Predicting Early Gambling in Children
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CITATION
Predicting Early Gambling in Children

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This large population-based study (N = 1,125) examined whether low inhibition (i.e., low anxiety) predicted early gambling, above and beyond disinhibition (i.e., impulsivity) and whether the two personal dispositions operated independently or interactively. It also examined whether the predictive role of these personal dispositions towards early gambling depended on parent gambling. Children’s personal dispositions were assessed at ages 6, 7, and 8 years through teacher ratings. Parent gambling participation and gambling problems were assessed when the children were 8 years old. Finally, children’s early gambling was measured through self-reports when the children were 10 years old. Results showed that teacher-rated impulsivity predicted early gambling for both genders. In addition, low anxiety predicted early gambling behavior, above and beyond impulsivity and control variables, albeit only in boys. Impulsivity and anxiety did not interact with each other, nor did they interact with parent gambling in predicting early gambling. However, parent gambling participation, but not problems, additively predicted early gambling for boys and for girls. The theoretical and practical implications of these findings are discussed.

Keywords: gambling, parent gambling, impulsivity, anxiety, children

Gambling behavior begins early: by pre-adolescence, 15% of boys and 5% of girls have already become involved in daily or weekly gambling (Ladouceur, Dubé, & Bujold, 1994; Stinchfield, Cassuto, Winters, & Latimer, 1997). Early initiation deserves attention since adolescent and adult problem gamblers report that they started gambling at an early age (approximately 10 years of age; Burge, Pietrzak, & Petry, 2006; Derevensky & Gupta, 2001; Shaffer, Hall, & Vander Bilt, 1999; Wynne, Smith, & Jacobs, 1996). However, very little is known about the risk factors that are prospectively linked to early gambling.

The few prospective studies that examined risk factors have reported two categories which predict early gambling. The first category includes dispositional factors, such as impulsivity; the second category includes environmental factors such as parent gambling (Govoni, Rupcick, & Frisch, 1996; Langhinrichsen-Rohling, Rohde, Seeley, & Rohling, 2004; Oei & Raylu, 2004; Pagani, Derevensky, & Japel, 2009). The finding that impulsivity is prospectively linked to gambling is in line with a growing body of literature showing an association of disinhibitory traits and gambling across the lifespan (Barnes, Welte, Hoffman, & Dintcheff, 1999; Pagani et al., 2009; Slutske, Caspi, Moffitt, & Poulton, 2005; Vitaro, Arseneault, & Tremblay, 1999; Vitaro, Brendgen, Ladouceur, & Tremblay, 2001). However, disinhibition may be only one of a number of different personal precursors of early gambling. In addition, environmental risk factors such as parent gambling may also represent precursors of early gambling. Moreover, personal dispositions and environmental risk factors may operate synergistically rather than independently (Sharpe, 2002).

Personal Dispositions: Impulsivity and Anxiety

There is accumulating evidence suggesting that diverse behavioral elements are involved in gambling (Goudriaan, Oosterlaan, de Beurs, & Van den Brink, 2004; Sharpe, 2002). Following pioneer work by Gray (1970, 1981), two bio-behavioral systems appear to be involved: The behavioral inhibition system (BIS) and the behavioral activation system (BAS). The BIS is sensitive to punishment and has been hypothesized as the neurological basis for the experience of anxiety. A low or weak BIS is reflected in low inhibition, low sensitivity to punishment, and low anxiety. In contrast, the BAS is sensitive to reward and is thought to control approach motivation and goal-oriented behavior. A high or strong BAS is reflected in high disinhibition, strong sensitivity to reward, and high impulsivity.

The BIS and BAS might be implicated in risk-taking behaviors such as gambling (Gray, 1990). More specifically, an overactive BAS has been related to an under-regulation of the dopamine system in the brain. In turn, an under-regulation of the dopamine system has been linked to high reward sensitivity and sensation seeking, two characteristics that might explain how impulsivity is linked to gambling (Chambers, Taylor, & Potenza, 2003; Driver-Dunckley, Samanta, & Stacy, 2003; Grant, Chambers, & Potenza, 2004; Ibanez, Blanco, & Suiz-Ruiz, 2002). In contrast, a weak BIS derives from central serotonergic mechanisms. A failure in these mechanisms translates into an inability to monitor punishment and
inhibit ongoing behaviors, two characteristics that have also been linked to gambling (Beauchaine & Neuhaus, 2008; Gray & McNaughton, 2000). As a result, it is possible that a strong BAS (as indexed by high disinhibition/high impulsivity) and a weak BIS (as indexed by low inhibition/low anxiety) have independent contributions to gambling since they do not share the same neural circuits and they separately control distinct, although correlated, behavioral predictors of gambling (Ibanez et al., 2002; Lee & Coccaro, 2007; van Gooren, Fairchild, Snoek, & Harold, 2007).

As suggested by some authors (Cloninger, 1986, 1987; Corr, 2002; Tremblay, Pihl, Vitaro, & Dobkin, 1994) the contributions of the BIS and the BAS may also be synergistic or interactive. For example, low inhibition (low anxiety) could potentiate the effect of high disinhibition (high impulsivity) on gambling, whereas high inhibition (high anxiety) may mitigate the effect of high disinhibition on gambling. Findings in other domains provide support for this assumption. It has been found that adolescents who are high on sensation seeking, a construct that is correlated with impulsivity, are more at risk of abusing alcohol if they are not anxious than if they are anxious (Conrod, Pihl, Stewart, & Dongier, 2000). Similarly, impulsive children who are not anxious have been found to become more delinquent than their impulsive counterparts who are anxious (Kerr, Tremblay, Pagani-Kurtz, & Vitaro, 1996). Impulsive children who are not anxious may be less cautious in abusing alcohol or perpetrating illegal acts because they are focused on immediate reward and not afraid of possible negative consequences. This interaction might be observed in regard to gambling which involves a risk of loss and a chance, albeit often remote, of winning. More specifically, impulsive children who are low on anxiety might be particularly at risk for early gambling because they not only are sensitive to reward, but also lack the inhibitory mechanisms (i.e., sensitivity to potential losses) that could help them refrain from engaging in risk-taking behaviors. Vitaro, Wanner, Ladouceur, Brendgen, and Tremblay (2004) provide limited support for this assumption. These authors have shown that adolescents who follow a chronic gambling trajectory are more impulsive and less anxious than non gamblers. However, they did not clarify whether impulsivity and anxiety operate additively or interactively in predicting early gambling.

Environmental Factor: Parent Gambling

The predictive power of the mentioned personal dispositions may, furthermore, be conditional on environmental factors such as parent gambling. This would imply that children’s personal dispositions would predict early gambling only under specific family circumstances. For example, a link between personal dispositions and early gambling may be found only when parents themselves model or approve of gambling. Indeed, parents who participate in gambling activities may be more indulgent and supportive of their children’s gambling activities (Govoni et al., 1996; Jacobs, 1989). Without parent indulgence, vulnerable children may become involved in risk-taking behavior such as gambling later in adolescence when the socializing influence of parents declines and the influence of peers increases (Catalano, Kosterman, Hawkins, Newcomb, & Abbott, 1996).

There is extensive empirical support for a link between parent gambling and adolescent gambling, independent of the way parent gambling is measured (i.e., through adolescents’ perceptions or parent reports; Cronce, Corbin, Steinberg, & Potenza, 2007; Har-doon, Gupta, & Derevensky, 2004; Langhinrichsen-Rohling et al., 2004; Vachon, Vitaro, Wanner, & Tremblay, 2004; Winters, Stinchfield, Botzet, & Anderson, 2002). Only one study, however, examined the association between parent gambling and gambling behavior in pre-adolescents (Pagani et al., 2009). This study found that parent gambling did not predict children’s involvement in early gambling above and beyond children’s personal dispositions (i.e., hyperactivity-impulsivity). However, this study, as all the others, did not examine the possibility of an interaction between personal dispositions and parent gambling. As argued above, the link between children’s personal dispositions and their involvement in early gambling could be exacerbated for those with parents who gamble. However, it is not clear whether it is parent gambling participation (i.e., how frequently parents participate in gambling activities) or parent gambling problems that is most relevant in this context. For this matter, no study (to our knowledge) examined whether parent gambling problems played a significant role in regard to childhood gambling above and beyond parent gambling participation. It is possible that parent gambling problems proves more important than parent gambling participation, both as a main effect and as a potential moderator of the links of children’s personal dispositions to gambling. This, however, remains uncertain since young children may be less aware of their parents’ gambling problems compared to their parents’ gambling participation—or parents’ approval of gambling activities. In addition, gambling participation is highly prevalent in adults whereas gambling problems are rare (Volberg, 2004). In this study, we included both parent gambling participation and parent gambling problems to see which would predict children’s gambling and which would possibly moderate the links of children’s personal dispositions to their gambling behavior.

The Present Study

In the present study, we investigated whether low inhibition (as reflected by low anxiety) predicts early gambling above and beyond high disinhibition (as reflected by high impulsivity). In addition, we explored whether these two personal disposition operated in an additive or interactive mode in predicting early gambling. Similarly, we investigated the possible additive or interactive interplay between either of the two personal dispositions and parent gambling (participation and/or problems) in predicting early gambling. An additive combination could entail that both sets of risk factors need to be further addressed in order to obtain optimal results for prevention programs. In contrast, an interactive combination would signify that offsetting one set of risk factors would be sufficient to prevent or mitigate early gambling. Clarifying these issues may have important consequences for the elaboration of a comprehensive etiological model with respect to the emergence of early gambling during the pre-adolescent years.

Children with highly impulsive dispositions demonstrate low performance on executive functions such as decision making, feedback processing, and risk estimation (van Meel, Oosterlaan, Heslenfeld, & Sergeant, 2005). Poor performance on these mental functions may represent lower intellectual capabilities. Hence, it is important to control for general intellectual functioning while assessing the link between impulsivity and gambling, to ensure this link is not spurious. Socio-economic status also has been linked to
youth and adult gambling (Welte, Barnes, Wieczorek, Tidwell, & Parker, 2004). Consequently, the present study controlled for children’s socio-economic status. Lastly, children’s gender was controlled since boys tend to gamble more and experience more gambling-related problems than girls (Ladouceur, Boudreau, Jacques, & Vitaro, 1999; Gupta & Derevensky, 1998). In addition to main effects and interactions of personal dispositions and parental behavior, we examined whether children’s gender moderated the association between personal dispositions and early gambling or the association between parent gambling and children’s early gambling. Given that boys tend to be more impulsive and less anxious than girls, we expected the links between these two behavioral dispositions and early gambling to be stronger in boys than in girls. No gender differences, however, were expected with respect to the link between parent gambling and children’s early gambling. We examined “early gambling” when the children were 10 years old since adolescent and adult problem gamblers began gambling. We examined “early gambling” when the children were 10 years old since adolescent and adult problem gamblers began their gambling activities at approximately this age (Derevensky & Gupta, 2001; Wynne et al., 1996).

**Method**

**Sample**

Participants were part of the Quebec Longitudinal Study of Child Development, a sample of children born in the Province of Quebec, Canada, between October 1997 and July 1998. Participants were selected from the Quebec Birth Registry through a stratified sampling procedure based on living area and birth rate. Families (N = 2675) were contacted by mail and telephone when children were approximately 5 months of age and 83.1% participated in the first assessment, resulting in an initial sample of 2,120 children. Of these, 51.2% were boys and most (91.5%) were Whites, 3% were Blacks, and 2.9% were Native Indians or Inuit. The majority (80.3%) were living with their two biological parents at the beginning of the study, whereas 12.6% and 7.1% were living in reconstructed families or with one parent (typically mothers), respectively. On average, mothers and fathers were 28.8 and 31.8 years of age, respectively; 16.9% of mothers and 19.9% of fathers did not hold a high school degree; 27.7% reported an income lower than CAD $30 000 (US $29,451). Before the first assessment used in this study, children were assessed six additional times, at 5 months, 17 months, 2.5 years, 3.5 years, 4 years, and 5.1 years of age.

Data from times 7 to 10 were used in this study. At time 7, i.e., by the end of kindergarten, children were on average 6.1 years old (SD = .30), at time 8, i.e., by the end of grade 1, they were 7.2 years old (SD = .31), and at time 9, i.e., by the end of grade 2, they were 8.2 years old (SD = .34). Finally, at time 10, i.e., by the end of grade 4, they were 10.1 years old (SD = .36). Signed informed consent was obtained from parents prior to each data collection. The ethics board of the Institut de la Statistique du Québec, the agency responsible for the data collection, approved the study.

To maximize the use of available data, boys and girls with complete data regarding parent gambling and self-reported gambling, and at least 1 data point with respect to teacher ratings (see measures below) were included in the analysis (n = 1,125; 48% boys). Compared to these 1,125 participants, children who were not included in the study (n = 995) had a more difficult temperament according to their mother at ages 5 and 17 months and lived in low income families.

**Measures: Predictors**

Teacher reports of impulsive and anxious behaviors were assessed via the Child Social Behavior Questionnaire (Tremblay, Vitaro, Gagnon, Piché, & Royer, 1991). Impulsive behaviors were measured through the use of three items which captured both the behavioral and cognitive aspects of impulsivity (Patton, Stanford, & Barratt, 1995): jumps from one activity to another, difficulty waiting his/her turn, impulsive-acts without reasoning. Anxiety symptoms were measured through the use of three items also: anxious when faced with novel situation; shy with new people; easily worried. These three items covered both the behavioral and cognitive aspects of anxiety (Huberty, 1997). All items were scored on a 3-point scale (0 = never, 1 = sometimes, 2 = often). Cronbach’s alphas were .77, .79, and .81 for impulsivity problems, and .76, .77, and .80 for anxiety symptoms at ages 6, 7, and 8 years, respectively. In order to improve the reliability of the impulsivity and anxiety measures collected yearly from different teachers, we computed for each child the average score across the three times of measurement for both measures. As seen in other studies, each measure was moderately stable (r = .54 and .53, from age 6 to 7 and from age 7 to age 8, respectively, for impulsivity and r = .47 and .44, from age 6 to 7 and from age 7 to age 8, respectively, for anxiety). The distributional properties of both averaged scales were acceptable: Skewness = 1.19, Kurtosis = 0.85 for impulsivity; Skewness = 0.99, Kurtosis = 1.04 for anxiety.

Parent gambling was assessed when the children were 8 years old. Parents (mothers and fathers separately) were administered the South Oaks Gambling Screen (SOGS; Lesieur & Blume, 1987). The SOGS assessed gambling participation and gambling problems.

To assess gambling participation, a list of different gambling activities was presented to the parents. This list included 11 items. For each activity, parents indicated whether they never (r = 0), less than monthly (r = .01), monthly (r = .2), weekly (r = .3), or daily (r = 4) participated in it over the past 12 months. A participation score was computed for each parent by averaging the frequency scores for all the different gambling activities of the past 12 months. Given that mother and father gambling were moderately correlated (r = .38, p < .05), a total mean score across the two parents was computed. The mean and standard deviation of the parent gambling participation scale is presented in Table 1. Internal consistency for the parent gambling participation was satisfactory (alpha = .67, Skewness = 1.01, Kurtosis = 1.39).

To assess gambling problems we asked each parent to indicate which of a series of 8 gambling-related problems he/she experienced over the past 12 months. The original SOGS problem scale is comprised of 12 additional items of which nine items assess different sources for funding gambling. Time constraints prevented from using the full 20-item scale; consequently, the eight items with the highest factor loadings were selected. For each child, we calculated a sum score of the possible gambling problems per parent separately. Internal consistencies and distributional characteristics were poor for both respondents (alpha = .53, Skewness = 7.59, Kurtosis = 95.74 and alpha = .57, Skewness = 7.93,
Kurtosis = 80.92 for mothers and fathers, respectively. In addition, mothers’ and fathers’ gambling problems were lowly correlated (r = .13), prohibiting the combination of the scores.

Measures: Outcomes

We used a self-reported four-item questionnaire to assess involvement in gambling when the children were aged 10 years. With the exception of a Bingo item (which was not used), the four items were similar to the ones used by Pagani et al. (2009): how many times during the past 12 months...did you play cards for money with non family members (1.07% of the sample had participated at least once); did you play cards for money with family members (6.42%); did you buy lottery tickets or asked an adult to buy lottery tickets for you (8.18%); did you place bets at sports venues or on games that required skills (5.16%). Conducted Fisher’s exact tests and Pearson chi-square tests indicated that the latter two types of games displayed significant differences in participation rates across gender. Specifically, boys (N - 53; 57.61%) played the lottery more often than girls (N - 39; 42.39%); χ²(N = 92; df = 1) = 4.06; p < .05. Similarly, boys (N - 46; 79.31%) participated more often in sports-related games than girls (N - 12; 20.69%); χ²(N = 112; df = 1) = 24.71; p < .001. The response scale of the items contained four possible responses: Never ( = 0), once or twice ( = 1), more than two times but less than 10 times ( = 2), and more than 10 times ( = 3). Given the preponderance of non-gamblers (N = 935; 83.11%), we distinguished two types of gamblers: A group of “Experimenters” who participated only in one type of game once or twice (response = 1; N = 131; 11.64%) and a group of “Gamblers” who either participated in one type of game more than two times (response > 2) or participated at least in two types of games (N = 59; 5.24%).

Measures: Controls

IQ was assessed when children were 6 years old. Each child was individually administered a series of subtests assessing mental processing adapted after the Kaufman Assessment Battery for Children (K-ABC). The K-ABC is an intelligence and achievement test for children aged 2-1/2 to 12-1/2 years of age (Cahan & Noyman, 2001). Internal consistency was high (alpha = .85).

Family socioeconomic status was assessed by asking parents to indicate their total household income (split into nine categories). We took the mean of time 1 through time 8.

Results

Preliminary Analyses

We examined the extent to which (a) teacher ratings of children’s personal dispositions at ages 6 to 8 years would predict subsequent self-reported gambling at age 10 years, and (b) what role parent gambling plays in this context. Specifically, we examined (1) an additive model, where all predictors would have independent direct effects on children’s gambling; (2) an interaction model, where children’s disinhibitory (i.e., impulsivity) and inhibitory (i.e., anxiety) characteristics would interact to predict children’s gambling; and (3) an interaction model, where parent gambling would moderate the links between personal dispositions and gambling. We also tested whether boys and girls would differ in this regard. Prior to these tests, we examined the bivariate links between the predictor variables and the outcome. Table 1 shows the means and standard deviations as well as the zero-order correlations among all control and predictor variables. Moreover, the table shows odds ratios (ORs) and associated p-values of Maximum Likelihood tests obtained when including each predictor separately in multinomial regressions for unordered categorical outcomes. The outcome variable child gambling groups was coded such that 1 indicated Gamblers, 2 = Experimenters, and 3 = Nongamblers. Nongamblers thus were the reference group. As seen in the table, with the exception of anxiety, each of the predictors was significantly linked to both child gambling groups in these univariate analyses. With respect to parents’ gambling problems, univariate analyses showed that only mothers’ gambling problems were associated with child gambling; specifically more gambling problems in the mother related to greater likelihood of being in the Gambler group, as opposed to the Non-Gambler group. Notably, mothers’ gambling problems were not related to the Experiment group. In preliminary analyses, we explored whether the association between mothers’ gambling problems and

| Note. Gender is coded such that 1 indicates girls and 0 indicates boys; ^ = odds ratios and p-values of Maximum Likelihood tests of univariate multinomial regressions for unordered outcomes are reported; types of gamblers were coded such that 1 = Gamblers, 2 = Experimenters, and 3 = Nongamblers (i.e., reference group); parents’ gambling problems are omitted because they were unrelated to any of the variables; the exceptions were significant links of fathers’ and mothers’ gambling problems to Parent Gambling Participation (r = .130*** and r = .125***; respectively) as well as links of mothers’ gambling problems to impulsivity (r = .080***). Child Gambling: Gamblers (odds ratio = 1.284***). * p < .05. ** p < .01. *** p < .001, two-tailed tests. |
the Gambler group would disappear when controlling for the effects of parent gambling participation. Moreover, we explored whether mothers’ and fathers’ gambling problems would be linked to child gambling when taking the interactive effects of personal dispositions into account. We therefore tested the same interaction terms with respect to parents’ gambling problems, as described below for parent gambling participation. Given that mothers’ gambling problems were only linked to one of the two outcome categories (i.e., Child Gamblers group), and thus differed across the categories of the outcome, we conducted hierarchical multinomial logistic regression analysis for unordered categorical outcomes. The results of these preliminary analyses showed that the link of mothers’ gambling problems to the Gamblers group was nonsignificant after controlling for parent gambling participation. This is not surprising given that gambling participation and gambling problems are related (Holtgraves, 2009). Finally, none of the tested interaction terms involving parent gambling problems (either mother or father) were significant for any of the two child gambling groups. We thus excluded parent gambling problems from the main analyses.

**Analytical Strategy and Main Analyses**

In the main analyses, we conducted hierarchical multinomial logistic regression analysis for ordered categorical outcomes to test our hypotheses. We used the Nagelkerke $R^2$ to estimate the proportion of the total variance explained in our outcome variable (child gambling at age 10). To assess model fit, we used the Pearson test that compares the current model with the saturated model. A non-significant test indicates a well-fitting model. Moreover, a nonsignificant Score Test for the Proportional Odds Assumption indicates that the ORs are equal for both groups of gamblers (i.e., Gamblers and Non-gamblers) when compared to Non-gamblers. In the case of a significant Score test, the ORs should be estimated separately for each gambler group, for example, by using multinomial logistic regressions for unordered categorical outcomes (as employed above). On the first step of the logistic regression, we included child’s gender, family income, intelligence, and personal dispositions (i.e., impulsivity and anxiety) as predictors in the model. On the second step, we tested whether impulsivity and anxiety would interact to predict gambling and whether these links would differ between boys and girls. Thus, the interaction between impulsivity and anxiety (i.e., impulsivity $\times$ anxiety) was entered on step 2a. On step 2b, we entered the two-way interaction of impulsivity and gender (i.e., impulsivity $\times$ gender). Similarly, on step 2c, we entered the interaction of anxiety and gender (i.e., anxiety $\times$ gender). On step 2d, we tested the three-way interaction of both personal dispositions and gender. On this last step, we included each of the previous two-way interactions of steps 2a to 2c as well as the three-way interaction term (i.e., impulsivity $\times$ anxiety $\times$ gender). Notably, following the recommendations of McClelland & Judd (1993), steps 2a through 2d were tested in a mutually exclusive sequence without protection against an inflated family-wise error rate. We also used this approach in the subsequent tests involving interactions. On the third step, we added parent gambling participation. On the fourth step, we tested whether parent gambling participation interacted with child personal dispositions in predicting child gambling groups and whether the possible interactive links would differ between boys and girls. For example, in order to test an interactive effect between parent gambling (participation) and impulsivity, we added this two-way interaction term (i.e., parent gambling $\times$ impulsivity) on step 4a. Next, on step 4b, we tested the interactive effect of parent gambling and impulsivity and potential gender differences in this respect. We thus added the following two-way and three-way interaction terms on step 4b: parent gambling $\times$ impulsivity, parent gambling $\times$ gender, impulsivity $\times$ gender, and parent gambling $\times$ impulsivity $\times$ gender. The same rationale was employed to test interactive effects between parent gambling and anxiety on steps 5a and 5b. In Table 2 we present the overall model fit and $\chi^2$-change associated with each step, the Wald $\chi^2$-test associated with each predictor, as well as the specific OR (and its 95% confidence interval) associated with each predictor of child gambling at age 10 years.

The results of the first step of the logistic regression showed that the gender was the only control variable to contribute significantly to children’s gambling. In contrast, family income and intelligence were unrelated to child gambling. Boys were more likely to gamble than girls ($OR = 0.59, p < .01$). With respect to child characteristics, impulsivity increased the odds of gambling by 22% ($OR = 1.22, p < .05$), whereas anxiety failed to yield a significant link to child gambling.

Of the interactions entered on the second step, only the interaction between anxiety and gender was significant ($OR = 1.56, p < .01$). As seen in Table 2, for boys, each unit increase in anxiety was associated with a decrease in the likelihood of gambling ($OR = 0.76, p < .05$). To probe the interaction, we recoded gender and the interaction term such that girls were the reference category. The results of this regression model showed that, for girls, anxiety was not significantly linked to gambling: Wald-$\chi^2_{11} = 2.27, p = .13; OR = 1.19, 95\%$ CI: 0.94, 1.50.

On the third step, we entered parent gambling participation. Each unit increase in parent gambling participation increased the likelihood of child gambling by 41% ($OR = 1.41, p < .001$), net of children’s characteristics. Moreover, on the fourth and fifth steps, we tested interactions regarding both child personal dispositions, parent gambling, and gender. None of these interactions were significant. The Score test for each of the tested regression models was nonsignificant indicating that the ORs were equal for the two gambler groups when compared to non-gamblers. Finally, nonsignificant Pearson tests indicated good model fit for each of the models.

**Discussion**

Present results indicate that impulsivity averaged across ages 6, 7, and 8 predicted early gambling by 10 years of age for both genders. In addition, low anxiety predicted early gambling, above and beyond impulsivity and control variables, but only for boys. Moreover, parent gambling participation additively predicted early gambling for boys and girls. However, impulsivity and anxiety did not interact with each other, nor did they interact with parent gambling in the prediction of early gambling. These findings and their implications are discussed in the following section.

**Impulsivity and Anxiety**

Consistent with past studies, teacher-rated impulsivity was found to predict self-reported early gambling, even when control-
ling for possible confounders such as family income, gender, and children’s intellectual functioning. This study is the first, however, to examine this link in 10-year-old children for whom gambling behavior is relatively recent. It is also the first study to examine low anxiety as an additional precursor of early gambling. In line with our expectations, low anxiety made a unique contribution to understanding the behavioral and emotional correlates of early gambling (and possibly other risk-taking behaviors; Beauchaine, Klein, Chambers & Potenza, 2003). As argued in the Introduction, a strong BAS may foster sensation seeking and reward sensitivity, likely through a dysregulated dopaminergic system, whereas a weak BAS may foster insensitivity to punishment and inability to regulate ongoing behavior, likely through a dysregulated serotonergic system (Beauchaine & Neuhaus, 2008; Chambers & Potenza, 2003). In turn, sensation seeking and reward sensitivity, as well as insensitivity to punishment and inability to regulate ongoing behavior, have been found to characterize individuals who are at risk for problem gambling (Crone, Vendel, & van der Molen, 2003; Franken, van Strien, Nijs, & Muris, 2008; Sonuga-Barke, Taylor, Sembhi, & Smith, 1992; Vitaro et al., 2001).

The present results regarding the additive role of anxiety in the prediction of early gambling in boys are also in line with some but not all past studies that examined the link between anxiety and gambling. For example, consistent with the present findings, Vitaro et al. (2004) reported that low anxiety assessed during pre-adolescence was related to chronic gambling in adolescent males. However, Hardoon and Derevensky (2002) found that adolescent problem gamblers were concurrently more, not less, anxious than non-gamblers, although they were also more excitable, extraverted, and under-controlled (i.e., more impulsive) than non-gamblers. Other researchers also found that adolescent gamblers report higher rates of anxiety and depressive symptoms than non-gamblers (Gupta & Derevensky, 1998; Stinchfield & Winters, 1998). These apparently contradictory results suggest the possibility for a transactional interplay between anxiety and gambling across different developmental periods: low, not high, anxiety may set the stage for early involvement in gambling, possibly because non-anxious children, especially boys, are less concerned with possible negative consequences related to gambling than their anxious counterparts. However, as gambling problems develop during the adolescent years, emotional problems such as anxiety and depression may develop, in boys and in girls alike. This might represent an illustration of the “turnabouts” model proposed by Rutter (1996) to explain the reversals of causal priority or direction between risk factors and adjustment problems over the course of development.

The finding that high impulsivity and low anxiety (for boys) predicted membership in both the Experimenters and the Gamblers groups does not fit well with a finding from Vitaro et al. (2004) who showed that these two characteristics applied only to early onset gamblers (who gambled already by early adolescence) but not to late onset gamblers (who started gambling by mid-adolescence). One way to reconcile these findings is to see both the.

### Table 2

<table>
<thead>
<tr>
<th>Overall Model Statistics</th>
<th>Odds Ratio Estimates</th>
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<tr>
<td><strong>Step 1</strong></td>
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<tr>
<td>$\chi^2$-Change (df)</td>
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<td>Socioeconomic Status</td>
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<td>Intelligence</td>
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<td>Teacher: Anxiety</td>
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<td></td>
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<td><strong>Step 2c</strong></td>
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<tr>
<td>Gender</td>
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<td>Socioeconomic Status</td>
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<td>Anxiety $\times$ Gender</td>
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<td><strong>Step 3</strong></td>
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<tr>
<td>Gender</td>
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<td>Intelligence</td>
<td>0.87 .35</td>
</tr>
<tr>
<td>Teacher: Impulsivity</td>
<td>0.00 .97</td>
</tr>
<tr>
<td>Teacher: Anxiety</td>
<td>4.29 .04</td>
</tr>
<tr>
<td>Anxiety $\times$ Gender</td>
<td>4.66 .03</td>
</tr>
<tr>
<td>Parent Gambling Participation</td>
<td>6.67 .01</td>
</tr>
<tr>
<td></td>
<td>21.00 .001</td>
</tr>
</tbody>
</table>

Note. Gender is coded 0 = boys and 1 = girls; CI = 95% confidence interval of odds ratio; the change in $\chi^2$ and $R^2$ reported in the second and in the fourth column is a change compared to the $\chi^2$ and $R^2$ in the previous step. The Pearson and the Score tests were nonsignificant for modeling steps 1 to 5 indicating good model fit and similarity of relationships across gambling groups, respectively. Only the step where a significant interaction was found is reported (i.e., step 2c with interaction of Anxiety and Gender).

* $p < .05$. ** $p < .01$. *** $p < .001$, two-tailed tests.
Experimenters and the Gamblers groups as early onset gambling groups at risk to embark on a similar chronic gambling trajectory by virtue of their combined personal and environmental risk factors.

Contrary to our expectations, we found no interaction between anxiety and impulsivity. Hence, low anxiety did not exacerbate the link between impulsivity and later gambling. Conversely, high anxiety did not mitigate the above link. Thus, it appears that the BIS and BAS systems operate independently to predict early gambling. Provided these results are replicated in future studies, it would mean that both systems need to be represented in etiological models of early gambling, at least for male gambling. Moreover, prevention studies might need to address directly and separately the cognitive and emotional aspects linked to hypo-sensitivity to punishment (BIS) and hyper-sensitivity to rewards (BAS).

Parent Gambling

Parent participation in gambling activities predicted children’s gambling above and beyond children’s personal dispositions. Different processes could account for this result, although none could be formally tested in the present study. First, the link between parent gambling and offspring’s early gambling could indicate that parents who are involved in gambling activities are more tolerant of their children’s gambling behaviors or are less effective in monitoring their children’s behaviors (Gupta & Derevensky, 1998; Vachon et al., 2004). Second, it could indicate that parents serve as models or as trainers of their offspring’s emergent gambling behavior, possibly during family activities involving gambling. After all, the majority of adolescent who gamble have been introduced to gambling by their parents (Ladouceur & Mireault, 1988). Interestingly, parent gambling problems did not predict child gambling, once parent gambling participation was included in the model. Even at the univariate level, only mothers’ gambling problems were related to only the Gamblers group. Most likely, these results may be accounted for by small variances and low internal consistencies of parents’ gambling problems. The results could also indicate that young children are not “affected” by their parents’ gambling problems possibly because they are not (yet) aware of them or exposed to their deleterious consequences such as family conflict and inconsistent parenting (Vachon et al., 2004).

The fact that our findings do not concur with the only other study that examined the predictive link between parent gambling and childhood gambling deserves some comments (Pagani et al., 2009). Several reasons might help explain why, contrary to the present study, no link between parent gambling participation and children’s gambling was found in the Pagani et al. study. First, Pagani et al. used four items to assess a “general construct of parent gambling involvement” that yielded low internal consistency (i.e., alpha = .58). This indicates that the likelihood to find such a relationship with child gambling was low. Moreover, this measure might have generated less variance than our more sensitive 11-item measure. Second, selection effects may have reduced variance in the previous study. Specifically, participants in the Pagani et al. study were less socioeconomically and ethnically diverse than the representative sample in the current study. Finally, the rather small sample size might have created a power issue in the Pagani et al. study.

Interplay Between Personal Dispositions and Parent Gambling

Surprisingly, parent gambling neither interacted with anxiety nor with impulsivity. This result has both theoretical and practical implications. At the theoretical level, it will be important in the future to acknowledge both sets of predictors as independent and additive. Personal dispositions may represent the genetic contribution of parents’ gambling to their offspring’s early gambling, whereas their gambling behavior may reflect a cultural contribution. In any case, both elements need to be targeted in prevention programs to obtain optimal results. Eliminating one set of risk factors or replacing it by its positive counterpart will not be sufficient to mitigate or buffer the contribution of the other set of risk factors in regard to early gambling. Finally, the popular but speculative view of an interactive interplay between personal dispositions and environmental risk factors held by many theorists needs to be revisited in favor of an additive perspective in the case of early gambling.

Limitations and Concluding Remarks

This study has many assets: it used a moderately large community sample and a longitudinal perspective. The latter is important in helping to disentangle the directionality of the links between personal dispositions, parent gambling, and children’s gambling. The use of different informants for the predictor and the outcome variables ensured that the predictive links were not artifically inflated through shared method variance. Finally, the inclusion of children’s intellectual abilities and socioeconomic status in the analyses reduced the possibility for spurious links. The study also has some limitations which need to be kept in mind when interpreting the findings. First, other possible relevant personal dimensions besides impulsivity and anxiety (such as sensation seeking) were not included. Second, no mediating mechanisms such as parent training or parent modeling were investigated. Third, attrition was relatively high (i.e., 47%). Given that participants who dropped out of the study had lower socioeconomic status and a more difficult temperament compared to participants, it is likely that they were also more impulsive, on average, and possibly less anxious. In consequence, a possible restriction of range on these measures might have resulted in conservative findings. Fourth, the possibility of a developmental shift regarding the directionality of the link between anxiety and gambling could not be examined. This shift may only occur later in adolescence rather than in the time window examined in the present study. Fifth, the use of an abbreviated scale to assess parent gambling problems might explain why this measure made no contribution in predicting child gambling. Sixth, our impulsivity or anxiety items may not have tapped into all the elements involved in impulsivity: sensation seeking and reward sensitivity, as well as insensitivity to punishment and inability to regulate ongoing behavior. Finally, the specific ethnic composition of the sample and a limitation to age 10 gambling may limit the generalizability of the findings. As reported in a number of prospective and retrospective studies, early onset gamblers are most at risk for later gambling problems. Yet, some late onset gamblers (i.e., who start gambling after age 10 years) may also experience gambling problems (Vitaro et al., 2004). Despite these limitations, it appears that (a) high impulsiv-
ity and, for boys, low anxiety both independently predict early gambling; and (b) parent gambling operates additively rather than interactively in this context. Prevention programs targeting children’s personal dispositions and/or parent gambling could help uncover the possible causal role played by these early risk factors.

References


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