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The interplay between chasing behavior, time perspective, and gambling severity: An experimental study

MARIA CICCARELLI[1]*, MARINA COSENZA[1], MARK D. GRIFFITHS[2], FRANCESCA D'OLIMPIO[1] and GIOVANNA NIGRO[1]

[1]Department of Psychology, University of Campania "Luigi Vanvitelli", Caserta, Italy
[2]Psychology Department, Nottingham Trent University, Nottingham, UK

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Background and aims: Chasing refers to continued gambling in an attempt to recoup previous losses and is one of the diagnostic criteria for gambling disorder. However, research on the topic is still in its infancy. This study investigated whether chasing behavior mediates the relationship between time perspective and gambling severity. *Methods:* Non-problem gamblers ($N = 26$) and problem gamblers ($N = 66$) with the same demographic features (age and gender) were compared on the Consideration of Future Consequences and a computerized task assessing chasing. The Italian South Oaks Gambling Screen was used to discriminate participants in terms of gambling severity. *Results:* Significant correlations were found relating to gambling severity, chasing, and time perspective. More specifically, the results showed that problem gamblers reported more chasing and a foreshortened time horizon. Chasers, compared to non-chasers, were found to be more oriented to the present. Regression analysis showed that male gender, present-oriented time perspective, and chasing were good predictors of gambling severity. Finally, to clarify if present orientation was on the path from chasing to gambling severity or if chasing was the mediator of the impact of present orientation on gambling severity, a path analysis was performed. The results indicated that present orientation had a direct effect on gambling severity and mediated the relationship between chasing and gambling involvement. *Conclusion:* The findings support the exacerbating role of chasing in gambling disorder and for the first time show the relationship of time perspective, chasing, and gambling severity among adults.

Keywords: gambling, problem gambling, gambling disorder, chasing behavior, chasing task, time perspective

INTRODUCTION

Chasing has been included as one of the diagnostic criteria for gambling disorder (previously pathological gambling) in the past three editions of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM; American Psychiatric Association [APA], 1987, 1994, 2013). It is also a behavioral criterion that is unique for gambling disorder. Chasing refers to continued gambling in an attempt to recoup previous losses during a gambling session (within-session chasing) and/or starting a new gambling session (between-session chasing; Breen & Zuckerman, 1999).

Chasing is a common behavior among problem gamblers (e.g., McBride, Adamson, & Shevlin, 2010; O'Connor & Dickerson, 2003; Sacco, Torres, Cunningham-Williams, Woods, & Unick, 2011), who frequently increase the size of their gambling bets in an attempt to recover the losses, exposing themselves to the risk of developing gambling disorder (Corless & Dickerson, 1989; Goudriaan, Yücel, & van Holst, 2014; Sharpe, 2002). Several studies have demonstrated that chasing can differentiate disordered gamblers from non-disordered gamblers (e.g., Breen & Zuckerman, 1999; James, O'Malley, & Tunney, 2016; Toce-Gerstein, Gerstein, & Volberg, 2003).

Several etiologic models have attributed chasing a prominent role in the onset and maintenance of gambling disorder (e.g., Sharpe, 2002). According to Blaszczynski and Nower's pathways model (2002), irrespective of the reason individuals start gambling (e.g., entertainment, socialization, emotional vulnerability, and/or preexisting psychosocial/biological predispositions), once a pattern of habitual gambling is established, the excitement resulting from gambling and the irrational beliefs related to the probability of winning may encourage chasing behavior, including both chasing losses (continuing gambling to recoup losses) and chasing wins (continuing gambling to gain more money). Chasing, in turn, facilitates problem gambling. Specifically, chasing appears to be an instrumental behavior in the maintenance of problem gambling. In other words, the ability to stop gambling, without following the urge to "get even" (Lesieur, 1979, p. 79) can differentiate regular (non-problem) gamblers from problem gamblers (Dickerson, Hinchy, & Fabre, 1987).

* Corresponding author: Maria Ciccarelli; Department of Psychology, University of Campania "Luigi Vanvitelli", Viale Ellittico, 31, Caserta 81100, Italy; Phone: +39 333 157 1608; Fax: +39 082 327 4759; E-mail: maria.ciccarelli@unicampania.it

Despite its importance in the development of problem gambling, the role of chasing has been largely neglected empirically, apart from a few studies that have observed the existence of a relationship between chasing and irrational beliefs (Campbell-Meiklejohn, Woolrich, Passingham, & Rogers, 2008; Griffiths & Whitty, 2010), impulsivity (e.g., Breen & Zuckerman, 1999), lack of emotional competence (Bibby, 2016), dysfunctional personality traits (Kim & Lee, 2011; Nigro, Ciccarelli, & Cosenza, 2018a), dissociation (Yakovenko, 2017), the motivation to win money (Campbell-Meiklejohn et al., 2012; Gainsbury, Suhonen, & Saastamoinen, 2014; Lister, Nower, & Wohl, 2016), decision-making impairments (Nigro, Ciccarelli, & Cosenza, 2018b), and increasing stake size (Parke, Harris, Parke, & Goddard, 2016).

Among the variety of individual differences associated with gambling disorder, one of the most important is time perspective (e.g., Nigro, Cosenza, Ciccarelli, & Joireman, 2016). Time perspective refers to an individual's orientation toward past, present, and future. Several studies have demonstrated the importance of time perspective in influencing choices, preferences, and behaviors in a variety of health, interpersonal, and financial decision-making contexts (Strathman, Gleicher, Boninger, & Edwards, 1994). Orientation to the present is also involved in different psychiatric conditions (e.g., Adams, 2012; Collins & Bradizza, 2001; Joireman, Kees, & Sprott, 2010), including gambling disorder (Cosenza, Matarazzo, Baldassarre, & Nigro, 2014; Cosenza & Nigro, 2015). Disordered gamblers have been found to be more prone than healthy counterparts in making short-sighted decisions (Cosenza, Ciccarelli, & Nigro, 2019; Cosenza, Griffiths, Nigro, & Ciccarelli, 2017; Hodgins & Engel, 2002). The choice to gamble is typically determined via the evaluation of the immediate outcomes without the consideration of the future negative consequences (e.g., job loss, bankruptcy, and/or jeopardized relationship). The weak orientation toward the future, with a focus on immediate consequences, is strongly and positively associated with gambling severity, risk proneness, and impulsivity (e.g., Ciccarelli, Malinconico, Griffiths, Nigro, & Cosenza, 2016; MacKillop, Anderson, Castelda, Mattson, & Donovick, 2006).

To the authors' knowledge, this is the first study to empirically investigate the relationship between chasing and time perspective in gambling. This is surprising given that the decision to chase is probably related to a weak concern for the long-term consequences of engaging in the behavior. In this study, problem gamblers were expected to be more likely to engage in chasing and to have a particular orientation to the present compared to healthy (non-problem) gamblers. It is also hypothesized that chasers will demonstrate a weaker future time orientation compared to non-chasers. Finally, this study explored the relationship between time perspective and chasing to clarify if present orientation was on the path from chasing to gambling severity or if chasing was the mediator of the impact of present orientation on gambling severity.

METHODS

Participants and procedure

Of 132 people recruited from several video lottery terminal gambling venues, 98 volunteers accepted to participate in the experimental study (rejection rate = 26%). To be a participant in the study, the inclusion criteria comprised: (a) gambling once a week or more and (b) being 18 years of age or over (with six participants excluded as a result of not meeting the inclusion criteria and/or being outliers). Consequently, the experimental sample comprised 92 voluntary participants, both males (85%) and females, aged between 18 and 70 years ($M_{age} = 35.72$; $SD = 11.29$), gathered from many gambling venues. They were administered the Italian version (Cosenza et al., 2014) of the South Oaks Gambling Screen (SOGS; Lesieur & Blume, 1987) to assess the severity of gambling involvement, the ChasIT (Nigro, Ciccarelli, & Cosenza, 2018b), a computerized task assessing chasing behavior, and the Consideration of Future Consequences (CFC-14; Strathman et al.,1994; Italian validation by Nigro et al., 2016) Scale that assesses time perspective.

Participants were individually led into a quiet room and took part in a single laboratory session. In each session, participants completed the self-report questionnaires (i.e., the SOGS and CFC-14) after performing the chasing task. The chasing task comprised two conditions with half of the participants randomly assigned to the control condition and the other half assigned to the loss condition. Furthermore, since the chasing task involved gambling with virtual money, participants were instructed to respond as if they were gambling with real money. Before data collection, participants gave written informed consent to a protocol approved by the research team's University Ethics Committee. For informed consent, participants were informed that their participation in the study was anonymous and were told that the study would be investigating the associations between several factors and gambling behavior. They were assured that their data would be analyzed in aggregate form and that they could withdraw from the study at any time if they so wished. Following data collection, participants were debriefed. Participants were thanked for their time and were not compensated in any way for participation in the study.

Measures

Problem gambling. Problem gambling was assessed using the SOGS. The SOGS is a 20-item dichotomous (yes/no) self-report measure of the frequency and the severity of gambling problems (e.g., "*When you gamble, how often you go back another day to win back the money you lost?;*" "*Have people ever criticized your gambling?;*" and "*Do you feel you have ever had a problem with betting or money gambling?*"). The items are based on the DSM criteria for problem gambling (APA, 1980). The scores vary from 0 to 20. Scores of 0–2 indicate no problem gambling, scores of 3–4 reflect problem gambling, and scores of 5 or above

denote (probable) pathological gambling. The SOGS was found to have a high internal consistency reliability coefficient in this study (Cronbach's α = .89; 95% CI [0.86, 0.92]).

Chasing behavior. Chasing behavior was assessed using the ChasIT. The ChasIT is a 60-trial simulated card game in which participants play against the house. The initial amount of money was €10 and participants were asked to treat the initial stake as real money. Given that the study included problem gamblers, it was felt that use of real money could pose a "risk of possibly provoking gambling urges or episodes" (Linnet, Røjskjær, Nygaard, & Maher, 2006, p. 46) and is one of the main reasons why virtual money was used. In the ChasIT task, each card reported a number ranging from 1 to 9. Participants won €1 if they had the highest card. If not, they lost the same amount of money. In both cases, participants received positive feedback ("*You won €1!*") or negative feedback ("*You lost €1!*") on the computer screen and heard a sound that varied according to the result.

The task comprised two experimental conditions, such as *loss* and *control*, which differ in the number of wins and losses. After the first 30 trials, participants in the control condition were informed that they saved the entire budget, whereas participants in the loss condition were informed that they lost €12, namely the entire budget plus €2. In both conditions, participants were allowed to continue gambling.

For the subsequent 30 trials, after each trial, participants received positive or negative feedback and were informed about the amount of residual credit remaining. At this point, participants had to decide, for each trial, if they would like to continue or stop the game, by pressing the "M" key to continue playing or the "Z" key to stop playing. Since participants could continue playing up until the end of the trial, the maximum chasing total score was 30. In the control condition, the final budget was €10, and in the loss condition minus €14. The number of wins and losses varied as function of condition (15 and 15 in the first and second parts of the control condition, and 9 and 21 in the loss condition).

The two blocks of wins and losses were randomized, but the sequence was the same for each condition. Participants who chose to stop playing at the beginning of the second phase of the computerized task were classified as "non-chasers," whereas participants who decided to continue playing were classified as "chasers." The decision to continue to play or stop, as well as the number of trials played, was the two dependent measures of interest.

Time perspective. Time perspective was assessed using the CFC-14. The CFC-14 is a valid and reliable self-report measure of time perspective, namely the ability to consider the future consequences of choices. It comprises 14 items scored using a 7-point scale (ranging from "extremely uncharacteristic" to "extremely characteristic") and consists of two subscales: immediate (e.g., "*I think it is more important to perform a behavior with important distant consequences than a behavior with less-important immediate consequences*") and future (e.g., "*I think that sacrificing now is usually unnecessary since future outcomes can be dealt with at a later time*"). The total score ranges from 14 to 98. Higher scores on the instrument reflect a greater orientation to the future. In this study, Cronbach's α for the full scale (α = .83; 95% CI [0.78, 0.88]) and for the two subscales was good: immediate (α = .82; 95% CI [0.75, 0.87]) and future (α = .77; 95% CI [0.69, 0.83]).

Statistical analyses

Data analyses were conducted using IBM SPSS version 20.0 (Armonk, NY, USA). The α level was set at $p < .05$. All variables were initially screened for missing data, distribution abnormalities, and outliers (Tabachnick & Fidell, 2013). Using $p < .001$ criterion for Mahalanobis distance, two male participants were eliminated as clear multivariate outliers. This left a final sample size of 92. All variables met the assumptions of normality, linearity, and homoscedasticity required for conducting regression analysis. Pearson's correlation coefficients were calculated to examine the relationships among the study variables. Analysis of variance was used to assess mean differences on continuous variables. For categorical data, differences in percentages were compared using the χ^2 test. Linear regression analysis was performed to examine the unique contribution of predictor variables to gambling severity. To control for the presence of multicollinearity, before interpreting the regression coefficients, the variance inflation factors were calculated, which were below the recommended cutoff of 10 (Ryan, 1997).

Path analysis was conducted using the EQS 6.2 software program (Encino, CA, USA) for structural equation modeling (Bentler, 2008). For each estimated model, goodness of model fit was evaluated using the likelihood ratio χ^2 test statistic corrected for data non-normality with Satorra and Bentler's (1994) method (S-B χ^2), as well as with four descriptive fit indices: the standardized root mean square residual (SRMR), the root mean square error of approximation (RMSEA) with its 90% confidence interval (90% CI), the goodness of fit index (GFI), and the comparative fit index (CFI). Acceptable fits between model and data are reflected by a non-significant S-B χ^2, GFI, and CFI indexes of 0.95 or greater, and RMSEA of between 0.05 and 0.08.

Ethics

The study procedures were carried out in accordance with the Declaration of Helsinki. The research team's University Ethics Committee approved the study. All participants were informed about the study and all provided informed consent.

RESULTS

Bivariate correlations were computed to examine associations between age, gambling severity, chasing (as both the self-reported behavior in the SOGS and the number of trials played in the ChasIT), and time perspective. As expected, the results showed that gambling severity was positively associated with chasing as both self-reported behavior (Item 4 of the SOGS) and the number of trials played in the chasing task, and with the immediate scale of CFC-14, and negatively associated with the future scale of CFC-14 and the CFC-14 total score (Table 1). The results also demonstrated strong negative correlations between chasing

Table 1. Pearson's correlation coefficients among measures

	1	2	3	4	5	6
1. Age	–					
2. SOGS	.132	–				
3. SOGS_4	.155	**.689****	–			
4. Chasing	−.072	**.626****	**.428****	–		
5. CFC-I	.021	**.417****	**.284****	**.407****	–	
6. CFC-F	−.205	**−.352***	**−.245***	**−.344****	**−.416****	–
7. CFC-14	−.127	**−.459****	**−.316****	**−.448****	**−.864****	**.818****

Note. Bold values represent significant correlation coefficients. SOGS: South Oaks Gambling Screen; SOGS_4: Item 4 of the SOGS measuring chasing; CFC-I: immediate scale of CFC-14; CFC-F: future scale of CFC-14; CFC-14: Consideration of Future Consequences total score. *Correlation is significant at the 0.05 level (two-tailed). **Correlation is significant at the 0.01 level (two-tailed).

behavior and the future scale of CFC-14 and CFC-14 total score. Furthermore, chasing was positively correlated with the immediate scale of CFC-14 and with Item 4 of the SOGS assessing self-reported chasing.

According to SOGS scoring, the sample comprised 26 non-problem gamblers (76.9% males), 17 problem gamblers (82.4% males), and 49 (probable) pathological gamblers (89.8% males). Given that no differences between problem gamblers and "probable" pathological gamblers were found, in line with previous studies (e.g., Blinn-Pike, Worthy, & Jonkman, 2010; Ciccarelli et al., 2016; Lee, Storr, Ialongo, & Martins, 2011), problem gamblers and (probable) pathological gamblers were merged into a single group of "problem gamblers" ($N = 66$). No significant differences between the two SOGS groups in terms of gender [$\chi^2(1) = 1.73$; $p = .19$] and age (non-problem gamblers = 36.96 years; problem gamblers = 35.23 years; $F_{1,\ 90} = 0.44$; $p = .51$) were found.

With regard to the ChasIT assessment, the group in the control condition comprised 89.4% males with an average age of 36.77 years, whereas the group in the loss condition comprised 80% males with an average age of 34.62 years. Analyses showed that the control and loss conditions were homogeneous in terms of participants' gender [$\chi^2(1, N = 92) = 1.56$; $p = .21$] and age ($F_{1,\ 90} = 0.83$; $p = .37$).

Approximately two thirds of participants in this study decided to chase (67.4%). Of these, 30.8% were non-problem gamblers and 81.8% were problem gamblers. The average number of trials played was 9.1 ($SD = 11.19$). χ^2 test did not show a significant association between the decision to chase and the ChasIT condition (control vs. loss) [$\chi^2(1,\ N = 92) = 0.35$; $p = .55$], suggesting that the decision to chase was not reliant on gambling outcomes.

The analysis of covariance (ANCOVA) performed on the number of trials played in the chasing task by gambling severity (non-problem gamblers vs. problem gamblers) and the ChasIT conditions (control vs. loss) using gender and age as covariates yielded a significant effect of group ($F_{1,\ 86} = 12.13$; $p = .001$; $\eta^2_p = .12$) and a tendentially significant effect of gender ($F_{1,\ 86} = 3.97$; $p = .05$; $\eta^2_p = .04$), whereas the effects of age ($F_{1,\ 86} = 0.10$; $p = .76$), condition ($F_{1,\ 86} = 1.23$; $p = .27$), and Group × Condition ($F_{1,\ 86} = 0.66$; $p = .42$) were not statistically significant. The analyses indicate that problem gamblers played for significantly more trials in the chasing task compared to non-problem gamblers ($p < .001$), with males chasing for more trials than females, but without any influence of age or task condition (Figure 1).

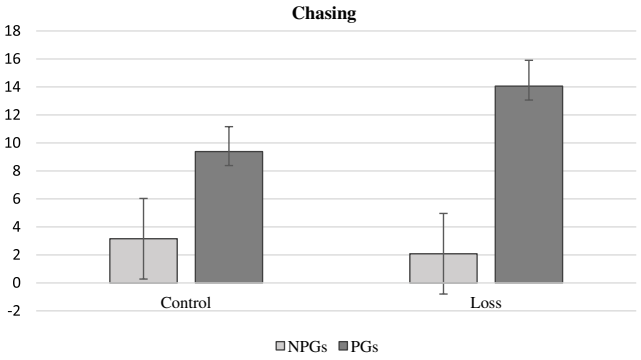

Figure 1. Differences among non-problem gamblers (NPGs) and problem gamblers (PGs) on chasing frequency (the number of trials played)

The repeated measure ANCOVA performed on the CFC-14 subscales using gambling severity as independent variable and gender and age as covariates yielded a significant Time Perspective × Group interaction ($F_{1,\ 88} = 6.06$; $p = .02$; $\eta^2_p = .06$), with problem gamblers scoring significantly higher on the immediate subscale than non-problem gamblers ($p < .01$). Neither the main effects of group ($F_{1,\ 88} = 2.07$; $p = .15$), gender ($F_{1,\ 88} = 1.02$; $p = .32$), age ($F_{1,\ 88} = 2.00$; $p = .16$), or the interaction effects of time perspective with gender ($F_{1,\ 88} = 1.12$; $p = .29$) and age ($F_{1,\ 88} = 2.11$; $p = .15$) were statistically significant.

To verify whether chasers differed from non-chasers on time perspective, a mixed ANCOVA was performed on the CFC-14 subscales, using the decision to chase as independent factor, and gender and age as covariates. From the analysis, the main effect of decision to chase tended toward significance ($F_{1,\ 88} = 3.5$; $p = .06$; $\eta^2_p = .04$), whereas the interaction between time perspective and decision to chase was significant ($F_{1,\ 88} = 6.36$; $p = .01$; $\eta^2_p = .07$), demonstrating that chasers significantly differed from non-chasers (showing a weaker orientation toward the future). No effects of gender ($F_{1,\ 88} = 1.76$; $p = .19$), age ($F_{1,\ 88} = 2.10$; $p = .15$), CFC × Gender ($F_{1,\ 88} = 0.40$; $p = .53$), or Time Perspective × Age ($F_{1,\ 88} = 1.93$; $p = .17$) were found. A linear regression model was run on gambling severity using gender, age, time perspective, and chasing as predictors. The regression analysis showed that male gender, chasing behavior, and the CFC immediate score were good predictors of gambling severity ($R^2 = .41$; $F_{3,\ 91} = 22.28$; $p < .001$).

Finally, considering linear regression analysis results and evidence from the aforementioned research on the role of gender, chasing, and time perspective on gambling involvement, path analysis was utilized in order to analyze the causal relationships among variables contributing to gambling severity. More specifically, the analysis was used to ascertain if chasing was on the path from present orientation to gambling severity or if present orientation was the mediator of the impact of chasing on gambling severity. Two different models were compared. Both models assumed that male gender predicted gambling severity directly. However, the first one (Model 1) assumed that present orientation predicted gambling severity not only directly, but also indirectly via chasing. The second one (Model 2) assumed that chasing predicted gambling severity not only directly, but also indirectly via present orientation. Model fit statistics (GFI and CFI estimates and RMSEA and SRMR values) for the two models are displayed in Table 2.

As Table 2 demonstrates, relative to the first model, the second one fitted the data better. On the whole, gender predicts gambling severity directly and chasing predicts gambling severity not only directly, but also indirectly via present orientation (Figure 2).

DISCUSSION

The focus of this study was to empirically examine the relationship between problematic gambling, chasing behavior, and time perspective. To assess chasing, an experimental task that has previously demonstrated good construct validity was adopted (for further information, see Nigro et al., 2018b). Its use allowed the behavioral measurement of chasing, overcoming all the limitations of self-report assessment tools that can easily be falsified (Orford, 2003).

In line with the hypotheses, problem gamblers reported more chasing behavior than non-problem gamblers. More specifically, problem gamblers were more likely to engage in continued gambling and more frequently continued gambling. These results are in line with Linnet et al. (2006) who also observed perseverance in making more "disadvantageous choices sequences" among pathological gamblers in a modified version of the Iowa Gambling Task (Bechara, Damasio, Damasio, & Anderson, 1994), but are in contrast with the findings of Breen and Zuckerman (1999) who found no effect of gambling severity on chasing. Given the strong observed correlation between gambling severity and chasing, the characteristics of the sample could potentially have affected the results. For instance, Breen and Zuckerman (1999) recruited a sample of male undergraduates evenly divided between participants gambling at least once per month and participants gambling less than once per month. This sample was different from that of this study where adult problem gamblers represented the majority of the sample (72%).

Notably, no significant effect of task conditions (i.e., control and loss) was found. Problem gamblers decided to continue gambling and gambled for more trials irrespective of previous outcomes. This is surprising, especially in the light of DSM-5 diagnostic criteria for gambling disorder (APA, 2013) that explicitly mentions the effect of losses on gambling persistence. Similarly, Lister et al. (2016) devised a virtual casino task where gamblers played in a loss or in a win condition. Contrary to expectations, the authors did not observe differences in chasing by task conditions but found participants with severe gambling involvement and those motivated to win money more likely to chase and gambled for more spins. These results suggest that the decision to persist in gambling may apart from gambling outcomes and may represent a personality trait-like characteristic (Nigro et al., 2018b). Alternatively, it is also conceivable that variable reinforcement schedules (i.e., wins) contributed to making chasing behavior more resistant to extinction.

In accordance with prior research on both adult and adolescent samples, problem gamblers have been shown to report a shortened temporal horizon, that is, they are more oriented to the present, rather than thinking about the future (Ciccarelli et al., 2016; Cosenza et al., 2017; Cosenza & Nigro, 2015; Daugherty & Brase, 2010; Hodgins & Engel, 2002; MacKillop et al., 2014; MacLaren, Fugelsang, Harrigan, & Dixon, 2012; Toplak, Liu, MacPherson, Toneatto, & Stanovich, 2007). As previously asserted (Nigro, Cosenza, & Ciccarelli, 2017), the inability to pay attention to the future consequences of personal actions may

Table 2. Path analysis fit indexes for alternative models

	S-B χ^2	*df*	GFI	CFI	RMSEA [90% CI]	SRMR
Model 1	5.09	1	0.97	0.94	0.212 [0.061, 0.407]	0.076
Model 2	0.10	1	0.99	1.00	0.000 [0.000, 0.190]	0.009

Note. S-B χ^2: Satorra–Bentler scaled χ^2 statistic; GFI: goodness of fit index; CFI: comparative fit index; RMSEA: root mean square error of approximation; 90% CI: 90% confidence interval for RMSEA; SRMR: standardized root mean square residual.

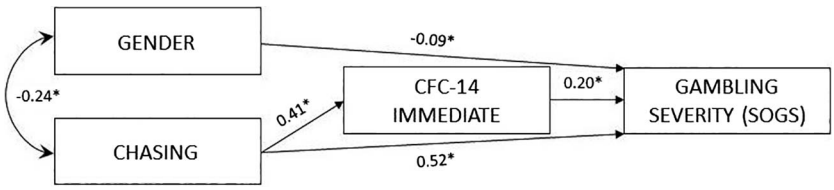

Figure 2. Path diagram for Model 2

be exacerbated by the high levels of dysfunctional impulsivity usually observed in such populations (e.g., Ciccarelli et al., 2016; Cosenza et al., 2017). As in previous research that found males to be more likely to increase bet sizes after a loss (O'Connor & Dickerson, 2003), in this study, the frequency of chasing behavior was associated with male gender. This may be due to the high prevalence of gambling in male, rather than female populations (DSM-5; APA, 2013).

It is also noteworthy that chasers differed from non-chasers in reporting a considerable orientation toward the present. The decision to bet again in the hope of "getting even" (Lesieur, 1979, p. 79) leads gamblers to make apparently fruitful choices in the short-term that turn out to be of dubious value in the long-term. Indeed, most of the time, the attempt to recoup losses fails and results in the accumulation of further losses, triggering a vicious circle that can lead to a loss of control of gambling activity. This result suggests that the reduction of chasing behavior (that has been demonstrated to increase the risk of developing gambling disorder) could potentially be facilitated by psychotherapeutic interventions that train people to think about the future. In the literature, the efficacy of the episodic future thinking has already been proven (e.g., Benoit, Gilbert, & Burgess, 2011; Daniel, Stanton, & Epstein, 2013; Lin & Epstein, 2014; Peters & Büchel, 2010). Most interestingly, the results of the path analysis clearly indicated that, alongside male gender and present orientation, chasing is the most powerful predictor of gambling persistence, since it affects gambling severity both directly and indirectly. In conclusion, not being able to resist the overwhelming urge to chase is crucial (i.e., the precipitating condition that leads to disordered gambling).

Limitations and future directions

Some limitations to this study need to be acknowledged. First, the monetary choices in the chasing task did not use real money. Although findings regarding the influence of real money on reward-based decision-making tasks are mixed (e.g., Johnson & Bickel, 2002; Hinson, Jameson, & Whitney, 2003), it is reasonable to presume that real money constitutes a more reliable measure of gambling reward. In addition, the low stake size, or the lack of possibility to choose how much to bet, further limited the strength of the present results. Second, the lifetime comorbidity with other problematic behaviors of participants was not assessed in this study. It is well known that the comorbidity of gambling disorder with substance disorders is common and that it could have an additive effect on different aspects associated with gambling (e.g., Griffiths, Wardle, Orford, Sproston, & Erens, 2010; Liu, Maciejewski, & Potenza, 2009; Lorains, Cowlishaw, & Thomas, 2011; Petry, Stinson, & Grant, 2005). Third, the low proportion of female participants limits the generalizability of the present results. These limitations should be addressed in further research. Finally, the lack of evaluation of chasing behavior even in a *win* condition represents a limitation of this study that also needs to be addressed in future research. Indeed, wins are an effective positive reinforcement that could further facilitate gambling behavior (Clark, 2010).

CONCLUSIONS

To the best of the authors' knowledge, this is the first study to examine the interplay between gambling severity, chasing behavior, and time perspective in non-problem gamblers and problem gamblers. In line with previous research, problem gamblers demonstrated a weak orientation to the future and were found to chase more frequently than recreational gamblers. In addition, participants who chased reported a foreshortened time horizon. The findings regarding chasing as mediator between gambling severity and time perspective are highly novel and have not been reported in the gambling literature previously. These results suggest that present orientation has a direct effect on gambling severity and mediates the association between chasing and gambling involvement.

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Authors' contribution: MCi and GN together designed the study and wrote the protocol. MCo and FD conducted literature searches and provided summaries of previous research studies. MCi conducted the statistical analysis and wrote the first draft of the manuscript. MDG revised the manuscript. All authors contributed to and have approved the final version of the manuscript.

Conflict of interest: MDG has received funding for a number of research projects in the area of gambling education for young people, social responsibility in gambling, and gambling treatment from GambleAware (formerly the Responsibility in Gambling Trust), a charitable body which funds its research program based on donations from the gambling industry. MDG's university receives funding from Norsk Tipping (the gambling operator owned by the Norwegian Government) for research being undertaken by MDG. MDG also undertakes consultancy for various gaming companies in the area of social responsibility in gambling.

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