

Beyond the Genetic Basis of Sensation Seeking: The Influence of Birth Order, Family Size and Parenting Styles

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Genetic analyses of sensation seeking have shown fairly high heritabilities for measures of this trait. However, 40 to 60% of the variance remains unexplained by genetic factors. This longitudinal study examines the influence of characteristics of the family environment -- birth order, family size, socio-economic status and parenting styles -- on two dimensions of sensation seeking: disinhibition and boredom susceptibility. Previous research has shown that these dimensions load on the same factor, are related to biologically based impulsive disorders, and have a common genetic basis. Questionnaire and biographical data obtained from 532 female and 479 male young adults (age between 18 and 30 years) were analyzed using structural modeling. The results show that participants who experienced little parental care and much control were more likely to have high scores on disinhibition and boredom susceptibility. It appears that these family factors may partly explain the previously reported effects of birth order and family size on sensation seeking.

Keywords: sensation seeking, birth order, parenting styles, longitudinal research, structural equation modeling

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Until the 1960s personality psychology was dominated by a strong environmentalism. At that time, references to the genetic and biological determinants of personality characteristics were sparse. However, at present personality psychology is liberated from the environmentalistic straitjacket, and the trait approach is flourishing. One good example is provided by the research on one particular personality trait: the sensation seeking tendency. This trait is defined by the seeking of varied, novel, complex and intense sensations and experiences, and the willingness to take physical, social, legal and financial risks for the sake of such experiences (Zuckerman, 2009). A large body of research demonstrates that differences in temperament, and sensation seeking in particular, have a biological (i.e., genetic, neurochemical and psychophysiological) basis (e.g., Campbell et al., 2010; Strelau, 2010). However, there is little research on the possible *social* determinants of this trait. We believe that knowledge of the environmental influences and mechanism involved is necessary for developing of a truly *bio-social* theory of sensation seeking. The present study contributes to this knowledge by examining the influence of one central aspect of the social environment: the family. Specifically, we focus on the relationship between young adults' retrospective reports of the child-rearing behaviors of their parents, and their own sensation seeking scores.

Sensation seeking

Zuckerman (1994, 2009) provides concise summaries of the studies that have demonstrated the relevance of sensation seeking in the areas of clinical, social and vocational psychology. Commonly used measures of this

trait, such as the several forms of the Sensation Seeking Scales (Zuckerman, 2007) include four sub-dimensions: thrill and adventure seeking, experience seeking, disinhibition and boredom susceptibility. Previous research in the field of vocational psychology showed that the latter two dimensions were particularly predictive of people's vocational and work career (T. Taris & Feij, 1999; Van Vianen, Feij, Krausz & R. Taris, 2003). Therefore, in this study we focus on disinhibition and boredom susceptibility.

Measures of disinhibition describe sensation seeking through social activities like parties, social drinking and sex. Boredom susceptibility represents an intolerance for repetitive experiences of any kind, including routine work and boring people (Zuckerman, 2009). Netter (2004) suggested that disinhibition and boredom susceptibility might be related to biologically based impulsive disorders. She found that both dimensions showed an affinity to disturbances in the serotonergic system. Helmers, Young and Pihl (1995) factor-analyzed the correlations among a number of self-report measures of impulsivity and sensation seeking. They found that boredom susceptibility and disinhibition loaded on the same factor ("Enjoyment of Experiences") as measures of psychopathy and risk taking. Koopmans, Boomsma, Heath and Van Doornen (1995) found relatively high correlations between disinhibition and boredom susceptibility ($r = .41$ in males, $r = .46$ in females). These phenotypic correlations were mainly induced by correlated genetic factors and, to a smaller extent, by correlated unique environmental factors.

Koopmans et al.'s (1995) work as well as other studies (e.g., Fulker, Eysenck & Zuckerman, 1994; Stoel, De Geus & Boomsma, 2006) demonstrate that differences in

sensation seeking have a considerable genetic basis (reported heritability coefficients vary from .40 to .60). Fulker et al. (1980) found no influence of shared environment on sensation seeking. However, Zuckerman (1994) pointed out that a lack of influence of a shared environment does not mean that the family environment cannot have specific effects on siblings in the same family. The next section discusses some of the main findings regarding the relationship between family factors and sensation seeking.

Family factors

The literature on temperament suggests that one of the essential functions of parental behavior is the administration of an adequate level of stimulation to their children. Exposure to novel social situations is a relevant socializing factor (Goldsmith, 1989). The outcome of the level of parental stimulation on adult sensation seeking may depend on the interaction of early levels of stimulation and the infant's innate reactivity to stimulation. Zuckerman (1994) suggested that fearful, overprotective parents may discourage exploration and make a child fearful of novel situations where outcomes are not predictable. Other parents may encourage a child's natural exploratory tendencies and avoid instilling fear more than is necessary. The study of the relationships between the family environment and sensation seeking is very complex due to assortative mating, parent-offspring similarity, influences of non-shared environment and genetic-environmental correlations (Bratko & Butkovic, 2003). Nevertheless, there is some empirical evidence on the relationship between sensation seeking and several family characteristics: birth order and family size, parenting styles and related biographical factors such as parents' socioeconomic status and religious affiliation.

Birth order and family size

Many authors have studied the relationships of birth order and family size with differences in attitudes, lifestyles, career choices and personality (e.g., Crozier & Birdsey, 2003; Sulloway, 2007; Wagner, Schubert & Schubert, 1984). In the sizeable field of sibling constellation effects, the sensation seeking trait is relatively underresearched.

Feij (1979) explored the relationship between the scores on a general sensation seeking scale, family size and birth order in a sample of 494 first year university students. He found a small but significant tendency for students from larger families to be higher in sensation seeking than students from smaller families ($\rho = .09, p < .05$). This finding may be explained by the tendency of parents to spend more time with firstborns (before subsequent births) and stimulate firstborns and only children more than later borns (Zuckerman, 1994). Early and exclusive parental stimulation could influence later development of sensation seeking. Further, Feij (1979) found an association between the percentage of students who considered themselves as having been brought up strictly and family size: this percentage increased with the number of siblings. The highest percentages were found for first- and second-borns from the larger families. These results support Wagner, Schubert and Schubert's (1979) conclusion that children from larger families accept more risk than children from smaller families. Large families may influence the development of the sensation seeking tendency by

providing a greater amount of social interaction and stimulus variation. Further, a strict way of upbringing, which seemed to be associated positively with family size, may stimulate independence and rejection of conventional norms and authorities -- a characteristic of sensation seekers. The high percentage of participants who were brought up strictly in the group of firstborns from large families may partially explain the higher sensation seeking scores of firstborns and only children.

Parental behavior

The relationship between youngsters' perceptions of the way they have been brought up and their sensation seeking scores was replicated in a sample of over 1000 pupils between 13 and 17 years of age (Feij & Kuiper, 1984). The participants in their study completed the Adolescent Temperament Questionnaire, which measures, among others, two aspects of sensation seeking: thrill and adventure seeking, and a cluster of disinhibition and experience seeking. Feij and Kuiper (1984) found that those who endorsed the statement "I was brought up rather strictly" ($N = 187$) had higher scores on the "disinhibition/experience seeking" component of sensation seeking than children who did not ($N = 838, t = 1.78, p < .05$ (one-tailed)). This difference was significant for girls ($t = 2.29, df = 504, p < .05$), but not for boys ($t = 0.11, df = 517, ns$). No differences on the "thrill and adventure" subtrait were found.

Summarizing this previous work, results clearly indicate that sensation seeking is related to young people's perception of the way they have been brought up. This relationship seems to be complicated by effects of sex, birth order and family size. These factors are mutually related as well as related to parental behavior. For example, parents are younger and generally more uncertain and anxious about parenting when raising their first child, and these uncertainties influence their treatment of the child. Moreover, parents may be more restrictive with and demand more responsible behavior from the oldest child (Cloninger, 1996).

Kraft and Zuckerman (1999) compared the perceptions of mothers and fathers by their children in intact families and step-parent families, and the relationships between these descriptions of parenting and personality traits of the children in a sample of college students. In a subsample of girls from stepfather families, they found a significant positive correlation ($r = .35, p < .01$) between impulsive sensation seeking and mother control/overprotection, measured by, respectively, the Zuckerman-Kuhlman Personality Questionnaire (Zuckerman, Kuhlman, Joireman, Teta, & Kraft, 1993) and a short form of the EMBU (Egna Minnen av Barndoms Uppfostran; Perris, Jacobsson, Lindström, Von Knorring & Perris, 1980). This correlation was positive but not significant among boys from stepfather families ($r = .16, ns$), and near zero for boys and girls from intact families. Data for stepmother families were not presented, because of a too small N . The EMBU-scale Mother love showed a significant correlation with impulsive sensation seeking in the total stepfather subsample ($r = -.21, p < .05$). However, this correlation was neither significant for male and female participants separately, nor for participants from intact families.

Although these results are not unequivocal, the results of some of the following studies also suggest a relationship between parenting behavior and youths' sensation seeking

or behavioral correlates thereof. For example, Barnes, Barnes and Marshall (2005) demonstrated the importance of the family environment in predicting offspring substance use and problem behaviors in both biological and adoptive families. Parenting behaviors were assessed by having each family member complete the Parental Bonding Instrument (PBI; Parker, Tupling & Brown, 1979) which measures parental overprotection (e.g., control and prevention of independent behavior) and parental care (affection, closeness and related behaviors). Especially parental care seemed to play an important role in predicting offspring substance use and problem behaviors. The higher the level of care provided by both parents, the lower the likelihood that the youth would smoke, drink heavily, have alcohol problems, use drugs, or engage in acting-out behaviors. Similar findings were reported by Burlew et al. (2009) and Gerra et al. (2004). Barnes et al. (2005) suggest that parents' use of coercive behaviors (such as yelling at the youth when they disobey) is not an effective strategy. This type of parenting behavior was found to be associated with youths' acting-out behaviors (more likely to lie, steal, or hurt other people). Furthermore, parents' use of behaviors that protect youth too much and do not allow them to grow into adults was found to be associated with youths' alcohol consumption. That is, the more the youth is over-protected, the more likely it will be that they will engage in heavy drinking.

Schlette, Brandström, Eisemann, Sigvardsson, Nylander, et al. (1998) found a significant association ($r = .19, p < .05$) between perceived fathers' overprotection (measured by the EMBU) and novelty seeking (as measured by the Temperament and Character Inventory; Cloninger, Przybeck & Svrakic, 1991) among 132 healthy adults. The correlation between these variables was significant in women ($r = .33, p < .01$), but not in men.

Whereas all the research summarized up to here focused on parental rearing behaviors as *perceived* and retrospectively reported by the children participating in the respective studies, a study by Bratko and Butkovic (2003) related parent's self-ratings of their child-rearing behaviors to the scores of their children on the Croatian translation of the SSS-Form V. Two aspects of parental behavior -- parental affection and control -- were measured by the Parental Behavior Scale (PBS), which was constructed for the purpose of the research. Both self-estimates and partner-estimate of the parental behaviors were obtained. Bratko and Butković found that partner estimates of Fathers' control were significantly correlated with children's scores on disinhibition ($r = .30, p < .05$) and general SSS ($r = .26, p < .05$). Due to the scoring of the PBS, these correlations mean that low Fathers' control is related to higher levels of sensation seeking. Partners' average estimate of Fathers' control showed a significant negative relation to general SSS ($r = .24, p < .05$). These results thus contradict the results obtained in the retrospective research mentioned earlier on.

There are several reasons why family factors such as birth order, family size and parenting styles may be causally related to children's sensation seeking behavior. First, the prenatal biological environment might be a causal factor. Orlebeke, Knol, Boomsma and Verhulst (1998) found a significant linear effect for maternal age on externalizing behavior problems in twins. It appeared that aggressive, oppositional and overactive behavior decreased with increasing maternal age. This was true for boys and girls as well as for first and second born twins. One of the explanations given by the authors is that testosterone levels

are higher in younger mothers. Following this line of reasoning, firstborns have on average younger mothers and are exposed to higher levels of testosterone during pregnancy, which may lead to impulsive sensation seeking behavior when the child grows up.

Second, the psychological environment may be a causal factor. According to Zuckerman's (1994) early stimulation hypothesis, parents behavior may influence the level of sensation seeking of their children. Parents spend relatively more time and attention to their firstborns or only children which may stimulate exploratory behavior and lead to a high sensation seeking tendency. Large families in general provide much stimulation for later-born children. However, this theory yields no unequivocal predictions. For example, much parental care could stimulate sensation seeking behavior, but the results of the studies discussed above suggest the opposite. Similarly, parental coercion and overprotection could discourage exploration tendencies and lead to low sensation seeking in the child; again, empirical data suggest the opposite relationship.

A third causal mechanism for a relationship between family factors and sensation seeking is interactionistic. Parents may react to the biologically based level of sensation seeking manifested in their children's behavior. For example, high sensation seeking in children may evoke the use of coercive parenting behavior. Conversely, the child may react to the child-rearing behavior of the parents. The use of coercion and overprotection may lead to rebelliousness and sensation seeking in the children. These mechanisms are examples of gene-environment correlation delineated by Plomin, DeFries and Loehlin (1977; cf. Goldsmith, 1989).

Finally, it should be noted that attribution and biased recall may explain some of the retrospective findings. For example, high sensation seekers might have experienced the rearing style of their parents as particularly restrictive.

Theory and empirical findings may be further complicated by two relevant aspects of the family environment: socio-economic status and religious affiliation. Both factors may influence parenting styles as well as sensation seeking behavior of children. Religious affiliation may have a profound influence upon the attitudes and values and child-rearing behaviors of parents. Interestingly, Boomsma, De Geus, Van Baal and Koopmans (1999) reported that persons with a religious upbringing, who are currently religious and who engage in church activities score lower on the scales of the Sensation Seeking Questionnaire. The most pronounced effect was on the disinhibition-scale. Boomsma et al. (1999) also found that the resemblances between twins for the disinhibition-scale differed according to their religious upbringing. Receiving a religious upbringing seemed to reduce the influence of genetic factors on Disinhibition, especially in males.

Apart from religiosity, the family's socio-economic status may have a far-reaching influence on the family composition, parenting styles and values and interests of the parents and their children. Consequently, SES may influence the development of the specific ways the sensation seeking tendency is expressed in behavior. In the middle- or upper-class environments, there is a greater range of sensation-seeking possibilities available in sports, cars and travel, whereas possibilities in the lower-class environments may be limited to sex, drugs, gambling and crime (Zuckerman, 1994, p. 383).

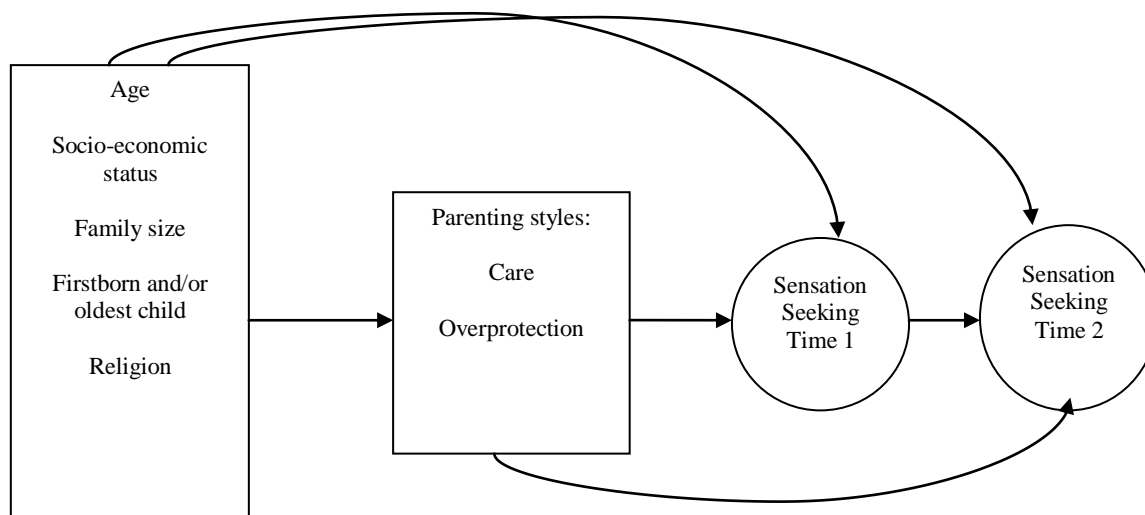


Figure 1. A heuristic model for the associations among family factors, parenting styles and sensation seeking

The present study

In this study, the model presented in Figure 1 is tested. The factors that appear relevant for the development of differences in impulsive sensation seeking are integrated in this model. The main assumption is that a relationship of family size and birth order with sensation seeking is mediated by parenting styles, i.e., the degree of care and overprotection by the parents.

Parents SES and religious affiliation, as well as children's (i.e., respondents) age and gender are included as control variables in the model. It is a well-documented finding that sensation seeking decreases with age, and also that men and women differ in the average level of sensation seeking (Zuckerman, 2009). Indeed, parenting behaviors toward boys and girls may well be different, meaning that it is important to control for these factors.

Furthermore, the replicability of the relationships across time is tested by including two assessments of sensation seeking, separated by a four-year interval, in the model. The longitudinal design further allows for a stronger test of possible causal relations among the concepts in this study than would be possible when using a cross-sectional design (Menard, 2008).

Based on the findings and theory discussed above, we hypothesize that sensation seeking is positively related to reported parental overprotection (Hypothesis 1), and negatively related to parental care (Hypothesis 2). Furthermore, we expect that sensation seeking scores are: on average higher for males than for females (Hypothesis 3), negatively related to respondent age (Hypothesis 4), and positively related to SES of respondent's family of origin (Hypothesis 5).

Firstborns and only children are expected to be at risk of a high amount of parental overprotection compared to later-borns (Hypothesis 6); regarding the amount of parental care experienced by firstborns/only children no explicit hypothesis seems justified. Respondents from larger families may have experienced relatively little parental attention and care; a negative association between family size and care is therefore expected (Hypothesis 7).

With respect to the religious affiliation of respondents parents no specific predictions are made. Strict religious attitudes may be related to loving and caring behavior as well as (perceived) coercion and over-protections.

Method

Procedure and sample

The data were collected in a two-wave panel study. The first wave was conducted at time 1 (T1) among a representative sample of 1775 Dutch young adults, evenly divided over three birth cohorts (1961, 1965 and 1969), and gender. All participants completed a self-report questionnaire measuring personality and background variables. Additionally, the participants were interviewed in their homes by trained interviewers using a structured interview schedule addressing attitudes, opinions and behavior with respect to several life domains (i.e., family, education and employment). An almost exact replication of the first wave was conducted four years later at time 2 (T2). About 70% of the participants ($N = 1257$) participated in this second wave as well. Nonresponse analyses revealed that higher-educated were slightly overrepresented in the sample. With respect to other variables (e.g. socio-economic status) no differences were found. After listwise deletion of missing values, the final sample was 532 females and 479 males.

Measures

Sensation seeking. Two dimensions of the sensation seeking construct (Zuckerman, 1994) were included in this study. The first was a six-item *Disinhibition* scale, with typical items being "I feel good after a couple of drinks", "sometimes I need to act out", and "I like wild parties". The second scale was a six-item *boredom susceptibility* scale, including items such as "I lose interest quickly if people or things around me remain the same", "Uncommon events provide me with the excitement I need", and "I would like to have a job that requires traveling around the world". Both dimensions were measured by a Dutch adaptation of Zuckerman's sensation seeking scale (Van den Berg & Feij, 2002). All items in these scales employed a seven-point response format (1 = "strongly disagree", 7 = "strongly agree"). The reliabilities (Cronbach's alpha) of these scales on the two respective waves were .78 and .82 for the disinhibition scale, and .68 and .70 for the boredom susceptibility scale. For both theoretical and empirical reasons (the correlation between the subscales was .48 at T1 and .49 at T2, $p < .01$; see Table 2), the scores on these scales were used as indicators of a latent trait "Sensation Seeking".

Parenting styles of father and mother; parents' religious affiliation. The degree to which the participant's (step)father and (step)mother provided a *warm, caring and loving upbringing* was assessed retrospectively by asking the participants to look back upon the first sixteen years of their lives, and to judge their family situation as it was then. Specifically, they had to provide answers to three items of the Parental Bonding Instrument (PBI; Parker, Tupling & Brown, 1979). These items represented Parker et al.'s "care" dimension, with items being "appeared to understand my problems and worries", "was affectionate to me", and "did not understand what I needed or wanted" (reverse scoring) (with scores between 1 "false" and 4 "true"). All three items had to be judged for father and mother separately, yielding two three-item scales. Despite the small number of items the reliability (alpha) of these two scales was acceptable, with .73 for the mother's behaviors and .61 for the father's behaviors. These scales were combined in a single latent construct, which is in the remainder referred to as (parental) *Care*. The degree to which the participant's father and mother used *control, strict rules and coercion* was measured in a similar

fashion. Three items of the PBI were used: "encroached upon my private life", "tried to make me dependent on them", and "was exaggerated concerned for me"; the alpha's of the scales were moderate: .58 for the mother's behaviors and .55 for the father's behaviors. These scales were also combined in a single latent construct (*Overprotection*).

Respondents' ratings of the *religious affiliation* of their (step)parents was obtained by a single-item measure: "How important did your parents find matters regarding religion or church?" (1 = "very unimportant" to 5 = "very important").

Biographical information. Besides age and gender, socio-economic status (SES) of the participant's family of origin was measured. Three indices were used to measure SES: the highest level of education completed by participant's father and mother, respectively, and the level of the job of the father; SES scores ranged from 1 (low) to 9 (high). The Cronbach's alpha of this composite SES scale was .68. Furthermore, information was available about the size of respondent's family of origin (number of siblings) and whether respondents were first-born or only child.

Results

Table 1. Means and standard deviations for males (N = 479) and females (N = 532); intercorrelations for the total sample

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
1. Disinhibition T2	1.00												
2. Boredom susceptibility T2	.49	1.00											
3. Disinhibition T1	.68	.35	1.00										
4. Boredom susceptibility T1	.35	.61	.48	1.00									
5. Mother care	-.12	-.13	-.11	-.08	1.00								
6. Father care	-.09	-.11	-.05	-.08	.70	1.00							
7. Mother overprotection	.09	.09	.10	.11	-.39	-.30	1.00						
8. Father overprotection	.10	.11	.09	.06	-.30	-.29	.82	1.00					
9. Age T1	-.16	-.20	-.20	-.20	-.08	-.10	.07	.04	1.00				
10. Socio-economic status	.08	.21	.08	.22	.01	.05	-.03	-.08	-.16	1.00			
11. Family size	-.01	-.10	-.01	-.11	-.10	-.09	.04	.09	.25	-.12	1.00		
12. Firstborn child	.00	.01	.00	.00	-.10	.06	.10	.12	-.06	.01	-.12	1.00	
13. Religion parents	-.06	-.05	-.05	-.06	.04	.07	.04	.08	-.10	.04	.26	-.09	1.00
14. Gender (high = male)	.23	.23	.13	.15	-.02	.01	.01	-.02	.02	.04	.01	-.01	.06
Females M	4.07	3.82	4.26	4.06	3.49	3.31	1.81	1.71	22.00	3.65	2.31	0.38	3.08
SD	1.26	1.13	1.21	1.18	0.59	0.70	0.68	0.65	3.25	1.82	1.84	0.49	1.35
Males M	4.65	4.35	4.57	4.40	3.47	3.32	1.82	1.68	21.84	3.78	2.33	0.37	3.24
SD	1.19	1.05	1.22	1.04	0.56	0.65	0.66	0.60	3.33	1.79	1.71	0.48	1.39
F(1,1009)	56.4*	58.7*	16.3*	23.0*	ns	ns	ns	ns	ns	ns	ns	ns	ns

Note. * $p < .001$; correlations of .06 and higher significant at $p < .05$. T1 = Time 1, T2 = Time 2.

Table 1 presents the means and standard deviations of all variables used in this study. A multivariate *F*-test revealed that there were strong gender differences with respect to the four indicators of sensation seeking, $F(13,997) = 7.34, p < .001$. Inspection of the univariate results showed that at both occasions, males obtained higher scores on boredom susceptibility and Disinhibition

than females. In all other respects, the average scores of males and females did not differ significantly.

Intercorrelations between all measures are presented in Table 2. As expected, significant positive correlations among the sensation-seeking scales, and negative correlations between the parental care and overprotection scales were found.

Table 2. Standardized maximum likelihood-estimates for the final model.

Variables	Sensation seeking T2 ^a	Sensation seeking T1 ^a	Parental care ^b	Parental protection ^c
Sensation seeking T1 ^a	.68***			
Parental care ^b	-.08**	-.08*		
Parental overprotection ^b		.09**		
SES		.22***		
Family size				-.08**
Firstborn child			-.06*	
Religion parents		-.11***	.09	
Age	-.08**	-.17***		
Gender	.18***	.18***		
<i>R</i> ²	.60	.14	.03	.01

* $p < .05$, ** $p < .01$, *** $p < .001$.

^a Standardized loadings: Disinhibition .54 (fixed for identification purposes); Boredom susceptibility .92 ($p < .001$), constrained to be equal across time.

^b Standardized loadings: Mother care .95 (fixed for identification purposes); Father care .77 ($p < .001$).

^c Standardized loadings; mother protection .92 (fixed for identification purposes); Father protection .85 ($p < .001$).

Specification and fitting of the model

The model presented in Figure 1 was estimated using structural equation modeling (Jöreskog & Sörbom, 2008). Model fit was assessed using the standard chi-square test, as well as the Root Mean Squared Residual (RMR), Non-Normed Fit Index (NNFI), and the Relative Fit Index (RFI). Values of .08 and lower (for RMR) and .90 and higher (for RFI and NNFI) indicate an acceptable fit (Byrne, 2009).

In a preliminary analysis we tested whether the variance-covariance matrix differed as a function of gender, effectively testing possible moderator effects of this variable. This analysis yielded a chi-square value ($N = 1,011$, $df = 105$) of 162.85, $RMR = .058$, $NNFI = .98$, $RFI = .94$. These values indicate that there was no reason to assume that gender moderated the effects between the dependent and the independent variables.

Then we estimated the model presented in Figure 1 for the pooled sample. Gender was included among the cluster of independent (exogenous) variables. Preliminary confirmatory factor analyses had already revealed that the measurement models of Sensation Seeking at time one and time two could be considered identical at both occasions. Thus, the loadings of Disinhibition and boredom susceptibility on the measures of Sensation seeking were held constant across both occasions. This model fitted the data poorly, chi-square ($N = 1,011$, $df = 40$) was 594.52, $RMR = .040$, $NNFI = .69$, $RFI = .67$. Inspection of the modification indices revealed that the model did not account well for the correlation between Disinhibition as measured at time one and time two. Thus, a correlation between the errors of these two scales was introduced, leading to a satisfactory fit; chi-square ($N = 1,011$, $df = 39$) was 197.88, $RMR = .030$, $NNFI = .91$, $RFI = .89$. Examination of the results indicated that several effects were not significantly different from zero; these were omitted from the model. The final model yielded a chi-square value ($N = 1,011$, $df = 52$) of 203.12, $RMR = .031$, $NNFI = .94$, $RFI = .92$. Table 3 presents the standardized maximum likelihood estimates for this model.

As Table 3 reveals, there was considerable across-time stability of Sensation Seeking (a standardized effect of .68, $p < .001$). Thus, participants who were high on Sensation Seeking at time one were often also high on Sensation Seeking at time two. The hypothesis that

perceived parenting styles would influence sensation seeking was supported by a lagged effect of Care on Sensation Seeking at time two (respondents whose parents provided a warm and loving upbringing were less likely to be sensation seekers at time two, a small effect of $-.08$, $p < .05$), and by cross-sectional effects of both Overprotection ($.09$, $p < .01$; participants who judged their upbringing as overprotective were more likely to be high on Sensation Seeking) and Care ($-.08$, $p < .05$; again, a warm and loving upbringing was associated with a low score on Sensation Seeking).

Further, family factors were indeed of importance in determining the participants' judgments of the type of upbringing they received during the first sixteen years of their lives. There was a negative effect of Family size on Parental Protection ($-.08$, $p < .01$); the larger the number of siblings in one's family, the less the participants felt that their parents had been overprotective of them. Further, respondents who were a firstborn or only child were less likely to report that their parents provided a warm and loving upbringing ($-.06$, $p < .01$). Participants whose parents attached much importance to religion were somewhat more likely to have experienced a warm and loving upbringing (a small effect of $.09$, $p < .01$), and less likely to be sensation seekers ($-.11$, $p < .001$). Finally, whereas we found a direct effect of SES on Sensation Seeking at time one ($.22$, $p < .001$), SES did not affect perceived parenting styles.

As regards gender and age, at both occasions we found that males were more likely to obtain high scores on sensation seeking than females (effects of $.16$ at time one, and $.17$ at time two, $ps < .01$). Age affected all four dependent variables. Further, at both occasions there was a significant negative effect of Age on Sensation Seeking (effects of $-.17$ at time one, and $-.08$ at time two, $ps < .01$); participants were less likely to be sensation seekers as they became older.

As Table 3 reveals, the proportion of variance explained by the independent variables is generally small. This applies especially to the two parenting styles (R^2 s were 1% for Overprotection and 3% for Care). Fourteen percent for Time one Sensation Seeking might be considered acceptable. The high proportion of explained variance in Time two Sensation Seeking is, of course, largely due to the strong lagged effect of Time one Sensation Seeking.

Discussion

The present study found that characteristics of the family environment had no direct effects on sensation seeking. Rather, their influence appeared to be mediated by parenting styles, which is consistent with our basic assumption. The only exception was for SES, which was directly related to respondent's level of sensation seeking: the higher the socio-economic status of the parental home, the higher the sensation seeking scores of the offspring were. This result confirms Hypothesis 5.

The two hypotheses stating that sensation seeking is related to perceived parenting behavior were supported: a positive relationship with overprotection (Hypothesis 1) and a negative relationship with parental care (Hypothesis 2) were found. The hypotheses which predicted a relationship between sensation seeking scores and sex and age (Hypothesis 3 and Hypothesis 4) were also confirmed. The latter findings have been frequently reported, underscoring the validity of the results of our study.

Compared to later-borns, firstborn or only children were less likely to report that their parents had provided a warm and loving way of upbringing. On the contrary, they were more likely to report that their parents were over-protective, restricting and coercive, as predicted by Hypothesis 6. In agreement with Hypothesis 7, respondents from the smaller families reported to have received more parental care than those who were raised in larger families. However, family size was not related to the reported degree of parental overprotection.

Whereas SES did not affect perceived parenting styles, the religious affiliation of the parents has a small effect on the reported level of parental care. A strong religious affiliation was directly related to a relatively high level of parental care and, indirectly, to low sensation seeking. No relationship between religion of the parents and over-protective child-raising behavior was found.

Overall, our study clearly shows that characteristics of the family environment have an indirect effect, and parenting behaviors have a direct effect on reported impulsive sensation seeking. To our best knowledge, this is the first study in which the most important variables in the family environment are simultaneously related to differences in sensation seeking in a representative sample of young adults. Although SEM yielded a reasonable fit between our model and the data, the explained amount of variance in sensation seeking is rather small: 14% explained variance in Time one a sensation seeking scores.

The fact that the predictive power of the two parenting styles is small should not be surprising, given the complexity of the subject and the proximate character of the operationalizations of many of the variables used in this study. Further research into the genetic as well as the social dynamics behind the relationships between family environmental factors and personality characteristics is necessary. Regarding the nature of the family environment, Goldsmith (1989) concluded: "The bulk of current evidence in the personality domain implies that non-shared environmental factors account for greater observed variance than shared factors" (p. 122). Parents' socio-economic status and their religious affiliation can probably be construed as shared environment. Family size, on the other hand, likely represents a non-shared environmental variable, especially for the first-born children. Regarding parenting styles, our study shows that these are differently perceived by first-born/only children and later-borns.

Interestingly, Rowe (1983) found that adolescent identical twins were more similar than fraternal twins in their perception of parental emotional warmth. According to Goldsmith (1989), this implies genetic influence on perception of a parenting variable that might affect temperamental development. Perception of another variable, degree of control, showed no genetic underpinnings in Rowe's (1983) study.

Study limitations. In spite of its longitudinal design, the problem of the causality of the relationship between parental behavior and children's personality remains largely unsolved in this study. It is tempting to conclude that the lagged effect of parental care on Time 2 sensation seeking reported in this study means that parental rearing styles affect children's personality causally. However, it should be noted that all data were obtained from a single source, and that in the case of parental care we are dealing with retrospectively collected data. That is, the findings presented here are consistent with at least three possible mechanisms that might have generated the association between parental child rearing behavior and sensation seeking. First, a strict and cold style of child-raising may *produce* sensation seekers (as assumed in the present study). Second, sensation seekers *perceive* their parental home as restrictive and cold (i.e., there is not necessarily a relationship between "objective" parental child rearing practices and sensation seeking). And third, *both* explanations for the longitudinal associations between parental behavior and sensation seeking might apply. As stated in the introductory section, there may be complex interactions between the actual parenting styles, the parenting behaviors as perceived, remembered and reported by children, and children's partially inherited personality characteristics. Relevant to this issue, it should be noted that previous research usually reported moderate positive correlations between parents' reports of their child-rearing styles and their children's perceptions thereof (e.g., Taris & Semin, 1997), suggesting that "objective" parental rearing styles indeed affect the development of their children's personality. Thus, it is unlikely that sensation seekers only *perceive* the parenting styles of their parents as cold and strict. Direct evidence for the link between parental rearing styles and personality development may be obtained by including parents' self-reports of their rearing-behaviors, as was done by Bratko and Butković (2003), and take the correlations between these self-reports and siblings reports of parenting behavior into consideration. Finally, additional evidence on the inheritability of sensation seeking may be obtained by examining the effects of parental sensation seeking and other demographic variables like parents age.

A final limitation of this study that should be mentioned is that our conclusions are based on just two aspects of the sensation seeking trait: boredom susceptibility and disinhibition. As a consequence of the broader context in which this study was conducted - a large scale investigation of social integration and career transitions of young adults - the space available for inclusion of personality measures in the research instruments was very limited. We believe that boredom susceptibility and disinhibition are relevant traits for our purposes, and that their combination into one latent trait, sensation seeking, is warranted. Nevertheless, future research should extend the model tested in this study to all four SS-dimensions.

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