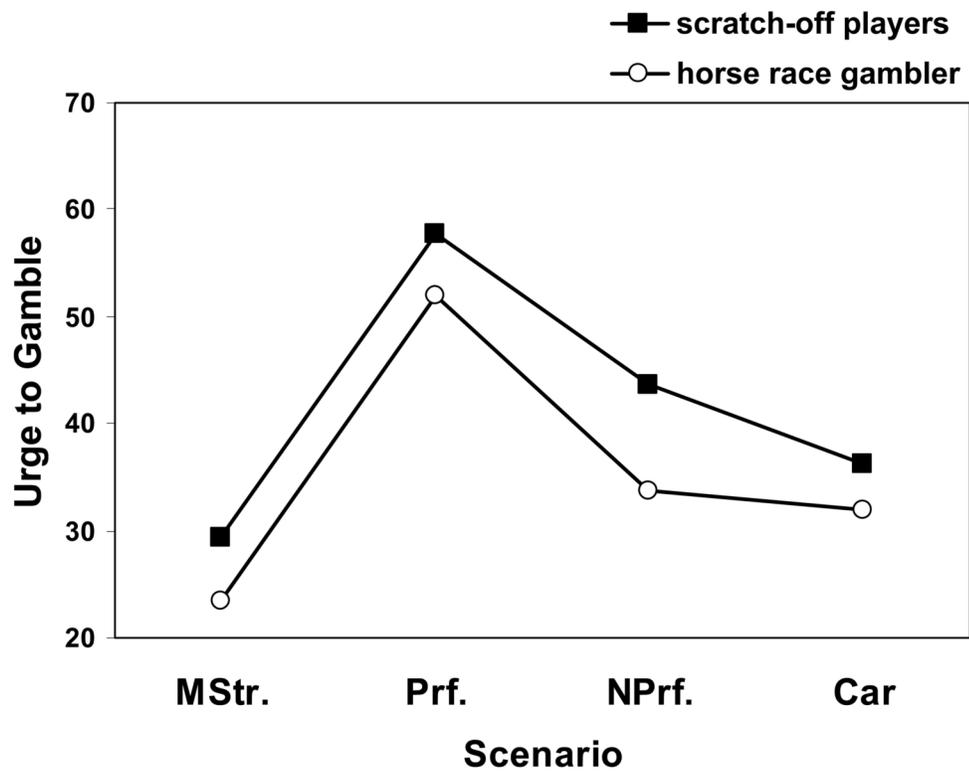
Bpm = beats per minute; MStr = Mental Stressor (mental arithmetic); Prf = preferred gambling activity; NPrf = non-preferred gambling activity; Car = Car chase

Figure 1.
Heart rate increases above baseline in beats per minute of scratch-off lottery players and horse race gamblers



MStr = Mental Stressor (mental arithmetic); Prf = preferred gambling activity; NPrf = non-preferred gambling activity; Car = Car chase

Figure 2.
Subjective excitement of scratch-off lottery players and horse race gamblers



MStr = Mental Stressor (mental arithmetic); Prf = preferred gambling activity; NPrf = non-preferred gambling activity; Car = Car chase

Figure 3.

Urge to gamble of scratch-off lottery players and horse race gamblers.