Longitudinal Associations of Explosive and Adventurous Temperament Profiles With Character Development:
The Modifying Effects of Social Support and Attachment

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ABSTRACT

Objective: The aim of this study was to examine (*a*) whether adventurous and explosive temperament profiles (presumed precursors of antisocial and borderline personality) are associated with character traits over a 15-year follow-up and (*b*) whether social support and attachment security modify the relationship between temperament profiles and character development.

Methods: 2,028 subjects of the Young Finns study completed the Temperament and Character Inventory, the Multidimensional Scale of Perceived Social Support, and the Relationship Questionnaire at 3 assessment points between 1997 and 2012.

Results: Both explosive and adventurous temperament profiles seemed to predispose individuals to have less mature personalities; that is, these profiles were consistently associated with lower cooperativeness ($P < .001$), and explosive temperament also with lower self-directedness ($P < .001$), over the entire follow-up period. These relationships did not vary significantly at the individual level and were sustained after controlling for age, gender, and socioeconomic status. However, the presence of high social support and secure attachment was found to decrease the likelihood that explosive temperament would lead to an immature adulthood character ($P < .001$). In contrast, persons with the adventurous temperament were likely to have a more mature character under low social support and an immature one under high experienced social support ($P < .05$).

Conclusions: Individuals with the explosive temperament benefit from high social support and secure attachment. From the point of view of the therapy process, this knowledge might be of importance. In contrast, individuals with the adventurous temperament were able to direct their behavior better in social environments that were not likely to support their basic temperaments.

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It has been shown that temperament profiles with extreme or conflicting variants of temperament dimensions are likely to lead to later maladaptive personality development, even to psychopathology.[1–3] This is especially highlighted in the psychobiological model of personality,[2] which identifies 2 temperament profiles with an especially high risk for unfavorable development. One is the explosive temperament profile consisting of high novelty seeking (the tendency to be impulsive and to explore novel and exciting stimuli and risk-prone experiences), low reward dependence (the need for attachment and others' approval, sensitivity to others' socioemotional cues, and emotional warmth toward other people), and high harm avoidance (the tendency to fear uncertain situations and experience anticipatory worry and emotional distress and the need for routines and security). The other is the adventurous temperament profile consisting of high novelty seeking and low reward dependence but, contrary to the explosive profile, low harm avoidance.[2] Previous cross-sectional research has suggested a correlation between the explosive temperament and borderline personality disorder and between the adventurous temperament and antisocial personality disorder.[3–6]

Developmental risks associated with explosive and adventurous temperament profiles are, however, modulated by the level of the maturity of personality; any temperament profile can be associated with either a healthy (mature) character or with an unhealthy (immature) character. Maturity of character is, in turn, defined by level 2 characteristics: self-directedness, which refers to responsibility, purposefulness, and resourcefulness in stressful situations and a disciplined style of behaving, and cooperativeness, which refers to empathic and helpful behavior toward other people and the will to act according to ethical principles.[7] When associated with mature character, ie, high self-directedness and high cooperativeness, adventurers might be responsible explorers or scientists, and people with explosive tendencies learn to self-regulate these emotional predispositions in mature ways. When associated with immature character—that is, low self-directedness and low cooperativeness—adventurous temperament may

Clinical Points

- Evidence has been lacking for how explosive and adventurous temperaments (presumed precursors of borderline and antisocial personality disorders) associate with character development.
- In individuals with explosive temperament, the heightened risk for immature character can be ameliorated by social support and secure attachment.
- Adventurous temperament is associated with higher self-directedness in unsupportive social environments, which argues for adaptive theories of antisocial behavior.

predispose to antisocial personality disorder, and explosive temperament, to borderline personality disorder.[4,6,8,9]

The likelihood of explosive and adventurous temperaments leading to an immature character, that is, low self-directedness and low cooperativeness is, however, well documented. It has been found in some samples that as many as 72% of people with explosive temperament are in the bottom third of the general population with regard to character maturity.[2] The evidence of the association between temperament and character traits is based on single-trait correlations and cross-sectional designs.[10–13] No longitudinal study has measured multitrait profiles, even though it is these profiles that have specific theoretical meaning in terms of adverse personality development,[8] and it is not known how consistently adventurous and explosive temperaments are associated with character traits over years.

Furthermore, no study has examined psychosocial factors that could ameliorate unfavorable character development in people with a particular temperament profile. Temperament traits are moderately stable from an early age, but character traits develop substantially between ages 20 and 35 years.[14] One salient factor often found to be associated with favorable changes in personality development is social support. Higher social support has been shown to decrease antisocial features during adolescence or adulthood.[15] In terms of temperament and character, lower perceived social support has been shown to correlate with higher novelty seeking and lower reward dependence as well as with lower self-directedness and lower cooperativeness.[16–18] Hence, it might be suggested that high social support could help individuals with explosive or adventurous temperaments to reach the average level of self-directedness and cooperativeness. However, evidence for this is still lacking.

Attachment style is shown to largely influence adulthood social relationships and perception of social support.[19,20] Insecure attachment is shown to be associated with immature personality,[21] borderline personality disorder,[22] development of borderline traits,[23] and the most severe features of antisocial personality.[24] Correlations of insecure attachment with both higher novelty seeking and lower reward dependence and with lower self-directedness and lower cooperativeness have also been found.[25,26] Thus, the consequences of insecure attachment have been studied, but not the question as to whether secure attachment could help individuals with the explosive or adventurous temperament to develop a more mature character.

In the present study, we examined (*a*) whether adventurous and explosive temperament profiles are associated with character traits continuously over a 15-year follow-up with several measurement points and (*b*) whether social support and attachment security modify the relationship between temperament profiles and character development. We used a data set that provided unique possibilities for examining between- and within-individual variation in the development of character and in the effects of temperament profiles while simultaneously controlling for a variety of psychosocial factors. On the basis of previous studies,[6,8] we hypothesized that adventurous and explosive temperament as such are associated with self-directedness and lower cooperativeness, but high social support and secure attachment ameliorate the risk of the adventurous or explosive temperament leading to an immature character.

METHODS

Participants

This study used data from the Young Finns Study, which began in 1980. Participants were selected from the population register, and the original sample consisted of 3,596 individuals from 6 age cohorts (born in 1962, 1965, 1968, 1971, 1974, and 1977). The investigation was carried out in accordance with the latest version of the Declaration of Helsinki, and the study design was reviewed by the Finnish Advisory Board on Research Integrity. All participants provided informed consent before participation. For this study, parental socioeconomic status was measured in 1980; temperament, in 1997, 2001, and 2007; character, in 1997, 2001, and 2012; participants' socioeconomic status, in 2001 and 2007; social support, in 1997, 2001, and 2007; and attachment, in 2001, 2007, and 2012. The sampling and design of the Young Finns Study are described in further detail elsewhere.[27]

We included in the analyses all participants who had full data for their temperament and character traits, their own and parental socioeconomic status, social support, and attachment in at least 1 of the measurement years. The remaining data consisted of 2,028 participants, 1,173 (57.8%) women and 855 (42.2%) men. The numbers of observations are shown in Supplementary eTable 1.

Measures

Temperament and Character Inventory. Temperament and character traits were measured using version 9 of the Temperament and Character Inventory (TCI), which includes 240 self-rating items.[28] The TCI temperament dimensions that we used included Novelty Seeking (40 items; Cronbach $\alpha = .85$), Harm Avoidance (35 items; $\alpha = .91$), and Reward Dependence (24 items; $\alpha = .80$), and the character dimensions included Self-Directedness (44 items; $\alpha = .91$) and Cooperativeness (42 items; $\alpha = .90$). Instead of the original true/false response scale, we used a 5-point Likert

scale ranging from 1 (completely disagree) to 5 (completely agree) in order to be able to make more subtle distinctions, as was also adopted in later versions of the TCI. The decision of which version of the scale to use was made in 1995, and the most recent version of TCI (TCI-R[29]) was published in 1999. We used the TCI also in the year 2001, 2007, and 2012 measurements to keep the results of different study waves comparable.

When temperament profiles were created, participants were classified as being high (above the median) or low (below the median) with regard to each dimension, as has also been done consistently in our previous studies.[17,30] In accordance with the psychobiological model, all participants who had high novelty seeking, low harm avoidance, and low reward dependence were classified as having the adventurous temperament profile.[2] Similarly, all participants with high novelty seeking, high harm avoidance, and low reward dependence were classified as having the explosive temperament profile.[2] The profiles were used to assign a binary temperament status (adventurous vs nonadventurous; explosive vs nonexplosive). This formulation prevents any overlap between adventurous and explosive temperaments, because these differ in whether a person is high or low in harm avoidance, whereas alternate symptom-based criteria result in an extensive overlap.

Psychosocial factors. Social support was measured using the Finnish version of the Multidimensional Scale of Perceived Social Support (MSPSS).[31,32] It consists of 12 self-rating items measuring perceived support from family (4 items; eg, "I can discuss my problems with my family"), friends (4 items, eg, "My friends really support me when I need help"), and a significant other (4 items; eg, "I have a significant other who comforts me"). All the items were answered with a 5-point Likert scale (1 = totally disagree, 5 = totally agree; internal consistency, $\alpha = .94$). Previous studies have indicated moderate to high internal consistency, test-retest reliability, and predictive validity for the Finnish version of MSPSS.[17,33,34]

Attachment style. Attachment style was measured using the Finnish version of the Relationship Questionnaire.[35] It consists of 4 statements, which are answered with a 7-point Likert scale (1 = totally disagree, 7 = totally agree). The statements measure 4 attachment styles: secure, preoccupied, dismissing, and fearful (eg, "I strive for relationships that are as close as possible, but others seem to avoid such closeness"). All items were scaled so that higher values referred to more secure attachment styles and summed together. Attachment security, social support, and character traits were standardized with the mean of 0 and standard deviation of 1. Previous studies have reported adequate predictive validity and high test-retest reliability during a 7-year follow-up for the Finnish version of the scale.[36,37]

Participants' and their parents' socioeconomic status. Socioeconomic status was measured using the number of educational years and occupational status. Participants' number of educational years ranged from 9 to 28, and their occupational status was classified with a 9-point Likert scale according to the year 2001 classification of the Center of Statistics in Finland.[38] In the analyses, we used the higher available value of occupational status between the years 2001 and 2007 and, consistently, the higher available number of educational years between the years 2001 and 2007. Parents' number of educational years ranged from 8 to 32, and their occupational status was measured with a 9-point Likert scale according to the year 1980 classification of the Center of Statistics in Finland.[39] Parents' educational years and occupational status were calculated if the information was available for at least 1 parent, and if they were available for both parents, we used their mean. Socioeconomic variables were added to the analyses as separate variables.

Statistical Analyses

Statistical analyses were conducted using IBM SPSS Statistics 23.0 (IBM Corp; Armonk, NY). We examined attrition by comparing the included and excluded participants with independent samples t tests and χ^2 tests of independence. We examined the relationship between temperament profiles, social support, attachment, and character traits with linear mixed models (LMMs) using restricted maximum likelihood estimation. LMMs can model dependencies between observations due to repeated measurements and examine simultaneously both between- and within-individual variation. In addition to classic ("fixed") regression effects, LMMs include random effects that estimate the between-individual variance (individual differences) in the fixed intercept and slopes.

In model 1, intercept, temperament profiles, gender, age, measurement time, and socioeconomic variables were set as fixed effects. Intercept and temperament profiles were also treated as random effects. In model 2, we added social support and attachment as both fixed and random effects to the model. In model 3, interactions between temperament profiles and social support and attachment were studied as fixed effects. Coefficients of determination were based on the Cox and Snell generalized R^2.[40]

RESULTS

Attrition Analysis

Men were more likely not to participate than women ($\chi^2_1 = 88.47$, $P < .001$). Nonparticipants had higher harm avoidance ($t_{2024} = 2.92$, $P = .004$), lower reward dependence ($t_{2023} = -2.99$, $P = .003$), lower cooperativeness ($t_{1981} = -2.59$, $P = .010$), and also lower self-directedness ($t_{1962} = -4.56$, $P < .001$). Additionally, nonparticipants had lower social support ($t_{2078} = -2.49$, $P = .013$), less secure attachment ($t_{2079} = -4.48$, $P < .001$), fewer educational years ($t_{2846} = -7.55$, $P < .001$), lower occupational status ($t_{2660} = -4.91$, $P < .001$), and lower parental occupational status ($t_{3502} = -2.47$, $P = .014$).

Descriptive Statistics

The means, standard deviations, and frequencies/prevalences of the study variables are listed in Table 1.

Table 1. Descriptive Statistics for the Variables Under Study

Variable	Female	Male	Test$_{df}$
Age, mean (SD), y	31.38 (4.95)	31.64 (5.00)	$t_{1549}=-0.86$
Gender, n (%)	1,173 (57.84)	855 (42.16)	
Years of education, mean (SD)	15.70 (3.32)	14.87 (3.44)	$t_{1549}=4.71$***
Occupational status, mean (SD)	6.25 (2.10)	5.94 (2.68)	$t_{1549}=2.38$*
Parental education, mean (SD)	9.84 (3.10)	9.95 (3.09)	$t_{1549}=-0.66$
Parental occupation, mean (SD)	6.22 (1.07)	6.23 (1.10)	$t_{1549}=-0.92$
Novelty seeking, mean (SD)	3.02 (0.41)	2.94 (0.39)	$t_{1549}=3.94$***
Harm avoidance, mean (SD)	2.68 (0.53)	2.45 (0.49)	$t_{1549}=8.98$***
Reward dependence, mean (SD)	3.51 (0.40)	3.15 (0.40)	$t_{1549}=17.76$***
Explosive temperament, n (%)			
1997	61 (6.88)	56 (10.33)	$\chi^2_1=5.34$*
2001	71 (7.17)	64 (9.09)	$\chi^2_1=2.07$
2007	78 (8.25)	64 (10.06)	$\chi^2_1=1.54$
Adventurous temperament, n (%)			
1997	80 (9.02)	104 (19.19)	$\chi^2_1=31.01$***
2001	81 (8.18)	147 (20.88)	$\chi^2_1=56.92$***
2007	83 (8.77)	143 (22.48)	$\chi^2_1=58.38$***
Self-directedness, mean (SD)	3.70 (0.44)	3.74 (0.42)	$t_{1549}=-1.58$
Cooperativeness, mean (SD)	3.83 (0.40)	3.68 (0.42)	$t_{1549}=6.94$***
Social support, mean (SD)	4.37 (0.70)	4.01 (0.82)	$t_{1549}=9.34$***
Attachment security, mean (SD)	4.65 (0.95)	4.36 (0.95)	$t_{1549}=5.95$***

*$P<.001$.
**$P<.01$.
***$P<.005$.

Table 2. Estimates and Standard Errors (SE) of Fixed and Random Effects When Predicting Standardized Scores of Self-Directedness

	Model 1 ($R^2=0.40$[a]) Estimate (SE)	Model 2 ($R^2=0.77$[a]) Estimate (SE)	Model 3 ($R^2=0.77$[a]) Estimate (SE)
Fixed effects			
Intercept	−0.71 (0.14)***	−0.42 (0.13)**	−0.42 (0.13)**
Explosive temperament[c]	−0.46 (0.05)***	−0.29 (0.05)***	−0.26 (0.05)***
Adventurous temperament[c]	0.07 (0.04)	0.11 (0.04)**	0.11 (0.04)**
Age	0.01 (0.00)*	0.01 (0.00)**	0.01 (0.00)**
Gender[b]	−0.09 (0.04)*	−0.26 (0.04)***	−0.26 (0.04)***
Parental education	−0.01 (0.02)	0.00 (0.01)	0.00 (0.01)
Parental occupation	0.01 (0.01)	−0.00 (0.02)	0.00 (0.02)
Education	0.06 (0.01)***	0.02 (0.01)***	0.02 (0.01)**
Occupational status	0.03 (0.01)***	0.04 (0.01)**	0.04 (0.01)***
Measurement time	−0.00 (0.01)	−0.00 (0.01)	0.00 (0.01)
Social support		0.26 (0.02)***	0.27 (0.02)***
Social support × explosive temperament[c]			0.01 (0.04)
Social support × adventurous temperament[c]			−0.08 (0.04)*
Attachment		0.23 (0.02)***	0.22 (0.02)***
Attachment × explosive temperament[c]			0.06 (0.05)
Attachment × adventurous temperament[c]			−0.01 (0.04)
Random effects			
Variance of intercept	0.54 (0.05)***	0.30 (0.04)***	0.30 (0.04)***
Variance of explosive temperament	0.06 (0.03)	0.02 (0.03)	0.03 (0.03)
Variance of adventurous temperament	0.02 (0.03)	0.06 (0.03)	0.06 (0.03)
Variance of social support		0.03 (0.01)**	0.03 (0.01)**
Variance of attachment security		0.03 (0.01)**	0.03 (0.01)**
Residual variance	0.29 (0.01)***	0.26 (0.01)***	0.25 (0.01)***

[a]Cox and Snell R^2.
[b]Men as the reference category.
[c]Participants without the risk temperament profile as the reference category.
*$P<.05$.
**$P<.01$.
***$P<.001$.

According to Cochran Q tests, the prevalence of explosive temperament did not change significantly between measurements among women ($Q_2=0.58$, $P=.75$) or among men ($Q_2=1.41$, $P=.49$). Neither did the prevalence of adventurous temperament change significantly between measurements among women ($Q_2=0.77$, $P=.68$) or men ($Q_2=5.04$, $P=.08$). Men had the adventurous temperament more often than women. Additionally, men had the explosive temperament more often than women in 1997. Women had higher novelty seeking, higher harm avoidance, higher reward dependence, and higher cooperativeness, more secure attachment, higher social support, higher occupational status, and more years of education.

Temperament Profiles, Social Support, and Attachment Predicting Character Traits

Table 2 shows the results of the LMMs predicting self-directedness. The estimates of the fixed effects can be interpreted as effect sizes so that, for example, having the explosive temperament predicted a 0.46 standard deviation lower value of self-directedness, while the effect of the adventurous temperament was nonsignificant. After social support and attachment were added to the model, the effect of the explosive temperament remained significant, and the effect of the adventurous temperament reached significance and predicted higher self-directedness. Both higher social support and more secure attachment predicted higher self-directedness. The interaction effect between social support and the adventurous temperament was also significant, indicating that individuals with the adventurous temperament have higher self-directedness than other people only at a low or average level of social support. Thus, having the adventurous temperament buffers against the effects of low social support on self-directedness (Figure 1A). Regarding random effects, there was significant individual-level variation in the average level (intercept) of self-directedness and in the slopes of social support and attachment, but not in the slopes of temperament profiles.

Both the explosive temperament and adventurous temperament predicted lower cooperativeness (Table 3, fixed effects). The effects withstood adjustments for social support and attachment, both of which predicted higher cooperativeness, and adjustments for interaction effects between temperament and social support or attachment. The interaction effect between social support and the adventurous temperament was significant, indicating that having the adventurous temperament weakens the

Figure 1. Predicted Values of Self-Directedness (A) and Cooperativeness (B) (Standardized With Mean = 0 and SD = 1) by Adventurous Temperament Profile and Social Support

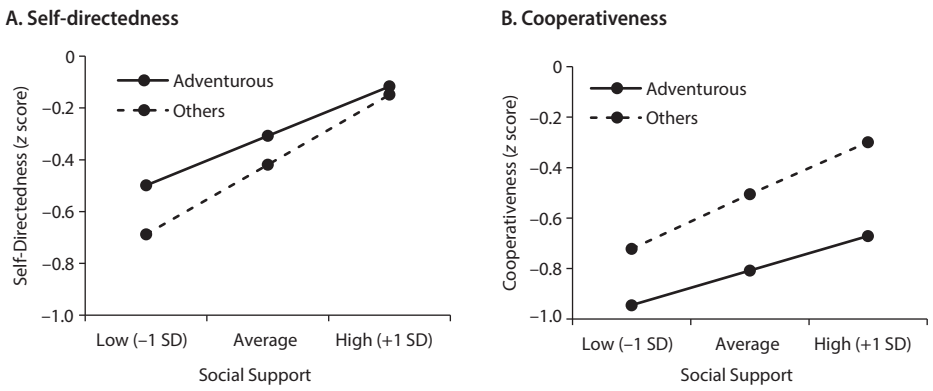


Table 3. Estimates and Standard Errors (SE) of Fixed and Random Effects When Predicting Standardized Scores of Cooperativeness

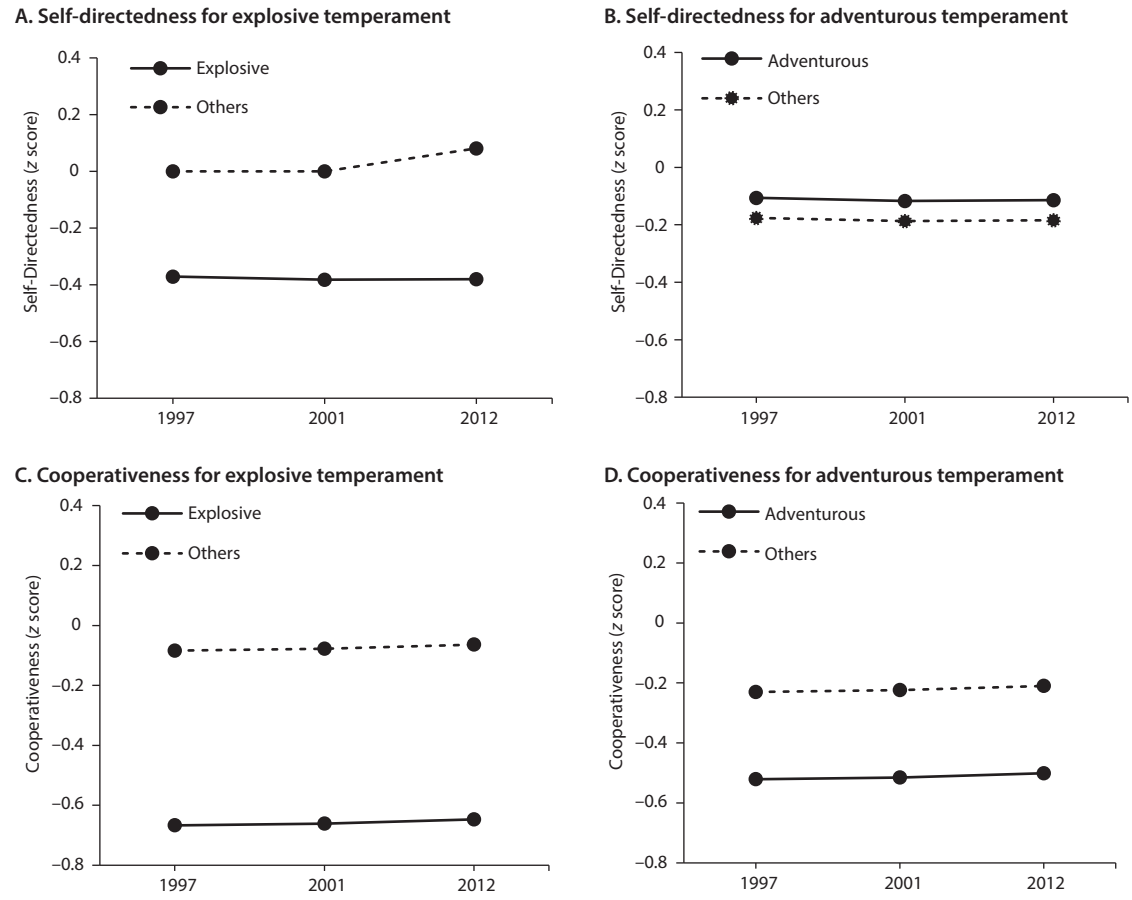
	Model 1 (R^2 = 0.45[a]) Estimate (SE)	Model 2 (R^2 = 0.77[a]) Estimate (SE)	Model 3 (R^2 = 0.77[a]) Estimate (SE)
Fixed effects			
Intercept	−0.82 (0.14)***	−0.51 (0.13)***	−0.51 (0.13)***
Explosive temperament[c]	−0.58 (0.05)***	−0.43 (0.05)***	−0.45 (0.05)***
Adventurous temperament[c]	−0.29 (0.04)***	−0.30 (0.04)***	−0.30 (0.04)***
Age	0.01 (0.00)*	0.01 (0.00)**	0.01 (0.00)**
Gender[b]	0.30 (0.04)***	0.15 (0.04)***	0.15 (0.04)***
Parental education	−0.01 (0.02)	0.01 (0.01)	0.01 (0.01)
Parental occupation status	0.01 (0.01)	−0.02 (0.02)	−0.02 (0.02)
Education	0.04 (0.01)***	0.02 (0.01)**	0.02 (0.01)**
Occupational status	0.03 (0.01)***	0.03 (0.01)***	0.03 (0.01)***
Measurement time	0.01 (0.01)	0.01 (0.01)	0.01 (0.01)
Social support		0.20 (0.02)***	0.22 (0.02)***
Social support × explosive temperament[c]			0.00 (0.04)
Social support × adventurous temperament[c]			−0.08 (0.04)*
Attachment		0.20 (0.02)***	0.20 (0.02)***
Attachment × explosive temperament[c]			−0.07 (0.05)
Attachment × adventurous temperament[c]			0.01 (0.04)
Random effects			
Variance of intercept	0.50 (0.05)***	0.34 (0.04)***	0.34 (0.04)***
Variance of explosive temperament	0.10 (0.03)**	0.04 (0.03)	0.04 (0.03)
Variance of adventurous temperament	0.00 (0.02)	0.01 (0.02)	0.01 (0.02)
Variance of social support		0.03 (0.01)*	0.03 (0.01)*
Variance of attachment security		0.03 (0.01)**	0.03 (0.01)**
Residual variance	0.28 (0.01)***	0.25 (0.01)***	0.25 (0.01)***

[a]Cox and Snell R^2.
[b]Men as the reference category.
[c]Participants without the risk temperament profile as the reference category.
*P < .05.
**P < .01.
***P < .001.

enhancing effect of secure attachment on cooperativeness (Figure 1B). Regarding random effects, there was significant individual-level variation in the average level (intercept) of cooperativeness and in the slopes of social support and attachment security. The random effect of explosive temperament in model 1 was attributable to the other covariates (Table 3).

As supplementary analyses, we created a temperament profile variable with 3 classes (1 = explosive temperament, 2 = adventurous temperament, 3 = others) so that when the predictive power of explosive temperament was examined, participants with adventurous temperament were not included in "others," and vice versa. The associations of explosive and adventurous temperament profiles with character traits did not change significantly. Second, we examined the temporal relationships between temperament profiles and character traits. Social support and attachment were not included in these analyses. We predicted character traits in 2012 by temperament profiles in 1997 and 2001, and the results were highly similar to before: the explosive

Figure 2. Estimated Marginal Means of Self-Directedness (A, B) and Cooperativeness (C, D) (Standardized With Mean = 0 and SD = 1) for Temperament Profiles and Measurement Years



temperament predicted lower self-directedness and lower cooperativeness, and the adventurous temperament predicted higher self-directedness and lower cooperativeness. Instead, after controlling for self-directedness and cooperativeness in 1997 and 2001, the associations disappeared—thus, the temperament profiles did not predict the average change in character traits between 1997 and 2012. This may have resulted from the fact that character traits were highly stable in all temperament profile groups during the follow-up (Figure 2).

DISCUSSION

To our knowledge, this was the first study to longitudinally demonstrate that in a general population, explosive and adventurous temperament profiles are associated with character traits. Individuals with the explosive temperament had less mature personalities, as indicated by lower self-directedness and cooperativeness, while individuals with the adventurous temperament had lower cooperativeness and, after controlling for social support and attachment security, also higher self-directedness. These relationships were highly stable: they were consistent over the 15-year adulthood follow-up, they did not vary significantly at the individual level, and they were sustained after controlling for age, gender, and socioeconomic status. In line with our findings, earlier research has also suggested that the explosive temperament is more likely to predispose to low self-directedness and cooperativeness than is the adventurous temperament. Furthermore, the effect sizes of the explosive temperament on self-directedness and cooperativeness were higher than those of the adventurous temperament. Since low self-directedness and cooperativeness are related widely to different forms of psychopathology,[4,6,8,9] the explosive temperament may initiate a long-term maladaptive developmental trajectory.

Contrary to our hypotheses, there was no direct association between the adventurous temperament and self-directedness, although controlling for social support and attachment revealed a positive correlation. This might suggest that people with the adventurous temperament direct their behavior comparatively well (high self-directedness) in less supportive social environments (Figure 1A). This is in line with theories that argue for positive natural selection for antisocial traits due to their good fit with harsh environmental conditions, that is, theories on the adaptive side of antisocial behaviors.[41,42]

Our findings also showed that in terms of mature character development, individuals with the adventurous temperament benefited from secure attachment as much as subjects with

other temperament profiles. Given the well-documented associations between the adventurous temperament and antisocial personality[4–6,43] and antisocial personality and immature character,[4,6] this finding might support a more hopeful perspective for the treatment of antisocial features. Individuals with borderline features have been effectively treated with dialectical behavior therapy that deals with attachment security,[44] while individuals with antisocial features are usually assumed to be unlikely to benefit significantly from psychotherapeutic interventions,[45] although there is also more hopeful recent evidence.[46,47] Our finding support the claim that positive parenting can buffer the heritable risk of antisocial behaviors, such as callous-unemotional behaviors, in early childhood.[48]

Consistently with the previous literature,[49] higher adulthood socioeconomic status was associated with more mature character development. However, parental socioeconomic status did not promote the development of higher self-directedness or cooperativeness in their offspring, which was contrary to the previous findings.[50] There is a rich body of evidence indicating that the effect of parental socioeconomic status is transmitted significantly via the offspring's socioeconomic status.[51] Hence, controlling for offspring socioeconomic status may have reduced the effect of parental socioeconomic status in the present study.

This study had some methodological limitations. We defined the temperament profiles using a median-split method that may have resulted in the unnecessary or artificial categorization of participants. The median-split method has, however, also been used productively in our previous studies,[17,30] and it is noted to be an optimal method for pattern recognition in the field of psychiatry.[52] Furthermore, the utilization of profiles make the assessments person-centered while still capturing multidimensional information about associated traits, thereby making the results informative for clinical mental health workers. Using normative mean scores instead of median-splits would have been an alternate justifiable method to define high and low scores of TCI dimensions, but it was not possible because the TCI has not yet been standardized in a Finnish population.

Second, the associations found in our linear mixed models may not necessarily represent causality. There may also have been unexplained variance in the analyses due to confounding variables. Especially, impulsivity is closely associated with both borderline and antisocial personality disorders,[53] but it could not be controlled in the present study.

A total of 1,568 participants (43.6%) of the initial sample were excluded from this study because of missing values. Attrition analysis indicated that the nonparticipants had higher harm avoidance and lower reward dependence, which indicates that some individuals with explosive temperament may have been excluded from the study. Previously, it has been shown that participants with psychiatric disorders are more likely to drop out of studies during follow-up.[54] With regard to social support, we studied subjective perceptions instead of actual received social support.[55] Perceived social support is, however, less situation-specific and reflects more stable personality structures than received social support.[21]

Despite the limitations, our study provided support for psychotherapeutic interventions promoting adventurous and explosive individuals' ability to form close and supportive relationships. Based on previous suggestions,[56] explosive individuals might benefit especially from meta-cognitive awareness training, mindfulness, and relaxation exercises that would lead to a higher self-acceptance and regulation of their affective instability and, in that way, to a better ability to form close relationships. Adventurous individuals, in turn, could be provided with programs focusing on negotiation skills training, values education, and exercises of social perspective taking, which would promote the development of a less impulsive and risk-taking interpersonal style.[46]

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Supplementary material: See accompanying pages.

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Supplementary material follows this article.

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Supplementary Material

Article Title: Longitudinal Associations of Explosive and Adventurous Temperament Profiles With Character Development: The Modifying Effects of Social Support and Attachment

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List of Supplementary Material for the article

1. **eTable 1** The Numbers of Observations for Variables Under Study in Each Measurement Year

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Supplementary eTable 1. The numbers of observations for variables under study in each measurement year.

	1997	2001	2007	2012	total
Temperament profiles	1429	1694	1582	not measured	4705
Self-directedness	1487	1711	not measured	1415	4613
Cooperativeness	1498	1728	not measured	1413	4639
Social support	1568	1792	1660	not measured	5020
Attachment security	not measured	1798	1657	1457	4903