

2007

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Recommended Citation

Kushner, M. G., Abrams, K., Donahue, C., Thuras, P., Frost, R., & Kim, S. (2007). Urge to Gamble in Problem Gamblers Exposed to a Casino Environment. *Journal of Gambling Studies*, 23, 121-132. Available at: <https://doi.org/10.1007/s10899-006-9050-4>. Accessed via Faculty Work. Psychology. *Carleton Digital Commons*. https://digitalcommons.carleton.edu/psyc_faculty/4
The definitive version is available at <https://doi.org/10.1007/s10899-006-9050-4>

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Published online: 24 January 2007
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Abstract Cue-reactivity has received increased attention in addiction research, though not for gambling in particular. We examined cue reactivity in 18 problem gamblers by accompanying them to a gaming casino and measuring their subjective urge to gamble over a 1-h period. Half of the sample was additionally exposed to a gambling-specific negative mood induction (NMI) manipulation via guided imagery. Overall, about two-thirds of the sample reported moderate to high-gambling urges during the casino exposure. Additionally, the NMI reduced cue-reactivity. Finally, gambling urges in both groups decreased over the course of the exposure sessions. These findings suggest that a majority of problem gamblers experience the urge to gamble when exposed to gambling cues and that the intensity of these urges decrease with time, especially in the presence of a gambling-relevant NMI. Cue exposure should be studied further as a potential tool in the treatment of problem gambling.

Keywords Pathological gambling · Cue exposure · Craving · Urges · Addiction

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Introduction

It has long been observed that exposure to situations and stimuli associated repeatedly with past addictive behaviors can promote relapse among addicted individuals attempting to abstain (e.g., Marlatt & Gordon, 1985). This observation has spawned a substantial research program examining the extent to which contextual cues can come to trigger the urge to engage in the addictive behaviors with which they have been frequently paired (e.g., Bradizza, Stasiewicz, & Maisto, 1994). Carter and Tiffany (1999) conducted a meta-analysis of cue-reactivity studies across a number of addiction types including alcohol, nicotine, cocaine, and heroin. They concluded that: (a) addiction-specific cues presented in the laboratory produce reliable effects in terms of self-reported cravings to use and, to a lesser extent, physiological activation; and (b) the pattern of findings across studies were consistent with the idea that cue reactivity is best characterized as a generalized positive-incentive state, that is, not specific to addiction type. That is, the same essential appetitive motivational response may characterize cue reactivity across various addictions. These findings provide the empirical bedrock upon which several researchers have attempted to build cue-exposure treatments for various addictions with the goal of extinguishing triggered urges/cravings (e.g., Conklin & Tiffany, 2002).

Although Carter and Tiffany's (1999) review of studies of cue-reactivity was restricted to those involving ingested substances of abuse, there is no logical barrier to the application of this view to appetitive habits in which actual drug consumption is not involved. For example, cognitive-behavioral formulations of problem gambling (PG) implicate internal and external conditioned "triggers" of the urge to gamble as a maintaining factor in the disorder (e.g., Sharpe & Tarrier, 1993). In spite of this, there have been limited investigations into cue reactivity as it pertains to PG. In fact, our search of the literature on this topic revealed only two studies (McConaghy, Blaszczynski, & Frankova, 1991; Symes & Nicki, 1997), one of which was a case report involving two subjects. These studies provide preliminary evidence that gamblers are cue reactive and that exposure to these cues might have a therapeutic benefit. As argued by Carter and Tiffany (1999) with reference to several drugs of abuse, such data (e.g., magnitude and overall pattern of responses to relevant cues) are critical both for evaluating the relative fit of various learning models of cue-reactivity in individuals with PG and for evaluating the potential application for cue exposure (CE) in the treatment of PG.

We investigated these issues in the present study by having problem gamblers move about (but not gamble) in a casino environment ("CE session") while we periodically measured the intensity of their urge to gamble. In addition to exteroceptive gambling cues (i.e., typical sights, sounds, and smells of a gambling casino), we also were interested in evaluating cue reactivity associated with a negative mood manipulation. This latter idea was based on data suggesting that negative mood induction (NMI) can precipitate urges to drink, over and above beverage presentation cues, in alcoholics (e.g., Cooney, Litt, Morse, Bauer, & Gaupp, 1997). If, for example, an individual with PG gambles frequently when worrying about money problems, it would be well within a classical conditioning model (e.g., Poulos, Hinson, & Siegel, 1981) to expect that this negative mood state could become part of a conditioned stimuli complex associated with gambling.

Methods

Participants

We recruited participants through ads in a local newspaper, soliciting participants for a paid university study on PG. Trained research assistants (RAs) screened respondents to determine their eligibility for participation. Those eligible to participate had a score on the South Oaks Gambling Screen (SOGS; Lesieur & Blume, 1987) of 5 or greater, indicating probable PG. Also, eligible participants reported “regular” casino gambling, which we defined as a minimum of once per week for the past 3 months.

Forty-seven callers were screened over the phone and 34 of them met study criteria and were scheduled for participation. Eighteen of the 34 potential participants showed up for their scheduled appointments. Due to experimenter constraints, all sessions were scheduled for a Sunday at 2 PM. Examination of the screening information indicated that the gambling symptoms of individuals who were scheduled but failed to show up did not differ from those of the actual study participants (Mean SOGS scores (SD): no-shows = 16.2(3.3); yes-shows = 13.8(3.8). Similarly, gambling frequency per week was not different between the two groups (Mean gambling frequency (SD): no-shows = 3.5(3.2); yes-shows = 3.5(1.8). The only demographic information we obtained at the screening juncture was gender. Chi-square comparisons showed that the yes- and no-shows did not differ significantly by gender; however, there was an apparent trend for no-shows to include a greater percentage of males (75% vs. 50%).

Measures

The South Oaks Gambling Screen (SOGS; Lesieur & Blume, 1987)

The SOGS is a widely used screening device for identifying PG. Respondents are asked to self-rate 16 items related to their gambling behavior, 11 of which are actually scored. Scores are derived by adding one point for each of the 11 scoreable questions that are rated in the pathological range. Scores greater than 5 are used to identify probable pathological gamblers (Lesieur & Blume, 1987). Using this criterion, the SOGS has been shown to reliably distinguish between individuals with versus without DSM-III-R criteria PG with minimal misclassification (Lesieur & Blume, 1987).

Beck Depression Inventory (BDI; Beck, Ward, Mendelson, Mock, & Erbaugh, 1961)

The BDI is a 21-item self-report measure of depression symptoms rated on a 4-point scale. Items are rated from 0, indicating the symptom is absent to 3, indicating that the symptom is severe. The BDI total score is derived by summing the individual item ratings.

Gambling Urge Intensity

Participants were instructed to rate the intensity of their urge to gamble on a 10-point scale anchored by 1 = “no urge” on the low end and 10 = “strong urge” on

the high end. Respondents are instructed to base their rating on how they felt “during the most recent walk around the casino” (all participants) and “at this moment” for those who underwent the NMI (see description of procedures below). Similar ratings of gambling urge intensity have been found to be sensitive to the intensity of gambling cues (Frost, Meagher, & Riskind, 2001) and response to treatment (Symes & Nicki, 1997).

Procedure: Pre-exposure Session

Phone Contact

As described above, the RAs screened ad respondents by telephone. For those deemed eligible, the RA read a description of the study and asked additional questions concerning problems directly related to gambling that the individual either had experienced or worried about in the following six areas: (1) important relationships; (2) finances; (3) occupation; (4) emotional function; (5) legal; (6) alcohol or drug use. (This information was used to individualize NMI.) Finally, the RA scheduled the individual to attend a one-time experimental session with three or four other participants and two experimenters. Five separate cohorts were run in this way to run the entire compliment of subjects through the single experimental session.

The Negative Mood Induction (NMI)

Prior to the exposure session, participants were randomly assigned to one of two conditions (CE alone, CE; and, CE plus NMI, CD + NMI). The experimenters then prepared an individualized NMI for each participant in the CE + NMI group. In order to develop each NMI, one of us (MGK) reviewed the gambling-related problems a given participant provided (see above) and recorded an audio (guided imagery) narration of a second-person account of these outcomes occurring and/or worsening as a direct result of the individual’s continued gambling. Each audiotaped NMI was ~5 min in length.

Procedures: The Exposure Session

Prior to Arrival at the Casino

The RA scheduled participants to arrive at a convenient location at 2 PM on a Sunday. Once participants arrived, one of our staff drove them in a van to the casino, which is an ~35 min drive from the initial meeting place. During the trip, all participants underwent an “urge priming” procedure that entailed listing up to five things they would do if they were to have a “very successful day gambling.” Participants were instructed not to talk about gambling with one another for the duration of the study.

At the Casino

Shortly after arriving at the casino, CE and CE + NMI participants were divided into separate groups. One RA led the CE group participants through five

consecutive repetitions of the following sequence: 10 min walking around the gambling floor of the casino followed by a brief gambling urge assessment period. Another RA led the CE + NMI group through 1 sequence as described above followed by four consecutive repetitions of the following sequence: 10 min walking around the gambling floor of the casino followed by a gambling urge assessment before and after listening to the 5-min NMI tape over headphones.

When walking the casino floor, the RAs led their group of participants through a pre-determined path with the aim of exposing them to a wide array of gambling stimuli. Participants were specifically reminded to “pay close attention to the sounds and sights of the slot machines and card tables.” Halfway through each of the 10-min walk-arounds, the RA stopped to play eight quarters, one at a time, in the slot machine as the group watched. (This element was added to further heighten the evocative nature of the CE procedure.) In all cases, participants were not allowed to gamble during the exposure session. Assessments and the NMI procedure took place just off the gambling floor in a secluded area of the casino.

Procedures: Following the Exposure Session

Following the conclusion of the five cycles, participants were paid for their participation, provided with a self-help booklet and referral information for problem gamblers, and were transported back to the initial meeting location.

Analyses

Based on CE research conducted with other addictive behaviors (e.g., Avants, Margolin, Kosten, & Cooney, 1995; Litt, Cooney, & Morse, 2000), we anticipated that some participants would not respond to the casino exposure with strong gambling urges. Because this could not be determined until a person was enrolled and engaged in the experimental session, we chose to address the issue by conducting two levels of analysis. One, labeled the “whole sample” analysis, included all participants for whom data were available ($N = 18$). The second, labeled the “cue reactive” analysis, included only individuals who responded to the casino environment with a minimal gambling urge rating.

In determining these categorizations, we followed the general plan outlined by Litt et al. (2000) in which we inspected the distribution of urge ratings blind to group to identify bi-modality and an optimal cut-point segregating the subgroups. Using a cut-off of ≥ 4 , we identified six individuals (two from the CE group and four from the CE + NMI group) with a mean urge rating of 2.33 ($SD = 1.03$) below the cutoff, leaving 12 participants above the cut-off with a mean urge rating of 7.92 ($SD = 1.41$; $F(1,16) = 73.2, p < 0.001$).

Results

Demographics and Clinical Status

As shown in Table 1, the groups did not differ in terms of age, ethnicity or employment status. However, the CE + NMI group had a non-significant trend of

Table 1 Demographic details by study group*

N	CE 8	CE + NMI 9	Overall 17	χ^2	<i>p</i> <
Female	50% (4)	56% (5)	50%	0.222	0.637
Caucasian	88% (7)	100% (9)	94%	1.19	0.274
Unemployed	25% (2)	22% (2)	24%	0.753	0.686
Age	Mean (SD) 32.13 (14.29)	45.22 (13.22)	39.06 (14.90)	F 3.86	<i>p</i> < 0.068
Clinical features					
Currently receiving treatment for gambling?	12.5% (1)	22.2% (2)	18%	0.28	0.60
Currently receiving treatment for emotional or substance use disorder?	50% (4)	44.4% (4)	47%	0.05	0.819
Received treatment for emotional or substance use disorder in the past?	28.6% (2)	66.7% (6)	50%	2.29	0.131
SOGS score	Mean (SD) 12.44 (2.74)	15.22 (4.41)	13.83 (3.84)	F	<i>p</i> < 0.128
BDI score	16.75 (8.31)	19.11 (12.67)	18.00 (10.58)	0.2	0.661

*One subject in the CE group was missing demographic information

being older than those in the CE group. Regarding clinical variables, neither group was more likely than the other to be in (have been in) treatment for gambling or substance abuse; however, there was a non-significant trend for the CE + NMI group to report more PG symptoms on the SOGS. Although the groups did not differ on the BDI, both groups demonstrated mean scores suggesting modest depression (Beck et al., 1961).

To help ensure that there were not spurious group differences in gambling urge intensity during the exposure session, we examined zero-order correlations between initial urge ratings during the experiment and background variables for which there was even a marginal group differences (Table 1). None of these associations were significant; however, we did find a moderate positive correlation between SOGS score and initial urge rating (Pearson $r = 0.39, p < 0.11$).

Group Comparisons of Urge to Gamble Over the Course of the Experimental Session

Figure 1 shows group differences in urge to gamble as assessed just prior to the NMI. Beginning with the cue reactive sample analysis, the results showed a significant group by time interaction [$F(4,38), p < 0.006$], related to changes in the CE + NMI group.

Urge scores for the CE group remained relatively flat over time (7.14, 7.71, 8.29, 7.86, 6.90; from the two baseline measures across three subsequent measurements [$F(3,22) = 1.35, p < 0.28$]), whereas the CE + NMI group declined over time (9.00, 8.20, 5.60, 5.60, 6.00) with a significant drop after the second baseline measurement [$t(38) = 2.64, p < 0.01$]. Notably, a parallel analysis conducted in the whole sample showed no significant group [$F(1,16) = 1.43, p < 0.248$] or group by time effects [$F(4,59) = 1.25, p < 0.299$].

Change in Gambling Urge Intensity from Pre-to Post-NMI

Figure 2 shows changes in rating from just prior to just following the NMI procedures. (Note the CE group data are retained for perspective only.) As shown in the

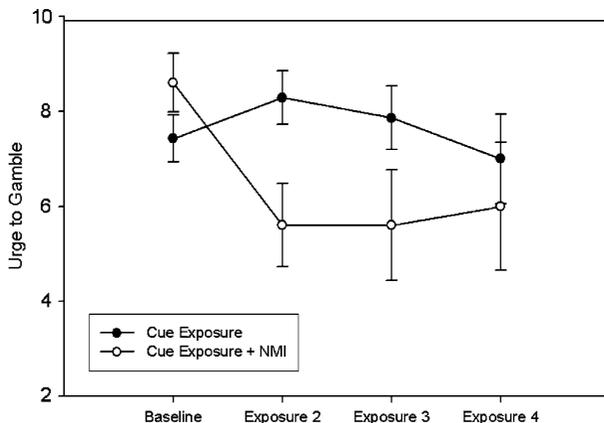
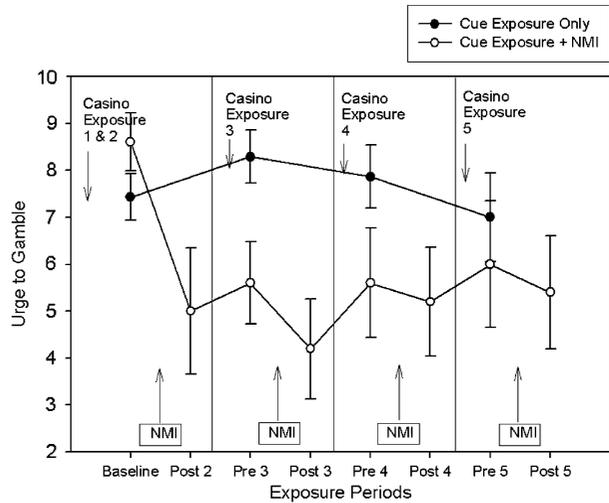


Fig. 1 Urge to gamble preceding each NMI and at corresponding time-points in the CE group

Fig. 2 Urge to gamble before and after the NMI and at corresponding time-points in the CE group



top panel of Fig. 2 (cue reactive sample), gambling urge is reduced following the NMI by an average of 1.5 points [$F(1,4) = 11.96, p < 0.026$]. Given the fresh exposure experience in between the two gambling urge measurements, it is not surprising that there is a trend, approaching statistical significance, for recovery of the gambling urge in the second measure relative to the first [$F(1,4) = 4.95, p < 0.090$]. However, as noted above, even with the recovery effect (about 0.93 points on average) desensitization remains evident across the gambling urge measures (Fig. 1). Notably, these findings also remained significant in the whole sample analysis in terms of both intra-NMI effects [$F(1,8) = 7.65, p < 0.024$] and between NMI effects [$F(1,8) = 7.23, p < 0.028$].

Discussion

We sought to examine whether problem gamblers would experience a strong urge to gamble when exposed to a casino environment but prohibited from gambling. Our primary finding is that two-thirds of the sample reported moderate to high-gambling urges. This rate of cue reactivity is highly similar to that found in studies of alcoholics exposed to drinking-related cues (e.g., Litt et al., 2000). The high rate of cue reactivity among problem gamblers can be explained by a classical conditioning paradigm (see Laberg, 1990). From this perspective, stimuli which are originally neutral (e.g., sights and sounds of a casino) become paired with gambling activity and, over time, can provoke the same physiological and psychological reactions (including urges) as gambling itself.

As noted, approximately one-third of the sample failed to experience even moderate urges to gamble when inside the casino. Two types of explanations for the existence of this group include those based on: (a) method-related parameters (e.g., a CE that did not include the stimuli appropriate for eliciting gambling urges in some subjects), and (b) participant-related parameters (e.g., a subtype of PG, that is, not strongly associated with gambling urges).

In terms of our method, it remains possible that we were simply ineffective in identifying the most appropriate cues for eliciting urges to gamble in some participants. That is, perhaps some or all of the no/low urge responders would have had strong initial urge ratings had they been exposed to specific gambling-related stimuli not included in our CE experience. Although all potential participants did endorse regular casino gambling and the expectation of feeling the urge to gamble when in a casino, more fine-grained screening may be necessary to identify the precise cues expected to elicit gambling urges in a given individual. This idea parallels the finding among alcoholics that cue reactivity is often greater if participants are offered a choice of beverage (Laberg, 1990). Further, the fact that participants were told they would not be able to gamble during the study may have dampened urges for some. Among alcoholics, for example, the expectancy of being able to consume alcohol promotes the urge to drink (Laberg, 1990).

We also considered that significant variation on any of a number of participant parameters could potentially have impacted upon gambling urge level in response to the CE. In order to evaluate whether some subjects failed to develop strong gambling urges because their gambling pathology was simply less severe, we compared the no/low urge subjects to others on the SOGS. The former group had a mean SOGS score of 12.83 (SD = 4.62) and the latter had a mean SOGS score of 14.33 (SD = 3.70). Statistical comparison showed that this difference was not statistically significant and, as can be seen, the effect size difference (about one-third of a standard deviation) is small. Further, the means of both groups were well above a SOGS score of 5, which is conventionally used to identify probable problem gamblers (Lesieur & Blume, 1987). In short, the evidence available does not indicate that the reason some subjects failed to generate strong gambling urges during the CE is that their gambling pathology was simply less severe.

However, the fact that no/low urge participants demonstrate gambling pathology, that is, commensurate with high-urge participants does not rule out the possibility that PG is actually a heterogeneous category within which only a subgroup is subject to strong gambling urges when faced with gambling cues. For example, Kim and colleagues (e.g., Kim, Grant, Adson, & Shin, 2001) have argued that only a subgroup of those with PG is driven to gamble primarily because of appetitive urges (i.e., others may gamble primarily as an attempt to escape painful affect) and that only this subgroup could be expected to benefit from interventions aimed primarily at the urge to gamble. This conclusion would point to the need to identify moderating variables marking those for whom the urge to gamble serves as a central gambling motive.

The Role of Negative Mood Induction

We had predicted a priori that NMI would enhance cue reactivity. We based this prediction on parallel studies on alcoholism (e.g., Cooney et al., 1997; Litt, Cooney, Kadden, & Gaupp, 1990) and classical conditioning models of addiction (e.g., Poulos et al., 1981). Further, elevated rates of depression have been found among those with PG (Blaszczynski & McConaghy, 1988), although such associations do not establish causality.

Unexpectedly, however, we found that NMI reduced cue reactivity (intensity of gambling urges). One possible explanation is that negative affect does, in isolation, increase cue reactivity but that negative affect stemming from guided imagery of

feared negative gambling consequences decreases cue reactivity. The guided imagery scripts used in our study highlighted undesirable outcomes resulting from gambling that the participant had earlier told us were of concern using dramatic, present-tense language. The NMI performed in the aforementioned studies of alcoholism did not involve the mentioning of negative consequences of continued alcohol use. [One of the studies referenced past events that led to craving and relapse (Cooney et al., 1997), and one did not mention alcohol or alcohol cues at all (Litt et al., 1990)].

Alternatively, perhaps NMI promotes appetitive urges among those with alcoholism but not among those with PG. Future studies could examine, among those with PG, the impact on cue reactivity of NMI by means other than guided imagery of potential negative consequences. The goal of such studies would be to tease apart the effects of negative affect, images of negative outcomes, and CE on gambling urge.

Treatment Implications

One implication of our data is that CE should be studied further as a potential tool in the treatment of PG. This form of behavior therapy has received limited attention from researchers as a method of treating PG (Conklin & Tiffany, 2002; McConaghy et al., 1991; Symes & Nicki, 1997). In the only controlled study using these techniques, McConaghy et al. (1991) found that aversion treatment, imaginal desensitization (i.e., imaginal CE) treatment, relaxation treatment, and in vivo CE were all comparable (around 30% success rate) when abstinence was the outcome criterion.

While not a test of a fully developed treatment, this experiment does provide information that is directly relevant to PG treatment and suggests the value of additional studies to evaluate a PG treatment program that includes CE plus NMI via guided imagery. In addition, preliminary treatment studies for PG (Ladouceur and colleagues), in which the focus was on correcting faulty assumptions found evidence that cognitive interventions had therapeutic potential (e.g., Sylvain, Ladouceur, & Boisvert, 1997). That said, other clinical data (based on individuals with anxiety disorders) shows that robust desensitization does not typically occur when corrective information is presented in the absence of CE (e.g., Borkovec & Sides, 1979; Watson, Gaiend, & Marks, 1971). An additional treatment issue to be explored will include the practicality of delivering CE in community-based settings with limited control and oversight as compared to the parameters (e.g., transportation to casino and supervision) of this study

In short, following the empirical demonstration of the value of CE plus NMI via cognitive means for reducing gambling urges, a fully developed treatment approach would still require a creative and clinically thoughtful approach to implement a practical delivery technology.

Study Limitations

Notable study limitations include the small sample size. On the other hand, this aspect of the study highlights the robust effect sizes involved in significant findings. There was also a large no-show rate, which may reflect the large time commitment (3–4 h) and the limitations of the time slots available for scheduling. Also, many

questions that are directly relevant to the application of the mechanism tested to a full-scale treatment were considered premature and therefore not addressed in this study. Further, because there was only one, fairly brief CE session and gambling urge was measured by self-report, we cannot at this stage determine the effects of additional CE on gambling urge or on actual gambling behavior. Additional limitations to be considered are the fact that the NMI tapes were not followed by an assessment of the subjects' mood which could have determined if there were a significant change in mood. Subjects also listened to the NMI tapes outside of the casino, so the observed urge reductions may be attributed to subjects not being directly exposed to the casino. The reductions in the urge to gamble over time were not further explored to consider the possibility of boredom. For example, knowing that gambling was not allowed or possible immediately after repeated exposures, there would be an expected reduction in the urge to gamble. Future studies could control for this limitation by exposing subjects to the possibility of a fairly immediate (i.e., morning and evening gambling visits in same day) gambling situation following the initial visit. Future studies may also consider matching subjects closely to their game of preference (e.g., slots, blackjack, craps) and the amount subjects typically gamble. Additional controls would need to include duration of abstinence from gambling which can have obvious effects in individuals urge intensity, as well as the frequency of prior gambling. This study did not control for possible comorbid disorders, which could potentially explain differences in gambling urge reported. Subjects receiving active treatment may have reported diminished gambling urge compared to non-treatment subjects. The SOGS, which has been shown to reliably distinguish between individuals with versus without DSM-III-R criteria PG with minimal misclassification (Lesieur & Blume, 1987), was used for screening as compared to DSM-IV structured clinical interview.

Subjects would also need to be matched in regard to activities engaged in during CE. For example, smokers and non-smokers would need to be controlled for with no smoking during NMI, which could subsequently induce relaxation and diminish the urge to gamble.

Notwithstanding the limitations discussed, we believe that the preliminary empirical support this study provides for the role of CE and NMI on gambling urges sets the stage for further experimental work, that is, designed to refine and expand this research program. In this pursuit, we expect that such work could further inform and be informed by studies exploring CE as a treatment for addictive behaviors beyond gambling (e.g., Monti et al., 2001; Rohsenow et al., 2001).

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