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Gambling with Rose-Tinted Glasses on: Use of Emotion-Regulation Strategies Correlates with Dysfunctional Cognitions in Gambling Disorder Patients

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Background and aims: Existing research shows that gambling disorder patients (GDPs) process gambling outcomes abnormally when compared against healthy controls (HCs). These anomalies present the form of exaggerated or distorted beliefs regarding the expected utility of outcomes and one's ability to predict or control gains and losses, as well as retrospective reinterpretations of what caused them. This study explores the possibility that the emotional regulation strategies GDPs use to cope with aversive events are linked to these cognitions. *Methods:* 41 GDPs and 45 HCs, matched in sociodemographic variables, were assessed in gambling severity, emotion-regulation strategies (cognitive emotion-regulation questionnaire, CERQ), and gambling-related cognitions (gambling-related cognitions scale, GRCS). *Results:* GDPs showed higher scores in all gambling-related cognition dimensions. Regarding emotion regulation, GDPs were observed to use *self-blame* and *catastrophizing*, but also *positive refocusing*, more often than controls. Additionally, in GDPs, putatively adaptive CERQ strategies shared a significant portion of variance with *South Oaks gambling screen* severity and GRCS beliefs. Shared variability was mostly attributable to the roles of *refocusing on planning* and *putting into perspective* at positively predicting severity and the interpretative bias (GDPs propensity to reframe losses in a more benign way), respectively. *Discussion and conclusions:* Results show links between emotion-regulation strategies and problematic gambling-related behaviors and cognitions. The pattern of those links supports the idea that GDPs use emotion-regulation strategies, customarily regarded as adaptive, to cope with negative emotions, so that the motivational and cognitive processing of gambling outcomes becomes less effective in shaping gambling-related behavior.

Keywords: gambling disorder, cognitive biases, emotion regulation, gambling-related cognitions, metacognition

INTRODUCTION

Regular gambling is much more likely to generate losses than wins (LaBrie, Kaplan, LaPlante, Nelson, & Shaffer, 2008; Walker, Schellink, & Anjoul, 2008). Games' probabilistic structures and the types of reinforcement schedules they implement, along with the existence of a house edge (by virtue of which a percentage of bets never returns to players), ensure negative monetary utilities for most gamblers in a large majority of gambling episodes.

Despite being disadvantageous in monetary terms, gambling is present in virtually every human culture, and turns problematic in a significant percentage of the population [average rate across countries: 2.3%; (Williams, Volberg, & Stevens, 2012)]. This fact challenges the common-sense principle that instrumental behaviors with negative expected utility should progress toward extinction but, simultaneously, has inspired research on the motivational factors that could contribute to make wins more effective as rewards, and losses less deterring (e.g., de Ruiter et al., 2009; Loxton, Nguyen, Casey, & Dawe, 2008).

Among the several factors contributing to abnormal adjustment to gambling outcomes in GDPs, beliefs about the subjective utility of gambling, the predictability or controllability of wins and losses, and the causes of past outcome sequences are the ones that have inspired more research. Raylu and Oei's (2004) influential model, for example, proposes five major gambling-related belief domains with potential clinical significance: (a) *gambling expectancies* about the joy, pleasure, or other kinds of personal utility that can be derived from gambling; (b) beliefs about the *inability to stop* gambling; (c) perceptions of the controllability of gambling outcomes (*control illusion*); (d) perceptions of the predictability of gambling outcomes (*predictive control*); and (e) attributional styles mainly characterized by interpretation of losses as due to external, removable factors, and wins as due to skill (*interpretative bias*). The last three of these beliefs are customarily categorized together as gambling-related cognitive biases (as they boil down to distorted perceptions of the causal structure underlying wins and losses). Available

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evidence convincingly shows that GDPs hold exaggerated or biased beliefs in the five domains (see Goodie & Fortune, 2013, for a review).

The novelty of this study relies on its focus on the potential entrenchment between emotion-regulation strategies and cognitions about gambling outcomes. This idea emerges from the fact that four of the five gambling-related cognitions identified in Raylu and Oei's model (gambling expectancies and the three cognitive biases affecting causal learning) are mostly about gambling outcomes, and stand as candidates to be sensitive to how gamblers deal with their emotional impact.

First, any strategy by means of which negative emotions are down-regulated can potentially decrease the impact of losses on GDP's gambling behavior. Indeed, the involvement of undersensitivity to losses in potentially problematic gambling behaviors is already well known. Abnormal reaction to losses discriminates between gamblers and other addicted patients (Torres et al., 2013), and some studies have also shown pathological and frequent gamblers to have lower scores in punishment sensitivity as measured by self-reports (Goudriaan, Oosterlaan, de Beurs, & van den Brink, 2004; Navas et al., 2014) and an abnormal brain response to monetary losses (see Quester & Romanczuk-Seiferth, 2015, for a review). Relatedly, loss processing has also been shown to be involved in gambling-related distorted cognitions (Billieux, Van der Linden, Khazaal, Zullino, & Clark, 2012; Michalczuk, Bowden-Jones, Verdejo-Garcia, & Clark, 2011; Worhunsky, Malison, Rogers, & Potenza, 2014). What remains to be investigated is the possible mediating role of emotion-regulation strategies in this set of relationships between loss sensitivity, cognitive distortions, and gambling behaviors. Still, there are strong reasons to predict that such mediation exists. According to dominant associative learning models, any factor reducing the aversive impact of outcomes can modulate the effectiveness of cue-outcome and action-outcome contingency learning (see Shanks, 2007, for a review), including that responsible for beliefs on the causal relationships between one's behavior and gambling outcome (i.e., control illusion) or between environmental cues and gambling outcomes (i.e., predictive control). Similarly, strategies reducing the emotional impact of accumulated losses (and particularly certain reappraisal strategies) could help GDPs cope with distress in the short term, but also motivate *reinterpretation* of such losses, and make future gambling more likely.

Second (and complementarily), emotion-regulation strategies that boost the positive valence of wins will straightforwardly increase gambling expectancies. These strategies could also be used to highlight "positive" aspects of losses. For example, near-wins (loss events perceptually close to the jackpot; e.g., two dollar signs and a cherry aligned on the display of a slot machine) exert rewarding effects (Clark, Crooks, Clarke, Aitken, & Dunn, 2012; Clark, Lawrence, Astley-Jones, & Gray, 2009). Abnormal reaction to near-wins correlate with GDPs' beliefs on the mastery of their instrumental or predictive skills, and, at the neurobiological level, is associated to BOLD signal in the ventral striatum, comparable to the one caused by true wins (Chase & Clark, 2010; Habib & Dixon, 2010; Sescousse et al., in press). In other words, up-regulating positive emotions could contribute, not only to gambling expectancies, but also to alter the mechanisms responsible for learning about appetitive aspects of gambling outcomes via, again, associative learning and causal attribution mechanisms.

In summary, in our working model, the strategies GDPs could use to boost positive emotions or to curve negative ones may contribute to gambling expectancies, control illusion, predictive control, and interpretative biases, and thus to problematic gambling behaviors. However, and somewhat unfortunately, models of emotion regulation have mostly neglected positive emotions (despite the fact that dysregulation of positive emotions has an important role in impulse control and risky behaviors, e.g., Cyders et al., 2007) and, to our knowledge, there are no available psychometric tools directly assessing regulation of positive emotions. In view of the lack of validated instruments, specific hypotheses in the present work will mostly tackle on strategies for regulation of negative emotions.

Garnefski and Kraaij's (2007) emotion-regulation model proposes that people can regulate the impact of negative emotions by using adaptive and non-adaptive strategies [see Gross (1999) for a different but conceptually related approach]. The latter include obsessive focusing on the emotion (*rumination*), *catastrophizing, blaming oneself*, and *blaming others*, and are more likely to increase than to reduce the negative emotional impact of aversive events, adding preoccupation, fear, guilt, or anger to the original emotion. The former include *acceptance, reappraisal* of the causes of the experienced emotion, and the several ways to taking distance from the emotion (*putting into perspective, positive refocusing*, and *refocusing on planning* alternative behaviors), which can be useful at softening or putting aside negative emotions. In accordance with the rationale outlined above, any of these supposedly beneficial strategies could contribute to the maintenance of cognitive distortions and gambling behaviors, whereas catastrophizing, rumination, and blaming oneself or others, although clearly disadvantageous, are less likely to play that role. Hence, from our overarching hypothesis that emotion-regulation strategies are entrenched with beliefs about gambling outcomes, the more specific (and counterintuitive) prediction can be derived that generally adaptive strategies people use to curve the impact of negative emotions could be counterproductive in GDPs. We are aware that gamblers' atypical emotion-regulation strategies could influence gambling in other ways (e.g., some GDPs may also make more use of plainly dysfunctional emotion-regulation strategies, which might lead to enhanced sensitivity to losses and compulsive loss chasing; Shao, Read, Behrens, & Rogers, 2013). In these cases, however, it is less clear what, if any, the role of outcome-related beliefs would be. For the sake of parsimony, we will keep our hypotheses regarding the relationships between emotion regulation, gambling cognitions, and gambling behaviors restricted to so-called adaptive regulation strategies and outcome-related beliefs.

We assessed two groups of GDPs and HCs using psychometric measures of gambling cognition, emotion regulation, and gambling severity, aiming to test the following set of hypotheses: first, we expected to corroborate previous reports that gambling-related beliefs in the domains identified by Raylu and Oei's (2004) model – and particularly

those involving incentive properties of and attributions about gambling outcomes (gambling expectancies, control illusion, predictive control, and attributional bias) – are heightened in GDPs (compared against matched controls) (Hypothesis 1). Second, given the high frequency of emotional (mostly negative) events in GDPs lives, we also expected them to mobilize emotion-regulation strategies to cope with them more often than controls (Hypothesis 2). Third, and most importantly, given the specificities of gambling, at least some of the so-called adaptive strategies (acceptance, reappraisal, putting into perspective, positive refocusing, and refocusing on planning) are predicted to correlate with gambling outcome-related cognitions (Hypothesis 3), and severity (Hypothesis 4), specifically in the GDP group.

METHODS

Participants

41 gambling disorder patients (GDPs) and 45 healthy controls (HCs), matched in age, education years, and intelligence quotient (IQ) (Table 1), took part in this study. GDPs had been diagnosed as such by the clinicians of the treatment center from which they have been recruited [AGRAJER – Granada Association of Rehabilitated Pathological Gamblers, APLIJER – Linares Provincial Association of Rehabilitating Gamblers, and ALUJER – Jaén Association of Rehabilitated Pathological Gamblers, based on the towns of Granada, Linares, and Jaén (Andalusia, Spain), respectively]. Most HCs were recruited among GDPs political relatives and friends, and the sample was completed by posting notices at the University of Granada's and the researchers' Internet-based social networks.

Inclusion criteria for GDPs, apart from the gambling disorder diagnosis (confirmed by their therapist by means of a semi-structured interview, carried out upon admission to treatment, and based on DSM-IV criteria), were (a) being in treatment for less than 6 months, (b) abstaining from gambling for at least 15 days (as reported by the participant and his/her therapist), and (c) an estimated IQ above 80, indicated by matrix reasoning and vocabulary subtests of the Wechsler Adult Intelligence Scale (WAIS-IV) (Wechsler, 2008). Exclusion criteria were (a) comorbidity with any psychiatric diagnosis (including addictive disorders other than nicotine dependence and gambling disorder) and (b) previous history of neurological disease or brain trauma causing unconsciousness for 10' or longer, as informed by the participant. Inclusion criteria for HCs were the identical, except for the GD diagnosis and treatment. Coincidentally, no females met the criteria to be included in the GDP group, so only males were recruited as controls. Comorbidities were assessed using a semi-structured interview, carried out, in the case of GDPs, by the patient's therapist, and, in the case of HCs, by a psychologist with clinical experience in assessment methods (the first author).

Measures

Cognitive emotion-regulation questionnaire (CERQ) (Spanish version; Domínguez-Sánchez, Lasa-Aristu, Amor, & Holgado-Tello, 2013). This tool consists of 27 5-point Likert scale items, assessing the use of nine different strategies for regulation of emotions caused by negative or distressing events. (1) *Self-blame* refers to thoughts about making oneself responsible for what has caused the emotion; (2) *other-blame* refers to thoughts of making others responsible for such an event; (3) *rumination* consists of obsessively focusing on the feelings and thoughts associated with the negative event; (4) *catastrophizing* refers to emphasizing and overestimating the negative experience or its consequences; (5) *putting into perspective* consists of thoughts brushing aside the seriousness of the event or considering its relativity when compared to other events; (6) *positive refocusing* refers to redirecting attention to joyful or pleasant themes; (7) *positive reappraisal* refers to reinterpreting the event in positive terms of personal growth; (8) *acceptance* includes thoughts of nonjudgmental resignation; and (9) *refocus on planning* refers to thinking about the steps that should be taken to handle the situation resulting from the event.

Gambling-related cognitions scale (GRCS) (Raylu & Oei, 2004). This questionnaire assesses five gambling-related cognitive distortions. *Inability to stop* and *gambling expectations* refer to personal beliefs of lacking capacity to control gambling impulses and overvaluing the joy or reward that can be obtained from gambling, respectively. *Illusion of control, predictive control*, and *interpretative biases* have to do with how gamblers connect gambling outcomes between them, with environmental cues or with

Table 1. Sociodemographic and clinical descriptive data of gambling disorder patients (GDPs) and healthy controls (HCs) groups

	GDPs Mean (*SD*)	HCs Mean (*SD*)	$F(1, 84)$	p	η^2
Age	35.22 (11.16)	33.22 (8.18)	.91	.34	.01
Education	13.06 (4.26)	13.31 (3.13)	.10	.76	.00
Months in treatment	3.11 (2.79)	–	–	–	–
Matrix reasoning	98.00 (13.00)	100.67 (13.00)	.89	.35	.01
Vocabulary	99.38 (14.20)	103.44 (13.13)	1.88	.17	.22
SOGS	10.05 (3.30)	.58 (.97)	338.97	<.01	.80
MC gambling score	2.68 (.85)	.02 (.15)	427.31	<.01	.84
MC alcohol misuse	.85 (1.06)	1.22 (1.17)	.58	.13	.03
MC substance misuse	.48 (.90)	.67 (.95)	1.27	.37	.01

Note. MC, MultiCAGE CAD-4.

one's behavior (causal attributions). The first one refers to the overestimation of personal control over gambling outcomes, the second to the perceived ability to predict future outcomes on the basis of previous ones or other cues in the environment, and the third to the tendency to reappraise losses accrued in time and attribute such losses to bad luck, coincidence or other external removable factors.

The English version of the GRCS questionnaire was translated into Spanish, and then back-translated into English by a native English-speaking bilingual translator. Potential asymmetries between the original and the back-translated versions of the questionnaire were discussed and eventually polished from the Spanish version by the translator and one of the authors. In addition, the questionnaire has been validated in a separate study (Del Petre et al., submitted) with an $n = 500$ sample of pathological and recreational gamblers. This validation study has yielded a well-fitting factorial structure, and Cronbach's α values of .74, .71, .84, .90, and .86 for gambling expectancies, illusion of control, predictive control, inability to stop, and interpretative biases, respectively.

MultiCAGE CAD-4 (Pedrero Pérez et al., 2007). This is a quick screening tool to detect risk of alcohol abuse, illegal drug abuse, problem/pathological gambling, excessive Internet surfing, excessive video gaming, hypersexuality, compulsive money spending/shopping, and eating disorders. Each subscale is composed of four yes/no items, checking for subjectively informed craving, relatives', friends', or other acquaintances' complaints about the behavior under assessment, guilt, or shame feelings/lack of acknowledgment, and self-reported compensatory behaviors. The questionnaire and its psychometric and diagnostic properties can be found in Pedrero Pérez et al. (2007). For this study we used the gambling, drugs use, and alcohol use subscales as control variables for sample matching.

South Oaks gambling screen (*SOGS*) (Lesieur & Blume, 1987). To estimate gambling severity, dependence, and debt accrual, as well as to estimate participation frequencies in different games, we used the Spanish version of SOGS. To date, this is the only validated instrument for the assessment of gambling severity in Spanish, it has been widely used, and has good psychometric properties (Echeburúa, Báez, Fernández-Montalvo, & Páez, 1994).

Procedure

Recruitment notices provided general information about the criteria to participate in the study, although all of them were further checked during the assessment session. The instruments described here are part of a larger protocol including several neuropsychological tasks, electroencephalographic, magnetic resonance, and heart rate variability recordings, as well as several other self-report tools, none of which were directly relevant to the aims of this study. The whole assessment protocol was composed of two sessions. All the instruments described here were included together in one of the sessions, which could be the first or the second one (depending on session balancing). Each session was divided into several clusters of tasks, separated by resting periods. Cluster order and the order of tasks within each cluster were counterbalanced.

Statistical analysis

Analyses of variance (ANOVA) were carried out to determine between-groups difference in (a) demographic variables, matrix reasoning and vocabulary subtests of WAIS-IV, and (b) SOGS severity scores and MultiCAGE gambling, alcohol and drugs subscores. Multivariate analyses of variance (MANOVA) were conducted to explore between-groups differences in (a) gambling-related cognitions and (b) cognitive emotion-regulation strategies. Two linear stepwise regression analyses with CERQ scores as independent variables and SOGS severity and MultCAGE gambling score as dependent measures were carried out to check for the relationship between emotion-regulation strategies and gambling overt symptoms. To test the relationship between emotion-regulation strategies and gambling-related cognitions (without incurring in underpowered multiple tests), we carried out an analysis in two steps. First, we applied *k*-means cluster analysis to discriminate between participants in term of their profile of gambling-related beliefs. Second, we used logistic regression analysis, with emotion-regulation strategies as predictors, to predict participants' classification in Cluster 1 versus Cluster 2. This relationship was further explored by linear stepwise regression analyses with CERQ measures as predictors and GRCS measures as dependent variables.

Finally, we performed a mediation path analysis on the relationship between putatively adaptive emotion-regulation strategies and SOGS severity score, using a global outcome-related beliefs score (computed as the sum of expectancy, control illusion, predictive control, and interpretative bias scores) as mediational variable. This analysis was carried out in three stages. First, a simultaneous regression approach was used to predict the GRCS composite score from emotion-regulation strategies, and SOGS severity score from the GRCS composite score and emotion-regulation strategies. Second, parameters were recomputed restricting the model to significant variables from the first stage. Finally, one-tailed Sobel tests (Sobel, 1982) were carried out to find out whether any paths from emotion-regulation strategies to gambling severity were significant (following Soper, 2016). For all these and previous analyses a significant threshold of $p < .05$ was established.

Ethics

The study was approved by the Ethics Committee of the University of Granada as part of the PSI2013-45055 (G-Brain) project, and was in accordance with the 1964 Helsinki declaration and its later amendments. Participants were informed about the aims and features of the study and all provided informed consent.

RESULTS

Sociodemographic variables

Mean (*SD*) age, education years, matrix reasoning, and vocabulary scores are displayed in Table 1. There were no differences in these variables. A χ^2 test yielded no effect of group either on the distribution of participants across

income level categories, $\chi^2(5) = 4.77$, $p = .44$. As noted above, all the participants in the study were males.

Gambling severity and alcohol and drugs misuse

Mean (*SD*) SOGS severity scores, and MultiCAGE gambling, alcohol, and drugs subscores are displayed in Table 1. As expected, there were significant differences between the two groups in SOGS severity and the MultiCAGE gambling subscore. The two groups, however, did not differ in alcohol and drug misuse scores.

Gambling-related cognitions across groups

There was a strong multivariate effect of group regarding the five GRCS scores (see Table 2, first row). Table 2 also displays mean (*SD*) scores and the results of exploring variable-by-variable between-subject effects. In all measures, GDPs showed higher scores than HCs.

Cognitive emotion-regulation strategies across groups

There was a strong multivariate effect of group regarding CERQ emotion-regulation strategies (see Table 3, first row). Table 3 also displays mean (*SD*) CERQ scores for both groups and results from exploring variable-by-variable between-group effects. GDPs reported more frequent use of self-blame, catastrophizing, and positive refocusing (and, marginally, putting into perspective, $p = .05$), and less frequent use of other-blame than controls.

Relationships of emotion-regulation strategies with gambling severity and cognitive distortions

For illustrative purposes, Table S1 (Supplementary Material) shows bivariate correlations (for GDPs only) between gambling disorder severity, cognitive distortions, and emotion-regulation strategies, with no α-growth correction. To find out which, if any, putatively adaptive emotion-regulation strategies independently correlate with severity, we carried out a stepwise linear regression analysis with age, education, and the key emotion-regulation strategies (putting into perspective, positive refocusing, refocusing on planning, positive reappraisal, and acceptance) as predictors, and SOGS total score as dependent variable. Only refocusing on planning was included in the final model (after one step) ($\beta = .49$, $t = 3.46$, $p < .01$; see Figure 1). A similar analysis with MultiCAGE gambling score did not yield any significant effect.

To test our hypothesis on the connection between gambling beliefs and emotion-regulation strategies, avoiding α-error growth for multiple analyses, we carried out an analysis in two steps. In the first step, a *k*-means cluster analysis with all GDPs on GRCS measures yielded a two-cluster solution in four iterations, segregating between strongly biased GDPs ($n = 18$) and a weakly biased GDPs ($n = 23$). Interestingly, the strongest effect of cluster

Table 2. Multivariate and variable-by-variable group effects on gambling-related cognitions as measured by the GRCS questionnaire

			Wilks' λ	*p*	η^2
Multivariate effect			.29	**<.01**	.71
	GDPs	HCs			
Between-subject effects	Mean (*SD*)	Mean (*SD*)	*F*(1, 84)		
Interpretative control	18.76 (6.48)	6.18 (3.83)	122.57	**<.01**	.59
Illusion of control	10.37 (5.61)	5.44 (2.34)	29.13	**<.01**	.26
Predictive control	22.98 (9.96)	8.62 (3.90)	80.06	**<.01**	.49
Expectancies	15.54 (6.26)	5.44 (2.28)	102.23	**<.01**	.55
Inability to stop	21.51 (7.74)	5.58 (1.32)	184.71	**<.01**	.69

Note. Values in bold are statistically significant at $p < .05$

Table 3. Multivariate and variable-by-variable group effects on emotion-regulation strategies as measured by the GRCS questionnaire

			Wilks' λ	*p*	η^2
Multivariate effect			.57	**<.01**	.43
	GDPs	HCs			
	Mean (*SD*)	Mean (*SD*)	*F*(1, 84)		
Self-blame	11.05 (3.09)	7.2 (2.54)	40.14	**<.01**	.32
Other-blame	4.32 (1.54)	5.42 (1.83)	9.10	**<.01**	.10
Rumination	11.07 (2.55)	10.42 (2.41)	1.59	.21	.02
Catastrophizing	8.1 (2.74)	6.02 (1.91)	16.85	**.01**	.17
Putting into perspective	10.61 (2.82)	9.36 (3.09)	3.84	.05	.04
Positive refocusing	9.27 (2.26)	7.96 (2.87)	5.49	**.02**	.06
Positive reappraisal	9.85 (3.68)	11.13 (2.65)	5.45	.07	.04
Acceptance	12.41 (2.17)	11.80 (2.66)	1.36	.25	.02
Refocus on planning	10.98 (3.27)	11.56 (2.16)	.10	.33	.01

Note. Values in bold are statistically significant at $p < .05$

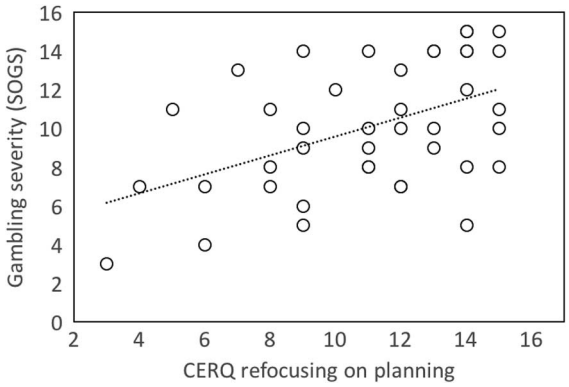

Figure 1. Dispersion diagram representing the correlation between CERQ refocusing on planning score and SOGS total score (gambling severity). See text for significance statistics

separation was found for predictive control ($\eta^2 = .77$), followed by interpretative bias ($\eta^2 = .51$), expectancy ($\eta^2 = .42$), control illusion ($\eta^2 = .37$), and inability to stop ($\eta^2 = .24$). This result is interesting by itself, because it confirms that cluster separation mostly represents differential strength in outcome-related beliefs, but much less so in perceived inability to stop gambling (indeed, cluster separation yielded identical results if performed exclusively on the four outcome-related cognitions).

The two clusters did not differ in age, education, intellectual performance, months in treatment, alcohol and drug-related problems (MultiCAGE), and MultiCAGE gambling score (min. $p = .19$), but differed in SOGS severity [$F(1, 38) = 5.39$, mean squared error (MSE) = 9.82, $p = .03$, $\eta^2 = .12$]. Not surprisingly, the strongly biased cluster (SOGS = 11.33, standard error (SE) = .74) showed more severe gambling symptoms than the weakly biased one (SOGS = 9.04, $SE = .65$).

In the second step, a forward conditional logistic regression analysis (with all the putatively adaptive emotion-regulation strategies as predictors) yielded putting into perspective as the only significant predictor (Wald = 6.45, $B = .35$, $p = .01$) of cluster membership. The one-predictor model correctly classified 73.9% of Cluster 1 (high bias), and 66.7% of Cluster 2 participants (low bias), Nagelkerke's $R^2 = .24$. This effect remained significant (Wald = 4.48, $B = .31$, $p = .03$) even if severity was included in a two-predictor model with putting into perspective. Hence, one emotion-regulation strategy – putting into perspective – clearly emerged as the one most closely related to clustering based on gambling-related cognitive distortions. Figure 2 (left panel) displays mean CERQ scores for the strategies entering the logistic regression analysis in each of the two clusters.

As noted above, the specific pattern of covariations underlying this connection between emotion-regulation strategies and gambling-related beliefs can be inspected in Table S1 (Supplementary Material). Still, we carried out stepwise linear regression analyses with putting into perspective, positive refocusing, refocusing on planning, positive reappraisal, and acceptance as predictors, and each of the gambling-related beliefs as dependent variables. This strategy yielded significant effects of refocusing on planning on control illusion ($\beta = .34$, $t = 2.27$, $p = .03$), and of putting into perspective on inability to stop ($\beta = .34$, $t = 2.23$, $p = .03$), and interpretative bias ($\beta = .35$, $t = 2.35$, $p = .02$). Among these, the last one can be interpreted as contributing to the general pattern of heightened outcome-related GRCS scores (Figure 2, right panel).

Mediation analysis

The result of the mediation analysis is displayed in Figure 3. This confirmed putting into perspective as the only significant predictor of outcome-related beliefs, and the latter and refocusing on planning as independent predictors of SOGS severity [The initial (simultaneous) regression analysis of outcome-related cognitions score over the five

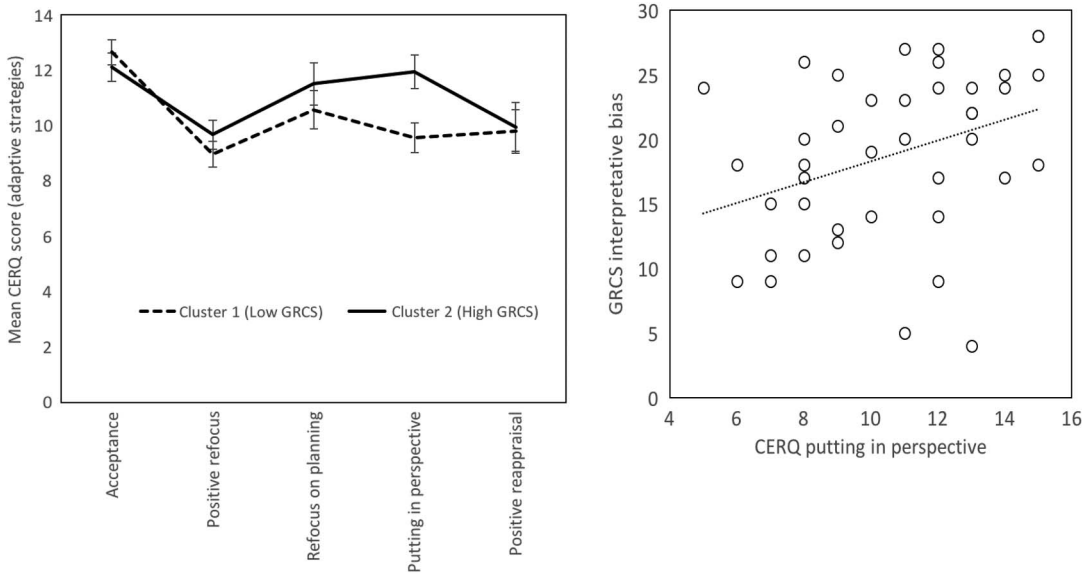

Figure 2. Left panel: Mean CERQ scores for putatively adaptive strategies in the highly biased (Cluster 2) and weakly biased (Cluster 1) subgroups of GDPs. Bars represent standard error of the mean. Right panel: Dispersion diagram representing the correlation between CERQ putting into perspective score and GRCS interpretative bias. See text for significance statistics

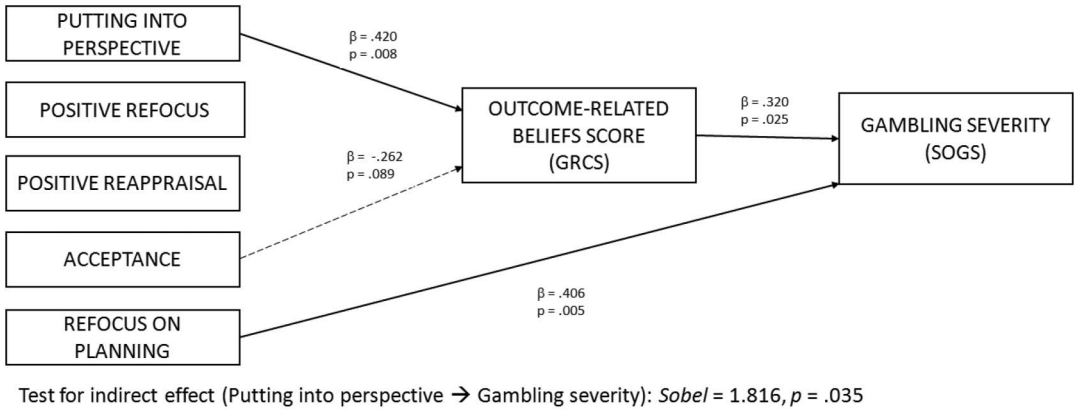

Figure 3. Mediation analysis of CERQ putatively adaptive emotion-regulation strategies on gambling severity in GDPs, using the outcome-related belief score (computed from GRCS expectancy, control illusion, predictive control, and interpretative bias subscores) as hypothetical mediator

emotion-regulation strategies under consideration yielded a significant effect of acceptance. More specifically, acceptance was observed to inversely predict outcome-related cognitive distortions ($\beta = -.43$, $p = .02$). This effect, however, fells below significance when the most parsimonious model (including only significant factors from the first stage) was tested to obtain definitive model parameters (as shown in Figure 3)]. More interestingly, an indirect effect (via outcome-related beliefs) on SOGS severity was found for the strategy putting into perspective.

DISCUSSION AND CONCLUSIONS

The aims of this study were to explore the differences between GDPs and HCs in gambling-related cognitions and use of emotion-regulation strategies, and to test the connection of emotion-regulation strategies with gambling severity and cognitive distortions in GDPs. We expected (a) gambling-related beliefs, including those regarding gambling outcomes, to be exaggerated or more strongly biased in GDPs when compared against HCs, and (b) GDPs to make a more frequent use of regulation strategies to cope with negative emotion-laden events (regardless of the theoretical adaptive or non-adaptive role of such strategies). Finally, (c) we expected emotion-regulation strategies, and particularly, those hypothetically effective at reducing negative emotions, to predict both the gambling severity and the intensity of gambling-related beliefs potentially linked to the processing of gambling outcomes.

Results fully confirmed our first prediction. All GRCS measures were higher in GDPs than in HCs (Table 2). These results are in line with previous literature (see Goodie & Fortune, 2013, for a review); and also confirm our previous data (Perales et al., submitted) that, among causal attribution biases – control illusion, predictive control, interpretative bias – the latter emerges as the one most strongly predictive of gambling severity and clinical status. Other studies, however, have reported a different ordering of size effects for the GRCS subscales (Michalczuk et al., 2011), which could be accounted for by the varying composition of the gamblers' samples across studies. Tentatively, a factor explaining the differences across studies could be the differences in preferred gambling modalities (a factor that has been shown to crucially determine the intensity and profile of cognitive distortions; Toneatto, Blitz-Miller, Calderwood, Dragonetti, & Tsanos, 1997).

Theoretically, the second prediction is more relevant, and was also partially confirmed (Table 3). GDPs were more prone to use catastrophizing (e.g., "I often think that what I have experienced is much worse than what others have experienced") and self-blame (e.g., "I feel that I am the one to blame for it") than HCs, which is compatible with descriptions of generalized negative emotionality in GDPs (Bagby et al., 2007), and with their consideration as non-adaptive emotion-regulation strategies. More counterintuitively, however, GDPs were also more prone to use positive refocusing (e.g., "I think of pleasant things that have nothing to do with it"), which is customarily included within the set of adaptive strategies contributing to resilience and emotional wellbeing (Hanley & Garland, 2014; Min et al., 2013). This difference apparently contradicts previous reports in which positive refocusing has been observed to inversely correlate with specific and general measures of psychopathology (Garnefski, Kraaij, & van Etten, 2005; Kelly, Lydecker, & Mazzeo, 2012). Still, despite being normally regarded as adaptive, positive refocusing involves displacing attention from the emotion without reprocessing its causes. In that sense, the overuse of positive refocusing could not be fully incompatible with the previous finding that pathological gamblers make less use of reappraisal that controls (Williams, Grisham, Erskine, & Cassedy, 2012).

Finally, the third prediction was also partially confirmed. Refocusing on planning (e.g., "I think about a plan of what I can do best") was the only emotion-regulation variable significantly predicting gambling severity when tested against the other strategies in the confirmatory stepwise regression analysis (Figure 1). Putting into perspective (e.g., "I think that it hasn't been too bad compared to other things"), on the other hand, independently correlated with cluster membership, namely, with global strength of distorted beliefs about gambling outcomes (which mostly seems to originate in its relationship with the interpretative bias; Figure 2). Refocusing on planning did not independently contribute to cluster membership, in spite of its independent correlation with control illusion and gambling severity.

In one way or another, refocus on planning and putting into perspective seem to signal gambling complications in the form of more severe symptoms or stronger cognitive distortions, respectively. At difference with what we have argued for positive refocusing, putting into perspective, and refocusing on planning are forms of reappraisal that involve a deeper processing of whatever has caused the negative emotion. It is difficult to interpret these strategies as ambiguous, with regard to their general beneficial value; and, on the other hand, the fact that they play a role both in gambling severity and in gambling-related cognitive distortions seems to indicate that the more effective the strategy is, the worse are their clinical implications in the gambling context. Consequently, at least some emotion-regulation strategies that can be considered useful to confront emotions with little cost for the individual, and sometimes even recommended to be included in cognitive-behavioral therapy packages (Min et al., 2013), are likely to have a paradoxical negative role in gambling disorder.

Complementarily, we found some very preliminary evidence that a different putatively adaptive emotion-regulation strategy (acceptance, e.g., "I think that I have to accept the situation") could play a protective role against cognitive biases. Acceptance is in a way the opposite of self-deception, and is regarded as an essential component of third-wave psychotherapies (e.g., Hayes, 2004). Our data on this regard are very partial and only allow speculation, but probably point out to an interesting future research target.

Still, the links between specific emotion-regulation strategies, and gambling-related beliefs, severity and other clinically relevant gambling features deserve further investigation. Our results seem to imply, as it happens with other trait variables, that those factors most strongly contributing to differences between GDPs and HCs are not necessarily the same contributing to individual differences among GDPs (Alverez-Moya et al., 2010). Indeed, gambler subtypes can be qualitatively different, with different patterns of beliefs playing an important role in gambling subtyping (Myrseth, Brunborg, & Eidem, 2010; Toneatto et al., 1997).

A possible implication of our results regarding emotion-regulation strategies is that their role in psychopathology is disorder type-dependent. In disorders where unrealistic pessimistic biases contribute to symptomatology (e.g., internalizing problems; Garnefski et al., 2005), putting negative events in perspective, or redirecting attention toward positive things or alternative plans, could reduce emotional impact without significant side effects. GD is different from such disorders in the sense that it courses with overestimation of self-efficacy in gambling settings – at least in some gamblers – and reducing the impact of feedback without correcting the underlying overestimation is potentially counterproductive.

These findings are also interpretable in terms of the tentative pathways leading to GD that could be addressed in therapy. Despite the – many times replicated – differences in cognitive distortions between gamblers and non-gamblers, and between GDPs and non-problem gamblers, and the association of the same cognitive distortions to gambling severity, treatments specifically tackling on such distortions – although significant — are less powerful than expected (Goodie & Fortune, 2013). Our results support the importance of tackling cognitive distortions in a contextualized manner, that is, taking into account the individual emotions that they could be functionally related to. This functional connection between emotions evoked by gambling and gambling-related cognitions has been recently unveiled by studies showing that the insula (a key structure in emotional processing, Ochsner, Silvers, & Buhle, 2012) plays a role in the maintenance of the gambler's fallacy. Patients with specific damage of this region do not exhibit the bias, and do not show either the usual heightened motivation to gamble that normally follows near-wins (Clark, Studer, Bruss, Tranel, & Bechara, 2014). Our finding that emotion-regulation strategies, and not only emotions *per se*, correlate with cognitive distortions seems to unveil at least one of the mechanisms underlying that emotion-cognition link.

This argument provides a way to surpass a frequently mentioned limitation of cognitive-behavioral therapy: GDPs often experience problems generalizing cognitive change from therapeutic to daily-life settings. Ladouceur and Sevigny (2003) suggest that patients "switch off" their newly acquired rational beliefs when gambling. In view of that obstacle, Lindberg, Clark, and Bowden-Jones (2014) proposed a metacognitive treatment approach designed to make patients become aware and reconfigure the connection between triggers and the cognitions induced by those triggers; in the present case, between loss-related aversive events and mostly automatic, over-practiced emotion-regulation strategies that could end up fueling cognitive distortions and gambling behavior. As alternatives to such strategies, Lindberg et al. (2014) explicitly propose detachment mindfulness and attention retraining. Our results support this general view, but, at the same time, suggest that some strategies, despite being superficially adaptive, can distort the meaning of gambling outcomes, and do more harm than good in the long term.

Limitations and strengths of the study

Several limitations can constraint the interpretation of the present results. First, the cross-sectional nature of the study makes impossible to establish with certainty the direction of causal links. In our mediation analysis, we have favored the interpretation that general, non-specific emotion-regulation strategies underlie situational, gambling-specific distortions. However, other causal models are also viable. Future research is required to experimentally determine whether intervening on such strategies does produce a change in gambling-related cognitions. Second, our results are based on self-report measures. Laboratory-based emotion-regulation tasks, inserted into real or simulated gambling are a promising tool to obtain more reliable measures, not affected by memory biases or social desirability. Third, and relatedly, these measures do not allow to directly evaluate outcome processing (e.g., win/loss sensitivity) in real gambling settings, so that our interpretation that emotion-regulation strategies are used to diminish the emotional impact of negative outcomes must be inferred from the pattern of relationships observed between specific emotion-regulation strategies and cognitive distortions, and thus remain partially speculative. Fourth, our sample was

composed only of males. Given that emotional pathways to gambling have been shown to be particularly relevant in females (e.g., Blaszczynski & Nower, 2002), generalizability must not be taken for granted. And fifth, availability of GDPs for research in our setting is limited, which precludes the possibility to use large samples. That means that α-growth across multiple tests is likely to be problem for multiple correlation and between-subject comparisons across multiple dependent variables. The multivariate approach used for group differences in GRCS and CERQ, as well as the logistic regression analysis to predict cluster membership in GDPs, were aimed at surpassing that limitation. Multivariate effects allow for stronger, although more general, conclusions, that are further explored via effects on individual variables. Effects on individual measures should thus be interpreted more cautiously.

On the side of strengths, in spite of the several sources of evidence linking gambling behavior and gambling-related cognition to emotional processing, this is the first study so far aimed at directly investigating the relationship between emotion-regulation strategies and gambling-related cognitions. Additionally, confirming our interpretation would straightforwardly provide a way to improve the currently available treatments for gambling disorder.

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Authors' contribution: JFN and JCP designed the research and analyzed data. JFN and MLG collected data. JFN, AVG, MLG, AM, and JCP interpreted results and wrote the paper.

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