FULL-LENGTH REPORT

Journal of Behavioral Addictions 6(1), pp. 51–63 (2017)
DOI: 10.1556/2006.6.2017.001
First published online January 24, 2017

The role of affect-driven impulsivity in gambling cognitions: A convenience-sample study with a Spanish version of the Gambling-Related Cognitions Scale

FRANCESCO DEL PRETE[1,3], TREVOR STEWARD[4,5], JUAN F. NAVAS[1,2]*, FERNANDO FERNÁNDEZ-ARANDA[4,5,6], SUSANA JIMÉNEZ-MURCIA[4,5,6], TIAN P. S. OEI[7,8] and JOSÉ C. PERALES[1,2]

[1]Mind, Brain and Behavior Research Center, University of Granada, Granada, Spain
[2]Department of Experimental Psychology, University of Granada, Granada, Spain
[3]Centre for Economic and International Studies, University of Rome "Tor Vergata", Rome, Italy
[4]Department of Psychiatry, Bellvitge University Hospital-IDIBELL, Barcelona, Spain
[5]Ciber Fisiopatología, Obesidad y Nutrición (CIBERObn), Instituto de Salud Carlos III, Madrid, Spain
[6]Department of Clinical Sciences, Faculty of Medicine, University of Barcelona, Barcelona, Spain
[7]School of Psychology, University of Queensland, Brisbane, Australia
[8]Department of Psychology, James Cook University, Singapore, Singapore

(Received: September 17, 2016; revised manuscript received: November 21, 2016; second revised manuscript received: December 21, 2016; accepted: December 24, 2016)

Background and aims: Abnormal cognitions are among the most salient domain-specific features of gambling disorder. The aims of this study were: (a) to examine and validate a Spanish version of the Gambling-Related Cognitions Scale (GRCS; Raylu & Oei, 2004) and (b) to examine associations between cognitive distortion levels, impulsivity, and gambling behavior. *Methods:* This study first recruited a convenience sample of 500 adults who had gambled during the previous year. Participants were assessed using the Spanish version of GRCS (GRCS-S) questionnaire, the UPPS-P impulsivity questionnaire, measures of gambling behavior, and potentially relevant confounders. Robust confirmatory factor analysis methods on half the sample were used to select the best models from a hypothesis-driven set. The best solutions were validated on the other half, and the resulting factors were later correlated with impulsivity dimensions (in the whole $n = 500$ factor analysis sample) and clinically relevant gambling indices (in a separate convenience sample of 137 disordered and non-disordered gamblers; validity sample). *Results:* This study supports the original five-factor model, suggests an alternative four-factor solution, and confirms the psychometric soundness of the GRCS-S. Importantly, cognitive distortions consistently correlated with affect- or motivation-driven aspects of impulsivity (urgency and sensation seeking), but not with cognitive impulsivity (lack of premeditation and lack of perseverance). *Discussion and conclusions:* Our findings suggest that the GRCS-S is a valid and reliable instrument to identify gambling cognitions in Spanish samples. Our results expand upon previous research signaling specific associations between gambling-related distortions and affect-driven impulsivity in line with models of motivated reasoning.

Keywords: gambling disorder, impulsivity, cognitive biases, gambling cognitions, psychometric tools

INTRODUCTION

Gambling disorder (GD) is defined as persistent and recurrent problematic gambling behavior leading to clinically significant impairment or distress (American Psychiatric Association, 2013). In the European Union, for example, problem gambling rates have been found to range from 0.3% to 3.1% (Planzer, Gray, & Shaffer, 2014). In Spain specifically, epidemiological research points to high rates of gambling behavior and specific culturally bound types of gambling (e.g., state lotteries and pervasive slot machines) are thought to encourage such behaviors (Jiménez-Murcia, Fernández-Aranda, Granero, & Menchón, 2014). Demographic variables (gender, age, and education levels), personality traits, schedules of reinforcement, comorbid states (drug and alcohol abuse, obsessive-compulsive disorder, and personality disorders), and delinquency/illegal acts have been identified as risk factors for problematic gambling (del Pino-Gutiérrez et al., 2016; Johansson, Grant, Kim, Odlaug, & Götestam, 2009; Petry, Stinson, & Grant, 2005). Cognitive behavioral therapy (CBT) is regarded as being effective at treating GD (Oei, Raylu, & Casey 2010; Raylu & Oei, 2010, 2016; Yau & Potenza, 2015), though relapse and dropout rates in such interventions remain high (Aragay et al., 2015). To enhance

* Corresponding author: Juan F. Navas; Departamento de Psicología Experimental, Universidad de Granada, Campus de Cartuja, s/n, 18071 Granada, Spain; Phone: +34 958243763; Fax: +34 958246239; E-mail: jfnavas@ugr.es

currently available treatment options, a better understanding of the mechanisms underpinning GD is crucial.

Recently, the role of altered gambling cognitions in the etiology and maintenance of GD has received increased interest from researchers and clinicians alike (Fortune & Goodie, 2012; Goodie & Fortune, 2013; Raylu & Oei 2002); although it has also been suggested that the causal link between GD and gambling cognitions could be bidirectional (so that GD and its accompanying cognitive distortions can remit spontaneously, or as a consequence of treatments not explicitly targeting such distortions, e.g., Echeburúa, Báez, & Fernández-Montalvo, 1996). Numerous studies have identified common patterns of distorted thinking in individuals with GD, and such patterns have been linked to the frequency of gambling behavior and GD severity (Emond & Marmurek, 2010). For example, the term *the gambler's fallacy* refers to the cognitive distortion that a win will follow a sequence of losses even though outcomes occur independently of each other and are therefore unpredictable (Delfabbro, 2004). Similarly, gamblers may be of the belief that they themselves are able to influence gambling outcomes through the use of strategies, rituals, or lucky charms [Illusion of control (IC); Teed, Finlay, Marmurek, Colwell, & Newby-Clark, 2012]. Other cognitive distortions involve the over-interpretation of signals of gambling skills, attributional errors, selective memory, and probabilistic bias (Cantinotti, Ladouceur, & Jacques, 2004; Goodie, 2005; Ladouceur & Sévigny, 2005).

The Gambling-Related Cognitions Scale (GRCS) is an instrument that assesses five domains of gambling-related cognition in clinical and non-clinical gamblers (Raylu & Oei, 2004). These domains consist of cognitions related to: interpretative bias (IB), IC, predictive control (PC), gambling expectancies (GE), and perceived inability to stop gambling (ISG; see the Measures section for details on the meaning of each domain). The GRCS has been found to be highly reliable (scale Cronbach's $\alpha = 0.93$, domain Cronbach's $\alpha = 0.77$–0.91) and criterion valid when tested against the South Oaks Gambling Screen (SOGS) (Whelan, Meyers, & Steenbergh, 2007), a widely used instrument for assessing gambling-related behavior (Lesieur & Blume, 1987; Stinchfield, 2002). Validated versions of the GRCS have been developed for Chinese (Oei, Lin, & Raylu, 2007), Japanese (Yokomitsu & Takahashi, 2015), Turkish (Arcan & Karanci, 2013), French (Grall-Bronnec et al., 2012), and Italian samples (Donati, Ancona, Chiesi, & Primi, 2015; Iliceto et al., 2015).

Gambling cognitions have clinical implications: gamblers who identify and correct their gambling cognitions have greater treatment adherence than gamblers who do not (Ladouceur et al., 2001). Thus, a Spanish validated, self-report questionnaire for the assessment of gambling cognitions is an essential preliminary step for conducting research on gambling cognitions and to determine their role in the efficacy of treatment interventions for GD patients in the Spanish population. [Preliminary tests of a provisional version of the scale suggest that it is also usable, with minor alterations, in other Spanish-speaking communities (Jara-Rizzo, Navas, & Perales, 2016).]

Interestingly, impulsive personality traits in problem gamblers have been found to correlate with gambling cognitions, and it has been hypothesized that an impulsive decision-making style could increase the acceptance of erroneous beliefs during the execution of gambling behavior (Michalczuk, Bowden-Jones, Verdejo-García, & Clark, 2011). Somewhat counterintuitively, gambling cognitions and particularly the IC bias were observed to be more closely linked to affect-driven impulsivity (positive and negative urgency and the tendency to act rashly under the influence of emotional states) than to cognitive impulsivity (lack of premeditation and lack of perseverance). In line with this evidence, gambling-related cognitions also correlate with anomalies in emotion-regulation abilities (Navas, Verdejo-García, López-Gómez, Maldonado, & Perales, 2016), as commonly observed in other putative behavioral addictions (Wolz et al., 2015). This supports the idea that gambling cognitions are self-serving, that is, they help gamblers curb negative affective states generated by aversive events (e.g., losses), and encourage them to keep on gambling, as suggested by motivated reasoning models (Kunda, 1990).

The aims of this study were: (a) to develop a Spanish version of the GRCS (GRCS-S) and examine its validity and reliability in Spanish samples and (b) to assess associations between cognitive distortion levels, measures of impulsivity, and gambling behavior. In line with previous evidence, we hypothesize cognitive distortions in gamblers to be linked, on the one hand, to problematic aspects of gambling behavior and gambling severity and, on the other hand, to affect-driven impulsivity traits.

METHODS

Participants and procedure

Data were collected between October 2012 and March 2015. A first convenience sample of 500 individuals was selected for factor analyses (henceforth, *factor analysis sample*). The only criterion for inclusion in this sample was having gambled at least once during the year before the assessment. Subsequently, using random number generation, this sample was split into two groups of 250 subjects (henceforth, *Subsets A* and *B*; see Table 1, upper panel).

For validity analyses, a different convenience sample of 137 participants (henceforth, *validity sample*) was used (Table 1, lower panel). This sample was composed of (a) treatment-seeking gamblers from three outpatient clinics (*Asociación Granadina de Jugadores de Azar en Rehabilitación*, *Asociación Provincial Linarense de Jugadores de Azar en Rehabilitación*, and *Asociación de Ludópatas Jiennenses en Rehabilitación*), in the cities of Granada, Linares, and Jaén (Andalusia, Spain), and (b) non-treatment-seeking gamblers meeting the same inclusion criterion described above. Exclusion criteria for this sample were: (a) having a history of neurological disease or brain trauma causing unconsciousness for 10 min or longer and (b) having been in treatment for a psychiatric disorder other than GD, in the case of GD patients. Time in treatment for GD patients ranged between 1 and 21 months (mean = 5.206 months and $SD = 4.963$). Fifty-two percent of these patients had been in treatment for three complete months or less.

Table 1. Participant characteristics

	Factor analysis sample	
	Subsample A	Subsample B
n	250	250
Age, mean (*SD*)	21.56 (7.04)	23.22 (9.63)
% of females	40.5	42.08
	Validity sample	
n	137	
Age, mean (*SD*)	34.96 (0.99)[a]	
% of females	16.78[b]	
% of *n* diagnosed as GD	37.23	
% of *n* with SOGS ≥ 5	40.88	

[a]Age information was lost for four participants. [b]Gender information was lost for three participants.

Most of the factor analysis sample ($n = 500$) was extracted from the same pool of participants assessed for a study by Navas, Torres, Cándido, and Perales (2014). These participants were contacted in the University of Granada faculties, by means of Internet posting, or through people who had already participated in the study (so that most were college students) and took part in-group assessment sessions carried out in several lecture rooms at the University of Granada. Only those who had gambled at least once in the last year were later selected as members of the factor analysis sample. Extra participants were recruited and assessed in the same way until an $n = 500$ sample size was reached. In the group sessions, after being debriefed about aims and procedures (via written and read-aloud instructions), and providing informed consent, they filled out all the questionnaires described below except the SOGS (Spanish version; Echeburúa, Báez, Fernández-Montalvo, & Páez, 1994) in random order. Participants in this sample were not paid, although college students taking courses from the Department of Experimental Psychology, University of Granada, at that time obtained course credits for their participation. Each session lasted approximately 30 min.

The validity sample ($n = 137$) partially overlaps with the one in Navas et al. (in press) and consisted of both disordered and non-disordered gamblers. Treatment-seeking gamblers in this sample (51 participants) were contacted through their treatment centers. For these gamblers, all assessments were conducted individually and face-to-face. After welcoming the participant and obtaining his/her consent, the assessment began. In these patients, assessments were part of a larger protocol aimed at carrying out a detailed evaluation of behavioral and neurobiological correlates of gambling (see, e.g., Navas et al., 2016; Perales, Navas, Ruiz de Lara, Maldonado, & Catena, in press). The whole protocol was divided into two sessions, and all the instruments mentioned here were administered during the first session, lasting for approximately 3 hr. Participants were not compensated in this session (although they were paid approximately €10/hr in the second session, with payment being channeled through the treatment center or a responsible relative). The clinical assessment, including GD and potential comorbidities diagnosis, was carried out by a professional therapist in the treatment center. All other assessments were carried out by a trained psychologist with extensive experience in clinical evaluations (third author). Beyond clinical diagnosis, fulfillment of inclusion/exclusion conditions was reported by the participant.

Non-treatment-seeking gamblers in the validity sample (86 participants) were contacted through people who had already participated in the study, by Internet posting or by personal contacts. They were individually assessed or, alternatively, received the materials via e-mail, and were asked to fill the questionnaires at home, and returned them again via e-mail. These off-site participants were informed about the participation conditions (exclusion/inclusion criteria) and debriefed about their task by phone. They were then sent an e-mail with a fact sheet about the study aims and the conditions of consent. After formal consent was obtained, they received a second e-mail with full instructions and the questionnaires. On-site assessments were carried out by the third author on an individual basis. In this case, the presence of psychiatric comorbidities was assessed by means of a structured interview carried out by the same evaluator. Completion time for the set of questionnaires was approximately 45 min.

Measures

GRCS-S. The original GRCS questionnaire (Raylu & Oei, 2004) assesses five gambling-related cognitive domains through twenty-three 7-point Likert style items. *ISG* (e.g., “I’m not strong enough to stop gambling”) and *GE* (e.g., “Gambling makes things seem better”) refer to personal beliefs of lacking the ability or capacity to control gambling impulses and overvaluing the joy, reward, or relief that can be obtained from gambling, respectively. *IC* (e.g., “Praying helps me win”), *PC* (e.g., “Once I have a won, I will definitely win again”), and *IB* (e.g., “Relating my losses to bad luck and bad circumstances makes me continue gambling”) are cognitive distortions involving causal attribution processes.

The English version of GRCS questionnaire was translated into Spanish, and then back-translated into English by a native, English-speaking bilingual translator. Potential discrepancies between the original and back-translated versions of the questionnaire were discussed and eventually polished from the Spanish version by the translator and one of the authors (see Appendix A for the final version).

UPPS-P impulsive behavior scale (Whiteside & Lynam, 2001). The brief Spanish version of the UPPS-P scale used here (Cándido, Orduña, Perales, Verdejo-García, & Billieux, 2012) contains 20 items (four items per dimension), and allows for a quick multidimensional assessment of impulsivity: positive urgency (e.g., “I tend to lose control when I am in a great mood”), negative urgency (e.g., “When I am upset I often act without thinking”), (lack of) premeditation (e.g., “My thinking is usually careful and purposeful”), (lack of) perseverance (e.g., “Once I get going on something I hate to stop”), and sensation seeking (e.g., “I quite enjoy taking risks”).

MultiCAGE CAD-4 (Pedrero Pérez et al., 2007). This instrument is a quick screening tool to detect alcohol misuse and illegal drug misuse among other problematic behaviors beyond the scope of this study. Each subscale consists of four yes/no items, checking for current feelings of craving, others' complaints about the potential problematic behavior, guilt or shame feelings and/or lack of self-acknowledgment, and self-reported compensatory behaviors. The scales of alcohol and illegal drug misuse have shown appropriate psychometric properties and predictive validity of alcohol and drug abuse. In this study, the illegal drug and alcohol subscales were used as control variables to check for GRCS-S domain specificity.

SOGS (Lesieur & Blume, 1987). This questionnaire is aimed to assess gambling severity, dependence, and debt accrual. It is the most commonly used tool in gambling research, a fact that allows comparisons across studies. The Spanish version used in this study has shown good psychometric properties (Echeburúa et al., 1994). It comprises 16 items, 12 of which are worded as yes/no questions, and count for calculating the SOGS dependence, debt, and total severity indices.

Statistical analysis

Preliminary analyses and selection of estimation method. Preliminary analyses showed that all variables of interest had non-normal distributions in the factor analysis sample, with strong violations of skewness and kurtosis. This fact, along with the use of ordinal measure scales (Muthén & Kaplan, 1985), led us to consider all the variables as discrete, and to use analyses and estimation methods appropriate for them (Babakus, Ferguson, & Joreskog, 1987). Hence, we used a robust method for the estimation of models [diagonal weighted least square (DWLS); Babakus et al., 1987; Schumacker & Beyerlein, 2009]. The inputs for DWLS implementation are a correlation matrix and a covariance matrix, suitable for ordinal data, and an asymptotic covariance matrix, that the software uses to adjust the estimation in the presence of extreme values.

Factor analyses. For testing and comparison purposes, we took four different nested factorial solutions into consideration: (a) the original five-factor model composed of GE, IC, PC, ISG, and IB; (b) a four-factor solution formed by GE, ISG, and PC, plus a fourth factor obtained by merging IC and IB items; (c) a three-factor solution composed of GE, ISG, and a third factor obtained by merging IC, PC, and IB items; and (d) finally, a one-factor solution resulting from loading all the items on a single factor. Model *b* was based on the assumption that IC and IB refer to illusory perceiving a connection between one's behavior and gambling outcomes (either *a priori* or retrospectively). Model *c*, on the other hand, reflects the fact that IC, PC, and IB are distortions in the realm of causal and contingency-based cognition (see Perales et al., in press).

The traditional goodness-of-fit measure (χ^2) assesses the magnitude of discrepancy between the sample and fitted covariance matrices (Hu & Bentler, 1999). However, χ^2 is sensitive to sample size and tends to reject the model as the sample grows larger (Bentler & Bonnet, 1980; Jöreskog & Sörbom, 1993). In addition, it does not provide enough information to discriminate between different models applied upon the same data set. In view of these features, we used several alternative indices (Schermelleh-Engel, Moosbrugger, & Müller, 2003), namely $\Delta\chi^2$, relative χ^2, root mean square error of approximation (RMSEA), normed fit index (NFI), comparative fit index (CFI), and expected cross-validation index (ECVI).

The statistic $\Delta\chi^2$, suitable for nested models, is the difference between the χ^2 values of two hierarchical models estimated with the same data. This difference is tested on the χ^2 table with degrees of freedom equal to the difference between the two respective values of degrees of freedom. A non-significant result leads to choosing the most parsimonious model (i.e., the model with fewer factors). Contrarily, when $\Delta\chi^2$ is significant, the best fitted solution is the least parsimonious model (i.e., the model with more factors) (Cheung & Rensvold, 2002; Gallucci & Leone, 2012). Relative χ^2 is the odds between χ^2 and its degrees of freedom, and its acceptance criterion varies among researchers, ranging from a value of less than 2 to a value of less than 5 (Schumacker & Lomax, 2004; Tabachnick & Fidell, 2007; Ullman & Bentler, 2003). RMSEA is a measure of the distance between the perfect model and the estimated model. It is not affected by sample size and values lower than 0.05 are assumed to imply a good fit (Hu & Bentler, 1995). NFI (Tucker & Lewis, 1973) and CFI (Bentler & Bonnet, 1980), compare the model of interest with alternative ones, such as the null or independence model. Values higher than 0.95 are acceptable, and those higher than 0.98 are optimal (Bentler, 1990). ECVI is the discrepancy between the covariance matrix in the analyzed sample and the covariance matrix that would be expected in a different sample with the same size (Jöreskog & Sörbom, 1993). The model with the smallest ECVI indicates the best fit.

As noted above, for factor analyses, the sample was divided into two subsamples ($n = 250$). The first (Data set A) was used for model estimation, whereas the second (Data set B) was used for model replication. Factor intercorrelations were computed using a non-parametric method (Spearman's rho), separately for the two subsamples. Reliability of the factors was computed using the intraclass correlation coefficient (ICC; Gallucci & Leone, 2012), again separately for the two subsamples.

Concurrent and criterion validity. Non-parametric correlational analysis (Spearman's rho) was used to test GRCS-S convergent validity with SOGS and specificity with MultiCAGE alcohol and drug scores [using the validity sample ($n = 137$), and the whole factor analysis sample ($n = 500$), respectively]. For criterion validity, a classification tree (Breiman, Friedman, Olshen, & Stone, 1984) was performed, using the variables from the best-fitting GRCS-S model as discriminative factors and the recommended threshold for clinical significance (SOGS severity ≥ 5) as criterion of group membership. Non-parametric correlation analyses were used to test GRCS-S/UPPS-P links in the factor analysis sample ($n = 500$). Parametric partial correlation analyses (controlling for clinically significant gambling) were used to further test and replicate GRCS-S/UPPS links in the validity sample ($n = 137$).

Preliminary and correlation analyses were conducted using Statistical Package for the Social Sciences (SPSS 20) software. Factor analyses were performed using LISREL 8.80 software (Jöreskog & Sörbom, 2006). PRELIS software was used for goodness-of-fit estimation (Jöreskog & Sörbom, 2006).

Ethics

The study procedures were carried out in accordance with the Declaration of Helsinki and its later amendments. The Ethics Committee of Clinical Research at the University of Granada approved the study as part of the funded PSI2013-45055-P project. All subjects were informed about the study and all provided signed consent.

RESULTS

Factor analysis

Fit indices for Subset A from the factor analysis sample are shown in Table 2 (left panel). Although all the solutions have good or very good fit indices, the four- and the five-factor solutions stand out as the best models. The comparison indices between these two solutions showed a lower ECVI for the four-factor solution (1.65 vs. 1.68, for four- and five-factor solution, respectively) and a non-significant $\Delta\chi^2$. In other words, although models *a* (the original one) and *b* (four factors, merging the two biases on own behavior's impact on gambling outcomes) are viable, a parsimony criterion would lead to selecting the latter.

In general, all the results for Subset B (Table 2, right panel) confirmed the ones obtained in Subset A, except for a slightly weaker strength. Again, the four- and five-factor solutions clearly beat the other models. ECVI for the four- and the five-factor solutions were virtually identical (1.86 vs. 1.85) and the $\Delta\chi^2$ value was not significant. The four- and five-factor models thus provide equivalent fits, with the former being preferable in terms of parsimony.

Factor intercorrelation

Intercorrelation analyses were run on eight factors (the five original ones, plus IC + IB, IC + IB + PC, and the one merging all the items together). All the correlations were significant and above 0.40 for Subsets A and B (Table 3). Intercorrelations between individual factors are in a range slightly higher than the one reported for the original scale (0.49–0.62 in Raylu & Oei, 2004). As in the original scale, the highest correlation was observed between PC and IB.

Reliability

Reliability outcomes are presented in Table 4. The overall scale showed an excellent value. For Subset A of the factor analysis sample, values were good for IC + PC + IB, IC + IB, ISG, and PC. Values were acceptable for GE and IB, and just sufficient for IC (for threshold values, see George & Mallery, 2007). Reliabilities were very similar for Subset B, although with slightly lower values. These results provide further proof of the goodness of the four-factor solution. Indeed, this solution does not isolate the factor IC, which is the only one with low internal consistency in the validation subsample.

Although the size of the validity sample ($n = 137$) was not large enough for factor analysis purposes (see results below for validity analyses), we did compute reliability

Table 2. Indices of goodness-of-fit for each model for both data sets from the factor analysis sample (see text for the meaning of the different indices)

	Subset A ($n = 250$)				Subset B ($n = 250$)			
	One-factor solution	Three-factor solution	Four-factor solution	Five-factor solution	One-factor solution	Three-factor solution	Four-factor solution	Five-factor solution
χ^2 (*df*)	417.14 (230)	326.07 (227)	307.49 (224)	305.62 (220)	503.94 (230)	421.23 (227)	360.37 (224)	349.64 (220)
$\Delta\chi^2$	/	91.07 (<0.01)	18.58 (<0.01)	1.87 (ns)	/	82.71 (<0.01)	60.86 (<0.01)	10.73 (ns)
Relative χ^2	1.83	1.44	1.37	1.39	2.19	1.86	1.61	1.59
RMSEA (CI)	0.06 (0.05; 0.07)	0.04 (0.03; 0.05)	0.04 (0.03; 0.05)	0.04 (0.03; 0.05)	0.07 (0.06; 0.08)	0.06 (0.05; 0.07)	0.05 (0.04; 0.06)	0.05 (0.04; 0.06)
NFI	0.98	0.98	0.98	0.98	0.97	0.98	0.98	0.98
CFI	0.99	0.99	1.00	0.99	0.99	0.99	0.99	0.99
ECVI (CI)	2.04 (1.83; 2.29)	1.70 (1.53; 0.91)	1.65 (1.48; 1.85)	1.68 (1.51; 1.88)	2.39 (2.15; 2.67)	2.09 (1.87; 2.33)	1.86 (1.67; 2.09)	1.85 (1.67; 2.07)

Note. RMSEA = root mean square error of approximation, NFI = normed fit index, CFI = comparative fit index, ECVI = expected cross-validation index, ns = not significant.

Table 3. Factor intercorrelation for Subsets A and B from the factor analysis sample

	GE	IC	PC	ISG	IB	IC + IB	IC + PC + IB	TOT
Subset A								
GE	1							
IC	0.57	1						
PC	0.69	0.64	1					
ISG	0.70	0.65	0.64	1				
IB	0.75	0.60	0.79	0.67	1			
IC + IB	0.75	0.87	0.80	0.74	0.92	1		
IC + PC + IB	0.76	0.82	0.92	0.73	0.91	0.97	1	
TOT	0.88	0.79	0.88	0.84	0.90	0.95	0.97	1
Subset B								
GE	1							
IC	0.54	1						
PC	0.60	0.60	1					
ISG	0.64	0.56	0.48	1				
IB	0.67	0.55	0.76	0.58	1			
IC + IB	0.70	0.84	0.78	0.64	0.92	1		
IC + PC + IB	0.70	0.79	0.91	0.61	0.91	0.97	1	
TOT	0.85	0.77	0.85	0.76	0.88	0.94	0.96	1

Note. GE = gambling expectancies, IC = illusion of control, PC = predictive control, ISG = inability to stop gambling, IB = interpretative bias, TOT = total.

Table 4. Reliability of all the factors in both data subsets from the factor analysis sample

	ICC Subset A (n = 250)	ICC Subset B (n = 250)	Number of items on the factor	Items that load on the factor
GE	0.80	0.72	4	1–6–11–16
IC	0.72	0.64	4	3–8–13–18
PC	0.80	0.78	6	4–9–14–19–22–23
ISG	0.85	0.79	5	2–7–12–17–21
IB	0.78	0.75	4	5–10–15–20
IC + IB	0.83	0.80	8	3–8–13–18 + 5–10–15–20
IC + PC + IB	0.90	0.88	14	3–8–13–18 + 4–9–14–19–22–23 + 5–10–15–20
One-factor solution	0.94	0.92	23	All

Note. ICC = intraclass correlation coefficient, GE = gambling expectancies, IC = illusion of control, PC = predictive control, ISG = inability to stop gambling, IB = interpretative bias.

indices for all factors in this sample. ICC values were 0.77 (GE), 0.68 (IC), 0.84 (PC), 0.91 (ISG), 0.89 (IB), 0.88 (IC + IB), 1.00 (IC + IB + PC), and 0.95 (full scale). That is, despite the smaller sample size, increasing the range of gambling severity scores (this sample was composed of both GD patients and non-disordered gamblers) slightly improved reliability of the subscales. IC remained, however, on the limit of acceptability.

In previous reports, reliability values (Cronbach's α) were 0.87 (GE), 0.87 (IC), 0.77 (PC), 0.89 (ISG), 0.91 (IB), and 0.93 (full scale), for the original scale, and 0.73 (GE), 0.75 (IC), 0.76 (PC), 0.84 (ISG), and 0.79 (IB), averaged across translations (French, Turkish, Japanese, Chinese, and Italian). In terms of both order and magnitude, these reliabilities are well matched by the ones found in our validity sample.

Validity

Concurrent validity. Correlations of GRCS-S factors with SOGS scores (in the validity sample) and MultiCAGE CAD-4 subscores (in the factor analysis sample) are shown in Table 5. As expected, GRCS-S scores strongly correlated with SOGS measures (dependence, debt, and total severity score). ISG was the factor showing the strongest correlation with SOGS scores, followed by the factors including IB (either isolated or in combination with IC and PC), and by PC, GE, and IC. Interestingly, GRCS-S factors did not significantly correlate either with alcohol- or illegal drug-related problems, which unveils a very strong specificity of the measured cognitions with regard to potentially problematic aspects of gambling.

Criterion validity. Using the recommended threshold (Lesieur & Blume, 1987), the validity sample (137 participants) was divided into two groups of problematic (SOGS ≥ 5, n = 51) and non-problematic (SOGS < 5, n = 86) gamblers. [All treatment-seeking gamblers had very high SOGS scores, which means 5.8% of the total number of non-treatment-seeking gamblers presented a SOGS score equal to or above 5 (the problem gambling threshold). This percentage is approximately what would be expected, based on problem gambling prevalence data in the population of

Table 5. Correlations of GRCS-S factors with gambling severity (SOGS) and alcohol and substance use (MultiCAGE CAD-4)

	GE	ISG	IC	PC	IB	PC + IC + IB	PC + IB
SOGS total	0.55**	0.74**	0.53**	0.61**	0.66**	0.66**	0.67**
SOGS dependence	0.54**	0.74**	0.51**	0.60**	0.66**	0.65**	0.66**
SOGS debt	0.41**	0.51**	0.34**	0.42**	0.44**	0.46**	0.46**
Alcohol use (MC)	0.15	0.16	0.08	0.05	0.12	0.09	0.08
Substance use (MC)	0.03	−0.07	0.02	0.01	0.04	0.03	0.03

Note. Spearman's rho correlations. MC = MultiCAGE CAD-4, GE = gambling expectancies, IC = illusion of control, PC = predictive control, ISG = inability to stop gambling, IB = interpretative bias.
*$p < .05$. **$p < .01$.

regular gamblers in Spain. So, it is unlikely that a desirability bias in SOGS responses could have significantly distorted our results. Still, a large majority of participants were assessed face-to-face. The presence of some desirability biases in these individuals can be somewhat reduced by ensuring confidentiality and introducing the evaluator as an experienced psychologist subject to strict ethical standards, but are not completely eliminated.] A classification tree (Breiman et al., 1984) was performed using the variables from the four-factor model to discriminate between groups. Results yielded a three-node tree wherein three of the four factors (i.e., ISG, IC + IB, and GE) correctly categorized 95.3% of non-problematic and 84.3% of problematic gamblers (total = 91.2%). After the third node, PC did not improve the percentage of correct categorization. The *I* effect size index (the improvement in classification capacity beyond chance; Henson, Natesan, & Axelson, 2014) yielded a value of 0.82 (customarily interpreted as very good; Hess, Olejnik, & Huberty, 2001).

Correlations between impulsivity traits and gambling cognitions

As shown in Table 6, all GRCS-S scores significantly correlated with positive and negative urgency, and GE, PC, and all factors including IB correlated with sensation seeking. Most interestingly, none of the GRCS-S scores correlated with cognitive impulsivity traits (lack of premeditation and lack of perseverance).

To ensure that this set of correlations does not merely reflect the potential confounding between GRCS-S scores and GD severity, we carried out partial correlation analysis between GRCS-S and UPPS-P measures, controlling for SOGS total score, in the validity sample (see Appendix B). The majority of the correlations lose strength, but the general pattern was very similar to the one in the first sample. GE lost significance with positive urgency and sensation seeking, and PC lost significance with negative urgency. The correlations between SOGS measures and the other factors did not show any qualitative changes in significance values.

DISCUSSION

The first aim of this study was to develop a Spanish version of the GRCS (GRCS-S) to assess gambling cognitions in Spanish communities and to determine the reliability and validity of this scale. Second, and more importantly, we sought to confirm and extend previously identified associations between gambling-related cognitive distortion levels, measures of impulsivity, and gambling behavior (Michalczuk et al., 2011).

Previous studies have identified a five-factor model in the GRCS: perceived ISG, GE, IB, IC, and PC. This study confirms the five-factor model to provide good fit for a Spanish sample and supports the soundness of the psychometric properties of the GRCS-S. However, a more parsimonious, four-factor model was also found to be viable. The superiority of the four-factor model is attributable to parsimony, and, quite likely, also to the relatively lower internal reliability of the IC factor. Tentatively, the lower reliability of the IC subscale, in turn, is attributable, first, to the fact that it is computed from only four items, and second, to the wording of one of such items in religious terms ("Praying helps me win"). Potentially, religiosity differences can have a large impact on responses to this item, and thus on global internal consistency. Conversely, the virtually constant IC internal consistency values observed across samples (from the factor analysis to the validity data sets) virtually discards the possibility that sample composition, different severity ranges, or treatment stage (in treatment-seeking gamblers) accounted for its relatively low value.

Table 6. Correlations of GRCS-S factors with impulsivity (UPPS-P) measures

	GE	ISG	IC	PC	IB	PC + IC + IB	PC + IB
Negative urgency	0.25**	0.35**	0.20*	0.23**	0.28**	0.27**	0.26**
Positive urgency	0.33**	0.30**	0.28**	0.41**	0.37**	0.40**	0.41**
Sensation seeking	0.18*	0.14	0.14	0.31**	0.31**	0.31**	0.32**
Lack of premeditation	−0.03	0.05	−0.11	0.02	0.01	0.01	0.03
Lack of perseverance	0.06	0.07	−0.05	−0.01	0.04	0.01	0.02

Note. Spearman's rho correlations. GE = gambling expectancies, IC = illusion of control, PC = predictive control, ISG = inability to stop gambling, IB = interpretative bias.
*$p < .05$. **$p < .01$.

This study also verifies the concurrent and criterion-related validity of the GRCS-S, and replicates previous reports that the GRCS model provides specific correlates of gambling clinical features. However, in Michalczuk et al.'s (2011) study, the strongest effect of group (GD patients vs. controls) was found for IC, and the weakest effect for PC and IB. In spite of the good general predictive value of the scale for clinically relevant features in both studies (group in one case, gambling severity in the other), this ordering is partially at odds with our finding that SOGS is strongly related to IB, but much more weakly to IC. This discrepancy can be attributed to differences across the study samples, to the fact that group categorization and SOGS severity are not equivalent variables, or to the differences in subscales reliabilities in the two versions of the scale. At this point, we have no evidence to favor any of these interpretations. Nonetheless, this study replicated the main finding from Michalczuk et al.'s (2011) study, in that impulsivity is highly correlated with increased cognitive distortion levels.

Most interestingly, correlations were only significant for affect- and motivation-driven components of impulsivity. The privileged link between gambling-related biases and emotion-driven impulsivity might be seen, in principle, as counterintuitive, considering that the UPPS-P contains specific dimensions straightforwardly assessing purely cognitive impulsivity (lack of premeditation and lack of perseverance). Recent, highly powered factorial analyses confirm this distinction and separate a *conscientiousness/planning* impulsivity component from inadequate coping of *negative emotionality* (Knezevic-Budisin, Pedden, White, Miller, & Hoaken, 2015; Sharma, Markon, & Clark, 2014). This view is also consistent with the proposal that poor executive and decision-making functioning is further qualified in accordance with the stronger or weaker involvement of abnormal emotion processing (Billieux, Gay, Rochat, & Van der Linden, 2010; Chester et al., 2016; Gunn & Finn, 2015).

Independent of the soundness of that factorization of impulsivity, evidence in the framework of the Theory of Planned Behavior has shown that heavy gambling is not necessarily accompanied by lack of planning (Martin et al., 2010), and in a previous study, we have observed a less future-oriented decision-making style only in a subgroup, but not the general population of disordered gamblers (Perales et al., in press). Our results corroborate that gambling-related cognitive distortions bear no strong connections with the conscientiousness/planning impulsivity dimension, as measured by UPPS-P dimensions lack of premeditation and lack of perseverance. Instead, strong cognitive distortions belong – along with affect-driven impulsivity – to a general executive and decision-making profile, in which emotions play a key role.

Several lines of evidence converge in stressing the importance of the link between emotion-driven processes and gambling-related cognitive distortions. For example, Clark, Studer, Bruss, Tranel, and Bechara (2014) have recently shown that lesions of the insula, an area strongly involved in emotional appraisal, abolish the near-win effect (known to be strongly linked to the illusory control bias in gamblers). On the other hand, positive and negative urgency empirically and theoretically overlap with emotion dysregulation in GD and other risky behavior patterns (Weiss et al., 2015; Wolz et al., 2016), and a connection between abnormal emotion regulation and the cognitive symptoms of GD has been recently reported by Navas et al. (2016).

These recent developments point out to the importance of dealing with cognitive distortions in therapy, while making sure their emotional and motivational underpinnings are not neglected, in line with models in which cognitions are shaped by emotions and motivations (Kunda, 1990). According to these models, the emotional stakes in the conclusions influence the neurocognitive mechanisms by means of which such conclusions are reached (Westen, Baglov, Harenski, Kilts, & Hamann, 2006).

In the realm of GD, cognitive distortions are likely to play a subjectively protective role against the distress generated by losses, mounting debt, or the very fact of regarding oneself as a disordered gambler (which would explain why most relevant cognitive biases have to do with reinterpreting or underestimating losses, overestimating future gains, or fueling one's sense of mastery).

Our findings provide some useful indications to be considered in GD treatment and prevention. Although the cognitive differences between GD patients and non-problematic gamblers, and the association of such differences to gambling severity, have been convincingly replicated, treatments specifically addressing cognitive distortions are less powerful than expected (Goodie & Fortune, 2013). In other words, the neglect of emotion regulation in attempts to restructure cognitive distortions in GD could account for the fact that patients with GD often experience problems generalizing cognitive change from therapeutic to daily-life settings (Ladouceur & Sevigny, 2003). Moreover, the abovementioned study by Navas et al. (2016) suggests that some emotion-regulation strategies usually regarded as adaptive, and frequently included in CBT packages, could be counterproductive in GD, as they can blunt the emotional impact of losses and fuel cognitive distortions. Taken together, these results support the use of metacognitive techniques, aimed at increasing awareness and reconfiguring responses to inner states, as for example, detachment mindfulness, attention retraining, virtual reality exposure, and neurofeedback (Chu & Clark, 2015; Fernández-Aranda et al., 2012).

Limitations

In spite of the importance of these conclusions, this study has a number of non-trivial limitations. First, only convenience samples were used. Therefore, further research with systematic sampling methods is needed to replicate the present findings in representative samples of sporadic, regular, problematic, and disordered gamblers. In other words, equivalence of the scale's factor structure across different populations should not be taken for granted. Second, and in relation to the previous point, our factor analysis sample was mostly composed of college students, and very few of them showed potentially risky gambling behavior. The sample was also more homogeneous than the one used for validation of the original scale and contained more females than most studies with regular (both disordered and non-disordered) gamblers. This could compromise generalizability and could also account for the low reliability of the IC dimension in subsample B. This problem is compensated in part by the fact that, in contrast, the validity sample was mostly composed by disordered and non-disordered gamblers recruited from gambling treatment centers and the general (non-college) population. In spite of its smaller size, this sample yielded good levels of reliability and usability for the GRCS-S scale.

Third, our clinical subsample was largely made up of male gamblers. Although the prevalence of problem gambling has repeatedly been found to be higher in male samples (Planzer et al., 2014), future research using the GRCS-S should aim to include more diverse samples.

Finally, this study was cross-sectional and did not assess the sensitivity of the GRCS-S across time. Other authors have recommended that follow-up assessments take place at four time points (short term, medium term, long term, and post-treatment) (Walker et al., 2006). Future studies are needed to examine the test–retest reliability of the GRCS-S.

Final remarks

The GRCS has been proven to be a valuable tool in the study of gambling behavior correlates and has helped to better understand GD symptomatology and temporal dynamics. In this paper, we have shown the Spanish version of this questionnaire to have adequate psychometric properties in two samples of young, mostly non-problematic, sporadic gamblers, and older, heavier gamblers (some of whom had been previously diagnosed as disordered gamblers). Most importantly, however, we have replicated and extended previous results on the tight bond between gambling cognitions and emotional and motivational aspects of impulsivity, which points out to the importance of including emotion-regulation training in psychoeducative interventions for GD prevention, treatment, and relapse control.

Funding sources: JCP and JFN are supported by a grant from the Spanish Government (Ministerio de Economía y Competitividad, Secretaría de Estado de Investigación, Desarrollo e Innovación; Convocatoria 2013 de Proyectos I+D de Excelencia) with reference number PSI2013-45055-P. JFN has been awarded with an individual research grant (Ministerio de Educación, Cultura y Deporte, Programa FPU, reference number FPU13/00669). JCP is member of a RETICS (RD12/0028/0017) group, funded by the *Spanish Ministerio de Sanidad y Consumo*. TS is supported by grants from the Carlos III Health Institute (FIS PI14/00290 and CIBERobn) and co-funded by FEDER funds – a way to build Europe. CIBER Fisiopatología de la Obesidad y Nutrición (CIBERobn) is an initiative of ISCIII. SJ-M is co-funded by FEDER funds/European Regional Development Fund (ERDF) – a way to build Europe and by a Ministerio de Economía y Competitividad grant (PSI2015-68701-R).

Authors' contribution: FDP and TS have equally contributed to this study and should be considered at the same level of authorship. FDP, JFN, and JCP contributed to the development of the study concept and design. FDP performed the statistical analysis. All authors aided with interpretation of data. TS wrote the first version of the manuscript. All authors were involved in further discussion and rewriting. JFN, FF-A, SJ-M, and JCP supervised the study. JCP is the principal investigator for the research project.

Conflict of interest: The authors declare no conflict of interest.

Acknowledgement: We thank *Asociación Granadina de Jugadores de Azar en Rehabilitación* (AGRAJER), *Asociación Provincial Linarense de Jugadores de Azar en Rehabilitación* (APLIJER), and *Asociación de Ludópatas de Jaén en Rehabilitación* (ALUJER) for their fruitful collaboration and assistance in the recruitment of participants.

REFERENCES

American Psychiatric Association. (2013). *Diagnostic and statistical manual of mental disorders (DSM-5)*. Arlington, VA, USA: American Psychiatric Publishing.

Aragay, N., Jiménez-Murcia, S., Granero, R., Fernández-Aranda, F., Ramos-Grille, I., Cardona, S., Garrido, G., Islam, M. A., Menchón, J. M., & Vallès, V. (2015). Pathological gambling: Understanding relapses and dropouts. *Comprehensive Psychiatry, 57,* 58–64. doi:10.1016/j.comppsych.2014.10.009

Arcan, K., & Karanci, A. N. (2013). Adaptation study of the Turkish version of the Gambling-Related Cognitions Scale (GRCS-T). *Journal of Gambling Studies, 31,* 1–14. doi:10.1007/s10899-013-9414-5

Babakus, E., Ferguson, C. E., & Joreskog, K. G. (1987). The sensitivity of confirmatory maximum likelihood factor analysis to violations of measurement scale and distributional assumptions. *Journal of Marketing Research, 24*(2), 222. doi:10.2307/3151512

Bentler, P. M. (1990). Comparative fit indexes in structural models. *Psychological Bulletin, 107*(2), 238–246. doi:10.1037/0033-2909.107.2.238

Bentler, P. M., & Bonett, D. G. (1980). Significance tests and goodness of fit in the analysis of covariance structures. *Psychological Bulletin, 88*(3), 588–606. doi:10.1037/0033-2909.88.3.588

Billieux, J., Gay, P., Rochat, L., & Van der Linden, M. (2010). The role of urgency and its underlying psychological mechanisms in problematic behaviours. *Behaviour Research and Therapy, 48*(11), 1085–1096. doi:10.1016/j.brat.2010.07.008

Breiman, L., Friedman, J. H., Olshen, R. A., & Stone, C. J. (1984). *Classification and regression trees*. Belmont, CA, USA: Wadsworth International Group.

Cándido, A., Orduña, E., Perales, J. C., Verdejo-García, A., & Billieux, J. (2012). Validation of a short Spanish version of the UPPSP impulsive behaviour scale. *Trastornos Adictivos, 14*(3), 73–78. doi:10.1016/S1575-0973(12)70048-X

Cantinotti, M., Ladouceur, R., & Jacques, C. (2004). Sports betting: Can gamblers beat randomness? *Psychology of Addictive Behaviors, 18*(2), 143–147. doi:10.1037/0893-164X.18.2.143

Chester, D. S., Lynam, D. R., Milich, R., Powell, D. K., Andersen, A. H., & DeWall, C. N. (2016). How do negative emotions impair self-control? A neural model of negative urgency. *NeuroImage, 132,* 43–50. doi:10.1016/j.neuroimage.2016.02.024

Cheung, G. W., & Rensvold, R. B. (2002). Evaluating goodness-of-fit indexes for testing measurement invariance. *Structural Equation Modeling, 9*(2), 233–255. doi:10.1207/S15328007SEM0902_5

Chu, S., & Clark, L. (2015). Cognitive and neurobiological aspects of problem gambling: Relevance to treatment. *Canandian Journal of Addiction, 6*(2), 62–71.

Clark, L., Studer, B., Bruss, J., Tranel, D., & Bechara, A. (2014). Damage to insula abolishes cognitive distortions during simulated gambling. *Proceedings of the National Academy of Sciences of the United States of America, 111*(16), 6098–6103. doi:10.1073/pnas.1322295111

Delfabbro, P. (2004). The stubborn logic of regular gamblers: Obstacles and dilemmas in cognitive gambling research. *Journal of Gambling Studies, 20*(1), 1–21. doi:10.1023/B:JOGS.0000016701.17146.d0

del Pino-Gutiérrez, A., Fernández-Aranda, F., Granero, R., Tárrega, S., Valdepérez, A., Agüera, Z., Håkansson, A., Sauvaget, A., Aymamí, N., Gómez-Peña, M., & Moragas, L. (2016). Impact of alcohol consumption on clinical aspects of gambling disorder. *International Journal of Mental Health Nursing.* doi:10.1111/inm.12221

Donati, M. A., Ancona, F., Chiesi, F., & Primi, C. (2015). Psychometric properties of the gambling related cognitions scale (GRCS) in young Italian gamblers. *Addictive Behaviors, 45,* 1–7. doi:10.1016/j.addbeh.2015.01.001

Echeburúa, E., Báez, C., Fernández-Montalvo, J., & Páez, D. (1994). Cuestionario de Juego South Oaks (SOGS): Validación española [South Oaks Gambling Screen (SOGS): Spanish validation]. *Análisis y Modificación de Conducta, 20*(74), 769–791.

Echeburúa, E., Báez, C., & Fernández-Montalvo, J. (1996). Comparative effectiveness of three therapeutic modalities in the psychological treatment of pathological gambling: Long-term outcome. *Behavioural and Cognitive Psychotherapy, 24,* 51–72. doi:10.1017/S1352465800016830

Emond, M. S., & Marmurek, H. H. C. (2010). Gambling related cognitions mediate the association between thinking style and problem gambling severity. *Journal of Gambling Studies, 26*(2), 257–267. doi:10.1007/s10899-009-9164-6

Fernández-Aranda, F., Jiménez-Murcia, S., Santamaría, J. J., Gunnard, K., Soto, A., Kalapanidas, E., Bults, R. G. A., Davarakis, C., Ganchev, T., Granero, R., Konstantas, D., Kostoulas, T. P., Lam, T., Lucas, M., Masuet-Aumatell, C., Moussa, M. H., Nielsen, J., & Penelo, E. (2012). Video games as a complementary therapy tool in mental disorders: PlayMancer, a European multicentre study. *Journal of Mental Health, 21,* 364–374. doi:10.3109/09638237.2012.664302

Fortune, E. E., & Goodie, A. S. (2012). Cognitive distortions as a component and treatment focus of pathological gambling: A review. *Psychology of Addictive Behaviors, 26*(2), 298–310. doi:10.1037/a0026422

Gallucci, M., & Leone, L. (2012). *Modelli statistici per le scienze sociali [Statistical models for the social sciences]*. Roma, Italia: Pearson Italia.

George, D., & Mallery, P. (2007). *SPSS for Windows step by step: A simple guide and reference: 14.0 update*. Cambridge, UK: Pearson.

Goodie, A. S. (2005). The role of perceived control and overconfidence in pathological gambling. *Journal of Gambling Studies, 21*(4), 481–502. doi:10.1007/s10899-005-5559-1

Goodie, A. S., & Fortune, E. E. (2013). Measuring cognitive distortions in pathological gambling: Review and meta-analyses. *Psychology of Addictive Behaviors: Journal of the Society of Psychologists in Addictive Behaviors, 27*(3), 730–743. doi:10.1037/a0031892

Grall-Bronnec, M., Bouju, G., Sébille-Rivain, V., Gorwood, P., Boutin, C., Vénisse, J. L., & Hardouin, J. B. (2012). A French adaptation of the Gambling-Related Cognitions Scale (GRCS): A useful tool for assessment of irrational thoughts among gamblers. *Journal of Gambling Issues, 27,* 21. doi:10.4309/jgi.2012.27.9

Gunn, R. L., & Finn, P. R. (2015). Applying a dual process model of self-regulation: The association between executive working memory capacity, negative urgency, and negative mood induction on pre-potent response inhibition. *Personality and Individual Differences, 75,* 210–215. doi:10.1016/j.paid.2014.11.033

Henson, R. K., Natesan, P., & Axelson, E. D. (2014). Comparisons of improvement-over-chance effect sizes for two groups under variance heterogeneity and prior probabilities. *The Journal of Experimental Education, 82,* 205–228. doi:10.1080/00220973.2013.813359

Hess, B., Olejnik, S., & Huberty, C. J. (2001). The efficacy of two improvement-over-chance effect sizes for two-group univariate comparisons under variance heterogeneity and nonnormality. *Educational and Psychological Measurement, 61*(6), 909–936. doi:10.1177/00131640121971572

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indices in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling, 6,* 1–55. doi:10.1080/10705519909540118

Hu, L., & Bentler, P. M. (1995). Evaluating model fit. In R. H. Hoyle (Ed.), *Structural equation modeling: Concepts, issues, and applications* (pp. 76–99). London, UK: Sage.

Iliceto, P., Fino, E., Giovani, E., Pretrucci, F., Decimoni, M., Sebatello, E., Candilera, G., & Oei, T. P. S. (2015). Factor structure and psychometric properties of the Italian version of the GREC-I. *Journal of Gambling Studies, 31,* 225–242. doi:10.1007/s10899-013-9405-6

Jara-Rizzo, M. F., Navas, J. F., & Perales, J. C. (2016). Psychological traits associated to recreational gambling in Ecuador and Spain. *Journal of Behavioral Addictions, 5*(S1), 50–51.

Jiménez-Murcia, S., Fernández-Aranda, F., Granero, R., & Menchón, J. M. (2014). Gambling in Spain: Update on experience, research and policy. *Addiction, 109*(10), 1595–1601. doi:10.1111/add.12232

Johansson, A., Grant, J. E., Kim, S. W., Odlaug, B. L., & Götestam, K. G. (2009). Risk factors for problematic gambling: A critical literature review. *Journal of Gambling Studies, 25*(1), 67–92. doi:10.1007/s10899-008-9088-6

Jöreskog, K. G., & Sörbom, D. (1993). *LISREL 8: Structural equation modeling with the SIMPLIS command language*. Chicago, IL: Scientific Software International.

Jöreskog, K. G., & Sörbom, D. (2006). *PRELIS 2*. Chicago, IL: Scientific Software International.

Knezevic-Budisin, B., Pedden, V., White, A., Miller, C. J., & Hoaken, P. N. (2015). A multifactorial conceptualization of impulsivity. *Journal of Individual Differences, 36,* 191–198. doi:10.1027/1614-0001/a000173

Kunda, Z. (1990). The case for motivated reasoning. *Psychological Bulletin, 108*(3), 480–498. doi:10.1037/0033-2909.108.3.480

Ladouceur, R., & Sevigny, S. (2003). Interactive messages on video lottery terminals and persistence in gambling. *Gambling Research: Journal of the National Association for Gambling Studies (Australia), 15*(1), 45–50. Retrieved from http://apo.org.au/node/47874

Ladouceur, R., & Sévigny, S. (2005). Structural characteristics of video lotteries: Effects of a stopping device on illusion of control and gambling persistence. *Journal of Gambling Studies, 21*(2), 117–131. doi:10.1007/s10899-005-3028-5

Ladouceur, R., Sylvain, C., Boutin, C., Lachance, S., Doucet, C., Leblond, J., & Jacques, C. (2001). Cognitive treatment of pathological gambling. *The Journal of Nervous and Mental Disease, 189*(11), 774–780. doi:10.1097/00005053-200111000-00007

Lesieur, H. R., & Blume, S. B. (1987). The South Oaks Gambling Screen (SOGS): A new instrument for the identification of Pathological gamblers. *American Journal of Psychiatry, 144*(9), 1184–1188. doi:10.1176/ajp.144.9.1184

Martin, R. J., Usdan, S., Nelson, S., Umstattd, M. R., LaPlante, D., Perko, M., & Shaffer, H. (2010). Using the theory of planned behavior to predict gambling behavior. *Psychology of Addictive Behaviors, 24,* 89–97. doi:10.1037/a0018452

Michalczuk, R., Bowden-Jones, H., Verdejo-García, A., & Clark, L. (2011). Impulsivity and cognitive distortions in pathological gamblers attending the UK national problem gambling clinic: A preliminary report. *Psychological Medicine, 41*(12), 2625–2635. doi:10.1017/S003329171100095X

Muthén, B., & Kaplan, D. (1985). A comparison of some methodologies for the factor analysis of non-normal Likert variables. *British Journal of Mathematical and Statistical Psychology, 38*(2), 171–189. doi:10.1111/j.2044-8317.1985.tb00832.x

Navas, J. F., Billieux, J., Perandrés-Gómez, A., López-Torrecillas, F., Cándido, A., & Perales, J. C. (in press). Impulsivity traits and gambling cognitions associated with gambling preferences and clinical status. *International Gambling Studies*. doi:10.1080/14459795.2016.1275739

Navas, J. F., Torres, A., Cándido, A., & Perales, J. C. (2014). ¿"Nada" o "un poco"?¿"Mucho" o "demasiado"? La impulsividad como marcador de gravedad en niveles problemático y no problemático de uso de alcohol e Internet ["Nothing" or "Just a bit"? "Much" or "Too much"? Impulsivity as a severity marker in problematic and non-problematic levels of alcohol and Internet use]. *Adicciones, 26,* 146–158. doi:10.20882/adicciones.19

Navas, J. F., Verdejo-García, A., López-Gómez, M., Maldonado, A., & Perales, J. C. (2016). Gambling with rose-tinted glasses on: Use of emotion-regulation strategies correlates with dysfunctional cognitions in gambling disorder patients. *Journal of Behavioral Addictions, 5*(2), 271–281. doi:10.1556/2006.5.2016.040

Oei, T. P. S., Lin, J., & Raylu, N. (2007). Validation of the Chinese version of the Gambling Related Cognitions Scale (GRCS-C). *Journal of Gambling Studies, 23*(3), 309–322. doi:10.1007/s10899-006-9040-6

Oei, T. P. S., Raylu, N., & Casey, L. (2010). Effectiveness of group and individual formats of a combined motivational interviewing and cognitive behavioral treatment program for problem gamblers: A randomized controlled trial. *Behavioral and Cognitive Psychotherapy, 38,* 233–238. doi:10.1017/S1352465809990701

Pedrero Pérez, E. J., Rodríguez Monje, M. T., Gallardo Alonso, F., Fernández Girón, M., Pérez López, M., & Chicharro Romero, J. (2007). Validación de un instrumento para la detección de trastornos de control de impulsos y adicciones: El MULTICAGE CAD-4 [Validation of a tool for screening of impulse control disorders and addiction: MULTICAGE CAD-4]. *Trastornos Adictivos, 9*(4), 269–278. doi:10.1016/S1575-0973(07)75656-8

Perales, J. C., Navas, J. F., Ruiz de Lara, C. M. R., Maldonado, A., & Catena, A. (in press). Causal learning in gambling disorder: Beyond the illusion of control. *Journal of Gambling Studies*. doi:10.1007/s10899-016-9634-6

Petry, N. M., Stinson, F. S., & Grant, B. F. (2005). Comorbidity of DSM-IV pathological gambling and other psychiatric disorders: Results from the national epidemiologic survey on alcohol and related conditions. *The Journal of Clinical Psychiatry, 66*(5), 564–574. doi:10.4088/JCP.v66n0504

Planzer, S., Gray, H. M., & Shaffer, H. J. (2014). Associations between national gambling policies and disordered gambling prevalence rates within Europe. *International Journal of Law and Psychiatry, 37*(2), 217–229. doi:10.1016/j.ijlp.2013.11.002

Raylu, N., & Oei, T. P. S. (2002). Pathological gambling: A comprehensive review. *Clinical Psychology Review, 22,* 1009–1061. doi:10.1016/S0272-7358(02)00101-0

Raylu, N., & Oei, T. P. S. (2004). The Gambling Related Cognitions Scale (GRCS): Development, confirmatory factor validation and psychometric properties. *Addiction, 99*(6), 757–769. doi:10.1111/j.1360-0443.2004.00753.x

Raylu, N., & Oei, T. P. S. (2010). *Cognitive behavior therapy manual for problem gamblers* (pp. 1–253). London, UK: Routledge.

Raylu, N., & Oei, T. P. S. (2016). Treatment planning for problem gamblers. *Australian Clinical Psychologists, 2,* 3–14.

Schermelleh-Engel, K., Moosbrugger, H., & Müller, H. (2003). Evaluating the fit of structural equation models: Tests of significance and descriptive goodness-of-fit measures. *Methods of Psychological Research Online, 8*(2), 23–74. Retrieved from http://www.mpr-online.de

Schumacker, R. E., & Beyerlein, S. T. (2009). Confirmatory factor analysis with different correlation types and estimation methods. *Structural Equation Modeling, 7*(4), 629–636. doi:10.1207/S15328007SEM0704_6

Schumacker, R. E., & Lomax, R. G. (2004). *A beginner's guide to structural equation modeling* (2nd ed.). Mahwah, NJ, USA: Lawrence Erlbaum Associates.

Sharma, L., Markon, K. E., & Clark, L. A. (2014). Toward a theory of distinct types of "impulsive" behaviors: A meta-analysis of self-report and behavioral measures. *Psychological Bulletin, 140,* 374–408. doi:10.1037/a0034418

Stinchfield, R. (2002). Reliability, validity, and classification accuracy of the South Oaks Gambling Screen (SOGS). *Addictive Behaviors, 27,* 1–19. doi:10.1016/S0306-4603(00)00158-1

Tabachnick, B. G., & Fidell, L. S. (2007). *Using multivariate statistics* (5th ed.). Needham Height, MA, USA: Allyn & Bacon.

Teed, M., Finlay, K. A., Marmurek, H. H. C., Colwell, S. R., & Newby-Clark, I. R. (2012). Sympathetic magic and gambling: Adherence to the law of contagion varies with gambling severity. *Journal of Gambling Studies, 28*(4), 691–701. doi:10.1007/s10899-011-9280-y

Tucker, L. R., & Lewis, C. (1973). A reliability coefficient for maximum likelihood factor analysis. *Psychometrika, 38*(1), 1–10. doi:10.1007/BF02291170

Ullman, J. B., & Bentler, P. M. (2003). Structural equation modeling. In J. A. Schinka & W. F. Velicer (Eds.), *Handbook of Psychology: Research Methods in Psychology* (Vol. 2, pp. 607–634). New York, NY, USA: John Wiley & Sons.

Walker, M., Toneatto, T., Potenza, M. N., Petry, N., Ladouceur, R., Hodgins, D. C., El-Guebaly, N., Echeburua, E., & Blaszczynski, A. (2006). A framework for reporting outcomes in problem gambling treatment research: The Banff, Alberta Consensus. *Addiction, 101*(4), 504–511. doi:10.1111/j.1360-0443.2005.01341.x

Weiss, N. H., Tull, M. T., Davis, L. T., Searcy, J., Williams, I., & Gratz, K. L. (2015). A preliminary experimental investigation of emotion dysregulation and impulsivity in risky behaviours. *Behaviour Change, 32*(2), 127–142. doi:10.1017/bec.2015.5

Westen, D., Blagov, P. S., Harenski, K., Kilts, C., & Hamann, S. (2006). Neural bases of motivated reasoning: An fMRI study of emotional constraints on partisan political judgment in the 2004 US presidential election. *Journal of Cognitive Neuroscience, 18,* 1947–1958. doi:10.1162/jocn.2006.18.11.1947

Whelan, J. P., Meyers, A. W., & Steenbergh, T. A. (2007). *Problem and pathological gambling* (Vol. 8). Boston, MA, USA: Hogrefe Publishing.

Whiteside, S. P., & Lynam, D. R. (2001). The five factor model and impulsivity: Using a structural model of personality to understand impulsivity. *Personality and Individual Differences, 30*(4), 669–689. doi:10.1016/S0191-8869(00)00064-7

Wolz, I., Agüera, Z., Granero, R., Jiménez-Murcia, S., Gratz, K. L., Menchon, J. M., & Fernandez-Aranda, F. (2015). Emotion regulation in disordered eating: Psychometric properties of the difficulties in emotion regulation scale among Spanish adults and its interrelations with personality and clinical severity. *Frontiers in Psychology, 6*(907). doi:10.3389/fpsyg.2015.00907

Wolz, I., Hilker, I., Granero, R., Jiménez-Murcia, S., Gearhardt, A. N., Dieguez, C., Casanueva, F. F., Crujeiras, A. B., Menchón, J. M., & Fernández-Aranda, F. (2016). Food addiction in eating disorders: Relevance of personality traits and sex. *Frontiers in Psychology, 7*(61). doi:10.3389/fpsyg.2016.00061

Yau, Y. H., & Potenza, M. N. (2015). Gambling disorder and other behavioral addictions: Recognition and treatment. *Harvard Review of Psychiatry, 23,* 134–146. doi:10.1097/HRP.0000000000000051

Yokomitsu, K., & Takahashi, T. (2015). Development and validation of the Japanese version of the Gambling Related Cognitions Scale (GRCS-J). *Asian Journal of Gambling Issues and Public Health, 5*(1), 1. doi:10.1186/s40405-015-0006-4

APPENDIX A: GRCS ITEMS WORDED IN SPANISH, AS USED IN THIS STUDY

Permission was granted to translate the original GRCS scale into Spanish from the authors of the original scale (Raylu & Oei, 2004). All items are responded using a 1–7 Likert-type scale (1 – *I completely disagree*, 7 – *I completely agree*).

1. Jugar me hace más feliz.
2. No puedo funcionar sin jugar.
3. Rezar me ayuda a ganar.
4. Las pérdidas en el juego, sin duda, van seguidas de una racha de ganancias.
5. Relacionar mis ganancias con mi habilidad y mi destreza en el juego hacen que siga jugando.
6. Jugar hace que las cosas parezcan mejores.
7. Estoy fuera de control, así que me resulta difícil parar de jugar.
8. Algunos colores y números incrementan mis probabilidades de ganar.
9. Hay que perder durante un tiempo si se quiere adquirir la experiencia necesaria para ganar.
10. Relacionar mis pérdidas con la mala suerte o a las circunstancias adversas me hace seguir jugando.
11. Jugar hace que el futuro parezca mejor.
12. No puedo resistir las ganas de jugar.
13. Guardo objetos que me ayudan a tener más probabilidades de ganar.
14. Si consigo ganar una vez, sin duda, seguiré ganando.
15. Relacionar mis pérdidas con la casualidad hace que siga jugando.
16. Echar una partida me ayuda a reducir la tensión y el estrés.
17. No soy lo suficientemente fuerte como para dejar de jugar.
18. Ciertos hábitos y rituales mejoran mis probabilidades de ganar.
19. A veces me siento con suerte, y aprovecho esas ocasiones para jugar.
20. Recordar cuánto dinero gané la última vez, me hace continuar jugando.
21. Nunca seré capaz de dejar de jugar.
22. Tengo cierta capacidad para predecir cuándo voy a ganar.
23. Si cambio los números a los que juego habitualmente, tengo menos posibilidades de ganar que si mantengo siempre los mismos números.

APPENDIX B: PARTIAL CORRELATIONS BETWEEN GRCS AND UPPS-P INDICES CONTROLLING FOR GAMBLING SEVERITY

As noted in the Results section, the validity sample ($n = 137$) assessed in SOGS was composed of both problematic and non-problematic gamblers. Given that GRCS and UPPS-P scores have been observed to strongly predict gambling severity, the possibility exists that the correlations between GRCS and UPPS-P scores are driven by gambling severity, a possibility that cannot be tested in the factor analysis sample (as participants in this sample were not assessed with the SOGS). To discard that explanation, partial *r* correlation analyses (instead of Spearman's rho analyses) were carried out on UPPS-P and GRCS subscores, while controlling for SOGS severity, in the validity sample.

Results from this analysis are shown in Table B1. Partial correlations replicated and clarified the pattern showed by non-controlled correlations. Negative urgency positively correlated with the perceived ISG and the combined IC/IB combined score; positive urgency correlated with the same factors and PC; and sensation seeking correlated with PC and the combined IC/IB score. Somewhat unexpectedly, gambling expectations (the belief that gambling is rewarding or enjoyable) negatively correlated with impulsivity dimensions, reaching significance for negative urgency and lack of premeditation.

Table B1. Partial correlation analysis between GRCS and UPPS-P measures controlling for SOGS total score

	GE	PC	ISG	IC + IB
Negative urgency	−0.09*	0.08	0.23**	0.16*
Positive urgency	−0.06	0.22**	0.18**	0.20**
Sensation seeking	−0.02	0.17**	0.03	0.11*
Lack of premeditation	−0.14**	0.02	0.05	0.00
Lack of perseverance	−0.07	0.03	0.07	0.02

Note. Pearson's *r* correlations. GE = gambling expectancies, IC = illusion of control, PC = predictive control, ISG = inability to stop gambling, IB = interpretative bias.
*$p < .05$. **$p < .01$.