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Life Events and Personality in Late Adolescence: Genetic and Environmental Relations

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The relationship between life events and personality was investigated in the Minnesota Twin/Family Study, using 216 monozygotic and 114 dizygotic 17-year-old male twin pairs. Participants completed a life events interview designed for adolescents and the Multidimensional Personality Questionnaire. Life events were categorized into three types: life events to which all members of a family would be subject and those affecting an individual, which can be broadly construed as either nonindependent or independent. Univariate genetic model fitting indicated the presence of significant genetic effects (h^2 = 49%) for nonindependent nonfamily life events but not for the other two types of life events. Bivariate genetic model fitting further confirmed that the significant phenotypic correlation between nonindependent life events and personality is in part genetically mediated. Specifically, the findings suggest that genetically influenced individual differences in constraint play a substantial role in life events whose occurrence is not independent of the individual's behavior.

KEY WORDS: Life events; personality; adolescence; genetic; multivariate analysis; twin-family study.

INTRODUCTION

One often cited finding in personality research is the correlation between measures of life events and personality. The purpose of this study is to show that, in part, this observed association between life events and personality is due to genetic factors.

Associations between life events and personality have tended to focus on four personality variables: negative emotionality, positive emotionality, type A behavior, and locus of control. Negative emotionality, or its approximation by neuroticism and anxiety scales, is the personality trait that has been studied most frequently in life events research. Aldwin *et al.* (1989) found that emotionality (neuroticism) was significantly related to negative life events, even when life events were assessed ten years after the measurement of emotionality. Similarly, Heady and Wearing (1989) found neuroticism correlated significantly with adverse life events reported 1 to 6 years after the measurement of neuroticism. Nelson and Cohen (1983), Reavley (1974), and Schlosser (1990) all found that measures of trait and state anxiety were also related to life events scores.

Whereas negative emotionality appears to be associated with undesirable life events, positive emotionality has been shown to be associated with desirable life events (e.g., Cole, 1992; Heady and Wearing, 1989). Type A behavior also has been shown to be related to a greater frequency of life events. Suls *et al.* (1979) found that Type A individuals reported significantly more life events having occurred during the previous 6 months than Type B individuals. Other studies report results similar to those of Suls *et al.* (e.g., Byrne, 1981;

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Rhodewalt *et al.*, 1984). Locus of control has also been hypothesized to moderate the impact of life events, such that those with external control beliefs will be more susceptible to the harmful effects of negative life events, as they feel more powerless than internals over circumstances outside of themselves. Consistent with this prediction, Sarason *et al.* (1978), Sandler and Lakey (1982), and Nelson and Cohen (1983) found that externals reported more negative life events than internals.

As has frequently been the case for behavioral measures such as IQ and personality, a number of recent behavioral genetic studies indicate that various measures of the environment, such as the reporting of life events, show significant genetic influence (Plomin and Bergeman, 1991). Wierzbicki (1989) reports a heritability of .41 for number of stressful life events from a twin study, suggesting that 41% of the variance in the life events score was due to genetic factors. McGuffin *et al.* (1988) offer indirect evidence for a genetic influence on life events scores. They found that 42% of the first-degree relatives of depressive probands reported recent life events, while only 7% of a community sample reported recent life events. When those events related to the probands were excluded, 29% of the relatives still reported life events. These results suggest that something familial leads to greater reporting of life events in the first-degree relatives of depressed patients (even life events unrelated to the depressed relative). Consistent with this are findings suggesting genetic influence on depression (Reich *et al.*, 1987). Plomin *et al.* (1990) also provide evidence for genetic influence on specific types of life events. Using data from older adult twins reared together and apart, 40% of the variance in total life events scores was estimated as genetic. When the total life events score was divided into the four scales of controllable (nonindependent), uncontrollable (independent), desirable, and undesirable life events, only controllable (44%) and undesirable (36%) life events showed significant heritability; genetic influence on uncontrollable and desirable life events was negligible.

These findings concerning differential heritabilities for independent and nonindependent events make intuitive sense. Those events that are most likely to be affected by the individual are no doubt those events that are most likely to show a genetic influence. Further, factors within the individual that influence behavior can be expected to mediate either the occurrence of the events or their reporting. Personality seems a likely candidate for a class of genetically influenced person factors which could affect life events scores. For example, Tellegen *et al.* (1988) report heritability estimates of .39 to .58 for the primary scales and higher-order factors of the Multidimensional Personality Questionnaire. To date, a wide range of personality variables has been shown to be genetically influenced; in fact, it is the rare personality variable that does not show significant genetic effects (Rose, 1995). Individuals perceive, approach, and interact with their environment based on personality dispositions. If individual differences in personality are genetically influenced, and if life events ensue from individuals' actions based on these personality traits, then it is reasonable to expect significant genetic influence on controllable or nonindependent life events.

The goals of this study were twofold. First, a sample of 17-year-old males was used to determine the heritability of life events in an adolescent sample, as opposed to the older adult samples that had previously been used (e.g., Plomin *et al.*, 1990). On the basis of previous research on genetic influences on life events, we predict that life events that are not independent of the adolescent's behavior will show significant heritability, while those that are independent of the adolescent's behavior will show no genetic effects. In this study, independent life events are conceptualized as occurring either within or outside the family environment. We expect that those life events that occur within the family will show significant shared environmental effects, whereas those events occurring outside the family will show primarily nonshared environmental effects. Second, an attempt was made to determine if genetic influence mediates the observed association between personality and life events. Consistent with our prediction of significant heritability for controllable life events, we also expect a significant portion of the life events–personality correlation to be genetically mediated.

METHOD

Participants

The data for this study were collected as part of the Minnesota Twin/Family Study (MTFS). The participants in this phase of the MTFS were recruited from the population-based pool of all male twins born in Minnesota from 1971 through 1982. The sample used in the present investigation was ascertained from birth records for the 5 birth years 1974–1978. Twin families were located and were recruited by mail and telephone. Biographical questionnaires (BQs) were sent to all families in which the twins were alive and well and who were willing to receive mailings from the MTFS. Just prior to the twins reaching age 17, a Mother's Interview, a 45-min semistructured family health interview, was scheduled. At the end of the interview, the family was invited to visit the lab for assessment. During the first 2 years of data collection, 1988 and 1989, families came for 2 days of assessment. In order to increase the number of subjects included in the study, as well as to improve recruitment, the study changed to a 1-day assessment in 1990. Although data are available from the parents of the twins, only data from the 17-year-old twins were used in this investigation.

There were 210 families with 17-year-old twins who made visits to the laboratory and for whom complete data are available on the Multidimensional Personality Questionnaire (MPQ) and life events interview. Additionally, there were 120 twin pairs who completed the MPQ but who did not visit the laboratory and therefore did not complete the life events interview, most of these being twin pairs who completed the MPQ by mail but were not recruited to visit due to scheduling limitations. For the univariate analyses, data were used from all twin pairs that had complete data for both twins on the measure. For the bivariate analyses, participants were included only if they had complete data for both twins on both measures. There were 216 monozygotic (MZ) twin pairs and 114 dizygotic (DZ) twin pairs for whom there were complete data on at least one of the measures used in this investigation.

Preliminary zygosity was determined by comparing a parental zygosity questionnaire asking, for example, "Could one twin fool friends or family by pretending to be the other?;" evaluating the physical similarity of the twins including the similarity of their eye color and ear lobe shape; and using an algorithm incorporating ponderal index, cephalic index, and fingerprint ridge count. If there was any discrepancy among these three estimates of zygosity, serological determination of zygosity was made through analysis of 12 blood group antigens and protein polymorphisms. The rate of zygosity misclassification is less than .001 for this serological procedure (Lykken, 1978). In a validation study with 50 adolescent twin pairs that used serological analysis as the standard, if the first three methods of classification agreed, serological analysis always confirmed this agreement.

Measures

Life Events Interview for Adolescents

Lifetime life events were measured with the Life Events Interview for Adolescents (LEIA). The LEIA is a 58-item interview developed by MTFS personnel on which subjects indicate whether or not they have experienced a variety of life experiences during their lifetime. The response format for the LEIA was changed slightly when the MTFS switched from the 2-day assessment to the 1-day assessment. However, a dichotomous rating of whether or not each item had ever been experienced can be obtained from both versions of the LEIA and it is these item endorsements which were used in computing LEIA scores. The items on the LEIA are similar to those found on various life events inventories developed for use with adolescent populations (e.g., Compas *et al.*, 1987; Johnson and McCutcheon, 1980; Swearington and Cohen, 1985).

The items on the LEIA were classified by three advanced clinical psychology graduate students into three groups: (a) events that happened to the family or to individuals within the family, (b) nonfamily events that were independent of the respondent's behavior, and (c) nonfamily events in which the respondent's behavior may have influenced whether or not the event occurred. The three raters agreed on classification of all but three of the items, and for each of these events, two of the three raters agreed on how to classify the event. Final classification for these three items was determined by discussing each item and arriving at a consensus. The Appendix shows the LEIA items in each of the three groups. Item endorsements were summed to provide the scale scores (a) Family-Related Life Events (FAM), (b) Independent Non-Family Life Events (INF), and (c) Nonindependent Non-Family Life Events (NINF). There are no clearly desirable events on the LEIA; all of the items are either undesirable or ambiguous. Therefore, no classification of events was made on the basis of desirability. In addition, Masten *et al.* (1996) emphasize that it is important to distinguish between discrete and chronic life events. However, as almost all of the items on the LEIA represent discrete events, this distinction was not made.

Multidimensional Personality Questionnaire

Personality was measured using the Multidimensional Personality Questionnaire-B (MPQ; Tellegen, 1982; 1988). The MPQ is a self-report personality inventory that was developed through factor analysis to assess normal personality functioning. The original MPQ contains 300 items which are answered dichotomously (e.g., "true" or "false"). A shorter version of the MPQ was used in this study and has 198 items which are answered on a 4-point scale (e.g., "definitely true," "probably true," "probably false," or "definitely false").

The MPQ's 11 primary personality traits (and Cronbach's alpha computed in this study) are Well-Being (.87), Social Potency (.84), Achievement (.84), Social Closeness (.84), Stress Reaction (.85), Alienation (.86), Aggression (.86), Control (.74), Harm Avoidance (.80), Traditionalism (.77), and Absorption (.83). These 11 scales can be combined to form three second-order factors: (a) Positive Emotionality (PEM), which may be conceptualized as the predisposition to experiencing positive affect; (b) Negative Emotionality (NEM), which may be conceptualized as the predisposition to experiencing negative affect; and (c) Constraint (CON), which may be conceptualized as a behavioral constraint parameter (Tellegen, 1985). In this investigation, scores for these three higher-order scales were computed by adding the scores for the primary scales which have loaded the highest on each factor in previous studies. The PEM score was obtained by adding the scores for Well-Being, Social Potency, Achievement, and Social Closeness. The NEM score was obtained by adding the scores for Stress Reaction, Alienation, and Aggression. The CON score was obtained by adding the scores for Control, Harm-Avoidance, and Traditionalism. Absorption was not included in the calculation of the higher-order factors, as this primary scale tends to load substantially on both PEM and NEM. Results in this study are reported for only the three higher-order factors, and not the 11 primary scales.

Model Fitting

Univariate and bivariate behavioral genetic models were evaluated in this study. The full univariate behavioral genetic model decomposes the phenotypic variance of each variable into four components: additive (A) and nonadditive (dominance, D) genetic effects and shared family environment (C), and nonshared environment (E) effects. The extent to which phenotypic relationships between life events and personality variables were associated with genetic and environmental factors was examined through bivariate behavioral genetic model fitting. As in univariate models, bivariate genetic analyses can be used to decompose the phenotypic covariance between two measures into additive and nonadditive genetic and shared environmental and nonshared environmental components. The essence of bivariate genetic analysis is the cross-twin correlation, which is the correlation between one twin's score on one measure and the other twin's score for the second measure. According to quantitative genetic theory, if genetic influences are important sources of phenotypic covariances, then the cross-MZ correlation should exceed the cross-DZ twin correlation. If shared environment is a substantial mediator of the association between the two variables, then the cross-twin correlation will be similar for MZs and DZs. Nonshared environmental mediation is implicated to the degree that genetic and shared environmental sources of covariance cannot explain phenotypic covariance. Figure 1 shows the bivariate (or Cholesky) model evaluated in this study. The Cholesky model is frequently used in quantitative genetic analyses (Neale and Cardon, 1992) and allows for the decomposition of the correlation between two phenotypes into components of variance *shared* between the two phenotypes and *unique* to one of the phenotypes; in this study, the life events scales. Path coefficients subscripted with "22" represent effects unique to the life events scales. Path coefficients subscripted with "11" and "21" represent effects emanating from the factors shared by the two phenotypes.

In order to determine the amount of genetic variance unique to a phenotype (life events) using standardized parameter estimates, we compute for additive genetic effects, $a_{22}^2/(a_{21}^2 + a_{22}^2)$. Further, $1 - [a_{22}^2/(a_{21}^2 + a_{22}^2)]$ equals the proportion of genetic variance shared between the MPQ factor and LEIA scale. Similarly, for the nonshared environment, $e_{22}^2/(e_{21}^2 + e_{22}^2)$ estimates nonshared environmental variance unique to the LEIA scale, and $1 - [e_{22}^2/(e_{21}^2 + e_{22}^2)]$ nonshared environmental variance

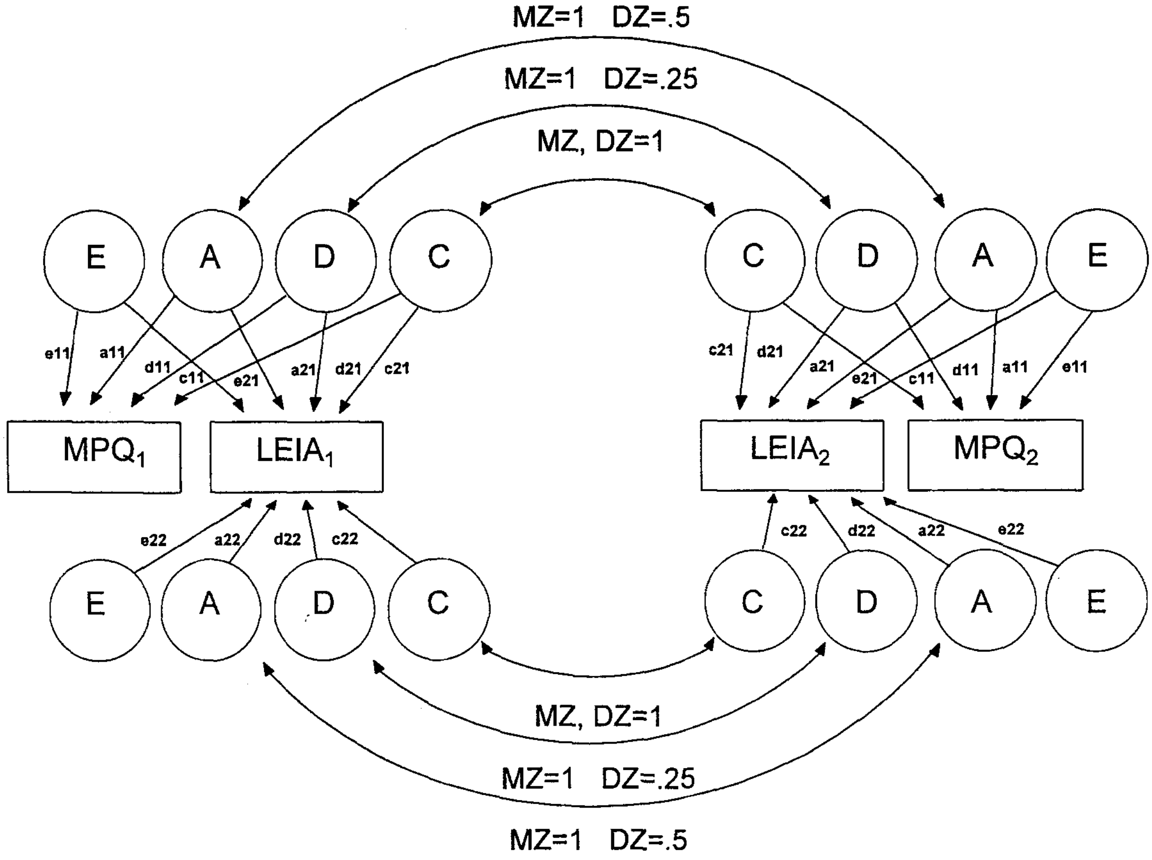

Fig. 1. Bivariate Cholesky twin model. Latent variables E, A, D, and C refer to nonshared environmental, additive genetic, dominance, and shared family environmental effects, respectively.

held in common between the MPQ factor and the LEIA scale. The Cholesky model also permits the calculation of the genetic correlation ($r_{gg'}$) and environmental correlation ($r_{ee'}$) between the two phenotypes. For example, if additive genetic effects are standardized to unit variance, then $a_{11} * a_{21} = r_{gg'}$ and if nonshared environmental effects are comparably standardized, then $e_{11} * e_{21} = r_{ee'}$. In addition, bivariate heritability, or the proportion of the phenotypic correlation ($r_{\text{MPQ,LEIA}}$) that is due to genetic effects, may be obtained by $r_{gg'}/r_{\text{MPQ,LEIA'}}$, where $r_{\text{MPQ,LEIA'}}$ is the phenotypic correlation implied by the model-fitting results. Similarly, bivariate environmentality, or the proportion of the phenotypic correlation that is due to environmental effects, may be obtained by $r_{ee'}/r_{\text{MPQ,LEIA'}}$. All modeling in this study was conducted with the LISREL VII program (Jöreskog and Sörbom, 1989).

RESULTS

Before presenting the results of the model-fitting analyses, we present the simple phenotypic correlations among the variables and the twin correlations for these variables. As indicated later, interpretations derived from examining the twin correlations were confirmed by the model fitting.

Phenotypic and Twin Correlations

The correlations between the LEIA scales and the MPQ factors are shown in Table I. As predicted, of the three LEIA scales, Nonindependent Non-Family Life Events (NINF) shows the strongest association with the MPQ factors, while the Independent Family Life Events (INF) scale is unrelated to the MPQ factors. Contrary to prediction, the

Table I. Correlations Between Life Events Interview for Adolescents (LEIA) Scales and Multidimensional Personality Questionnaire (MPQ) Factors (n = 290)

	MPQ factor		
LEIA scale	Positive Emotionality	Negative Emotionality	Constraint
Family	−.04	.11	−.19**
Independent Non-family	.10	.03	−.05
Nonindependent Non-family	.17*	.18*	−.34**

Note. *$p < .01$. **$p < .001$.

Table II. Intraclass Twin Correlations for Life Events Interview for Adolescents (LEIA) Scales and Multidimensional Personality Questionnaire (MPQ) Higher-Order Factors

Scale	MZ twins	DZ twins
Family	.79***	.82***
Independent Non-Family	.18*	.29*
Nonindependent Non-Family	.46***	.31*
Positive Emotionality	.54***	.35***
Negative Emotionality	.36***	.10
Constraint	.58***	.17

Note. Twin-pair sample size for LEIA scales, MZ (127) and DZ (63); for MPQ scales, MZ (181) and DZ (99). *$p < .05$. ***$p < .001$.

Family Life Events (FAM) scale is significantly related to the Constraint factor.

Table II presents intraclass correlations for the LEIA scales which are consistent with predictions: the NINF is the only scale showing evidence for genetic influence, with the MZ correlation exceeding the DZ correlation. If genetic effects are responsible for this difference, they are most likely additive in nature since the DZ correlation is more than half the MZ correlation. Conversely, none of the other LEIA scales show any evidence of genetic influence; in fact, the DZ correlation exceeds slightly the MZ correlation for two of the measures. The pattern of twin correlations for these measures suggests shared family environmental influence.

Table II also shows intraclass twin correlations for the MPQ higher-order factors. As predicted, there is evidence for genetic influence for all three factors, as indicated by larger MZ than DZ correlations. The case (Negative Emotionality, Constraint) where the MZ correlation is more than twice the DZ correlation suggests nonadditive genetic effects.

Univariate Genetic Analyses

Life Events Interview for Adolescents

The results of maximum-likelihood model fitting with LISREL using twin variances and covariances are presented in Table III and confirm the findings with intraclass correlations. The full model for each scale includes additive genetic (A), shared or common environment (C), and nonshared environment (E) components. Note that a dominance parameter was not fit to these data because the pattern of twin intraclass correlations provided no evidence for its presence. The model which minimizes the value of the Akaike information criterion (AIC) is selected as the best-fitting model. For NINF, the best-fitting model includes additive genetic and nonshared environment components, each accounting for approximately 50% of the phenotypic variance. Although the full ACE model fits the data reasonably well by the chi-square goodness-of-fit statistic, the contribution of shared environmental factors in the full model is relatively small; the reduced model which specifies all environmental variance as nonshared is a better fit. In addition, the AIC is at a minimum for this (AE) model. For the other two LEIA scales there is no evidence for genetic influence. The best-fitting model for each of these variables is a CE model with shared and nonshared environment components. Consistent with predictions, shared environmental influences account for most of the variance in FAM (81%), while nonshared environmental influences account for most of the variance in INF (79%). The difference between chi-squares comparing the reduced AE model to the full ACE model is significant for the FAM scale, indicating a significant deterioration in the fit of the model when the shared environment component is fixed to zero for this variable. The model with only a nonshared environment component, which essentially tests the hypothesis that all the variance is random, is not a good fit for any of the variables. Table III also shows significant chi-square goodness-of-fit statistics for all of the models for FAM, suggesting that none of the models fit the data. This likely reflects either unequal variances among the twin groups or nonnormality of FAM, as chi-square is very sensitive to departures from normality. In-

Table III. Life Events Interview for Adolescents (LEIA): Maximum-Likelihood Model-Fitting Results

		Parameter estimate			Test of model					
Scale	Model	*a*	*c*	*e*	χ^2	df	*p*	AIC	χ^2_{diff}	df
FAM	ACE	.00	.90	.45	16.03	3	.001	10.03		
	AE	.87	—	.44	49.13	4	.000	41.13	31.10*	1
	CE	—	.90	.45	16.03	4	.003	8.03	.00	1
	E	—	—	1.00	210.24	5	.000	200.24		
INF	ACE	.00	.46	.89	1.78	3	.620	−4.22		
	AE	.46	—	.89	3.69	4	.449	−4.31	1.91	1
	CE	—	.46	.89	1.78	4	.777	−6.22	.00	1
	E	—	—	1.00	10.37	5	.065	.37		
NINF	ACE	.59	.35	.71	3.63	3	.304	−2.37		
	AE	.70	—	.71	3.98	4	.409	−4.02	.35	1
	CE	—	.63	.75	6.07	4	.194	−1.93	2.40	1
	E	—	—	.99	41.17	5	.000	31.17		

Note. FAM, Family; INF, Independent Non-Family; NINF, Nonindependent Non-Family; A, additive genetic; C, shared environment; E, nonshared environment; AIC, Akaike information criterion. χ^2_{diff} = (reduced model χ^2) − (full model χ^2) [with df = (reduced model df) − (full model df)]. *$p < .05$.

spection of the FAM raw data revealed a positive skew and a highly peaked distribution, suggesting that lack of normality may be leading to the significant chi-square statistics. Because transformation of the raw data did not remove successfully the nonnormality, data were left nontransformed. MZ and DZ variances for FAM did not differ, nor did the variances of Twin 1 and Twin 2.

Multidimensional Personality Questionnaire

The results of maximum-likelihood model fitting with LISREL using twin variances and covariances are presented in Table IV. The full model for PEM is an ACE model, while the full model for NEM and CON is a ADE model. Results from the model fitting confirm the effects suggested by the pattern of twin correlations. For the three MPQ factors, the best-fitting model by AIC was a reduced model which included nonshared environment and one of the other components. For the PEM factor, the AE model provides the best fit to the data, suggesting a heritability of 52%. For the NEM and CON factors, the DE model provides the best fit to the data, suggesting heritabilities of 36 and 59%, respectively, although significant nonadditive effects without the presence of significant additive effects is a questionable model. It should be noted that the AE model fits almost as well as the DE model for negative emotionality and constraint.

Bivariate Genetic Analyses

In the univariate genetic analyses, the Nonindependent Non-Family Life Events scale (NINF) was the only life events scale evidencing genetic influence. Thus, only the NINF was used in the bivariate genetic analyses with the three MPQ factors. Table V shows within-person and double-entry cross-twin correlations for the NINF scale and MPQ higher-order factors. Cross-twin correlations are between the NINF scale in Twin 1 and the MPQ factor in Twin 2. The within-person correlations indicate that the NINF scale is correlated with the three MPQ factors. The cross-twin correlations either are nonsignificant or do not appear significantly greater for MZ twins than DZ twins.

In the univariate genetic analyses, the best-fitting model for the NINF scale included additive genetic and nonshared environment components and the best-fitting models for the three MPQ factors included either an additive genetic or a dominance component and a nonshared environment component. Thus, for the modeling analyses, bivariate genetic Cholesky models with additive genetic and nonshared environment components were fit to the data for the NINF and MPQ factors. The results of the model fitting are shown in Table VI, which includes the parameter estimates, chi-square goodness-of-fit tests, proportions of genetic and environmental variance unique to the NINF scale and held in common with the MPQ factor, genetic, environmental, and phenotypic correlations implied

Table IV. Multidimensional Personality Questionnaire (MPQ): Maximum-Likelihood Model-Fitting Results

		Parameter estimate				Test of model					
Scale	Model	*a*	*c*	*d*	*e*	χ^2	df	*p*	AIC	χ^2_{diff}	df
PEM	ACE	.52	.50	—	.69	2.13	3	.454	−3.87		
	AE	.72	—	—	.69	3.71	4	.446	−4.29	1.58	1
	CE	—	.69	—	.72	4.27	4	.371	−3.73	2.14	1
	E	—	—	—	1.00	76.04	5	.000	66.04		
NEM	ADE	.00	—	.60	.80	1.48	3	.688	−4.52		
	AE	.59	—	—	.81	2.38	4	.666	−5.62	.90	1
	DE	—	—	.60	.80	1.48	4	.831	−6.52	.00	1
	E	—	—	—	1.00	26.46	5	.000	16.46		
CON	ADE	.30	—	.71	.74	.72	3	.869	−5.28		
	AE	.76	—	—	.66	2.55	4	.636	−5.45	1.83	1
	DE	—	—	.77	.64	.77	4	.942	−7.23	.05	1
	E	—	—	—	1.00	77.87	5	.000	67.87		

Note. PEM, Positive Emotionality; NEM, Negative Emotionality; CON, Constraint; A, additive genetic; C, shared environment; E, nonshared environment; AIC, Akaike information criterion. χ^2_{diff} = (reduced model χ^2) − (full model χ^2) [with df = (reduced model df) − (full model df)].

Table V. Within-Person and Double-Entry Cross-Twin Correlations for Nonindependent Non-Family Life Events (NINF) and Multidimensional Personality Questionnaire (MPQ) Factors

	Nonindependent Non-Family Life Events		
MPQ factor	Within-person (n = 200)	MZ cross-twin (96 pairs)	DZ cross-twin (49 pairs)
Positive Emotionality	.17**	.13	−.10
Negative Emotionality	.18***	.08	.20*
Constraint	−.34***	−.17*	−.23*

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

Table VI. Nonindependent Non-Family Life Events (NINF) and Multidimensional Personality Questionnaire (MPQ) Factors: Bivariate Model-Fitting Results

	Parameter estimate																	
Factor	e_{11}	a_{11}	e_{21}	a_{21}	e_{22}	a_{22}	h^2_c	h^2_u	e^2_c	e^2_u	$r_{gg'}$	$r_{ee'}$	r'	h^2_{BV}	e^2_{BV}	χ^2	*p*	AIC
PEM	70	−.72	.12	−.10	.73	−.66	.02	.98	.03	.97	.07	.08	.15	.48	.52	7.84[a]	.90	19.84
	.71	−.71	.16		.73	−.66										8.87	.88	18.87
	.70	−.72		−.19	.74	−.65										10.69	.77	20.69
	.70	−.72			.74	−.67										15.54	.50	23.34
NEM	.70	−.71	.11	−.16	.74	−.65	.06	.94	.02	.98	.11	.08	.19	.58	.42	8.74[a]	.85	20.74
	.71	−.70	.17		.74	−.65										11.16	.74	21.26
	.70	−.71		−.24	.75	−.62										10.93	.76	20.93
	.70	−.72			.70	−.72										18.55	.29	26.55
CON	.70	−.72	−.15	.33	.61	−.70	.29	.71	.06	.94	−.24	−.11	−.35	.69	.31	6.33[a]	.96	18.33
	.76	−.65	−.27		.63	−.73										17.25	.30	27.25
	.69	−.72		.43	.63	−.65										11.95	.68	21.95
	.70	−.72			.63	−.78										37.38	.00	45.38

[a] df = 14.

Note. PEM, Positive Emotionality; NEM, Negative Emotionality; CON, Constraint; h^2_c, common genetic variance; h^2_u, unique genetic variance; e^2_c, common environmental variance; e^2_u, unique environmental variance; $r_{gg'}$, genetic correlation; $r_{ee'}$, environmental correlation; r', phenotypic correlation as estimated by model; h^2_{BV}, bivariate heritability; e^2_{BV}, bivariate environmentality; AIC, Akaike's information criterion.

by the models, and bivariate heritability and environmentality estimates.

For positive emotionality and negative emotionality, almost all of the NINF scale's genetic variance is unique, with little held in common with the MPQ scales. The same conclusion may be reached with respect to environmental variance: for PEM and NEM, either common genetic (a_{21}) or common environmental (c_{21}) effects (but not both) may be removed from the model without a significant decrement in fit as indicated by a significant increment in chi-square following the removal of a parameter. Thus, we cannot conclude whether shared genetic or shared environmental effects mediate significantly the relation between the NINF scale and PEM and NEM. On the other hand, a significant proportion of constraint's variance is shared with NINF: removing either common genetic or environmental effects from the model reduces the fit significantly. Further, the bivariate heritability estimate for constraint and NINF is .69. We may conclude that more than half the observed relation between nonindependent life events and constraint is reliably mediated by genetic factors.

DISCUSSION

This study predicted that life events dependent on individual behavior would show significant genetic influence and that this genetic influence would be correlated with genetic influences on personality. Both predictions were confirmed. Genetic factors contributed significantly to reports of nonindependent nonfamily life events (NINF; h^2 = .49) and did not contribute to reports of family-related (FAM) or independent nonfamily (INF) life events. The remaining variance in NINF was associated with nonshared environmental factors, while the variance in FAM was attributable largely to shared environmental effects and that in INF, to nonshared environmental effects. Also consistent with prediction was the finding of a significant genetic association between the NINF and the MPQ factor constraint. Although in absolute terms, the genetic association was modest, it accounted for more than half of the phenotypic correlation. For the MPQ factors positive and negative emotionality, the existence of significant shared genetic variance could not be unambiguously determined.

The findings from this study suggest that genetic factors play a role in behaviors that are associated with the actual occurrence of the events rather than just the *reporting* of the events. Genetic factors are implicated in the reports of life events that are potentially influenced by the individual's behavior but not in the reports of events that are considered independent of the individual's behavior. Additionally, the high agreement among both MZ and DZ twins on FAM life events provides evidence against response bias in the life events scores because two members of the same family, independently reporting these events, are in substantial agreement concerning their occurrence. Thus, the correlations between the NINF life events score and the MPQ factors likely represent associations between personality and the occurrence of the events.

Although at least one-half of the phenotypic correlation between life events and personality was attributable to shared genetic influence, most of the genetic influence on personality was not shared with life events. This result is not counterintuitive; it is entirely possible for most of the genetic variance on each of the two traits not to be shared yet for the traits to be correlated genetically (Plomin, 1986). After all, life events scores usually account for no more than 10% of the variance in personality scores (e.g., Henderson *et al.*, 1981); a host of other variables is equally, if not more, associated with individual differences in personality.

In previous studies, negative emotionality and its correlates have been the focus of investigation with respect to life events. This study also provided evidence for the genetic association between nonindependent life events and low constraint. It is quite likely that the attributes which characterize low-constraint individuals, such as impulsivity, recklessness, risk taking, and rebelliousness, induce adverse consequences in the individuals possessing these traits.

Several limitations of this study should be noted. This study used cross-sectional personality data and retrospective, lifetime reports of life events. As a result, it is difficult to make inferences about cause and effect relations between variables. In addition, the sample was limited to one age group and one gender. Generalizations from the findings to other age groups or to female adolescents must be viewed as tentative. Another limitation concerns the limited scope of the life events inventory. As noted, the LEIA does not include distinctly positive events. Further, the items on the LEIA are certainly not an exhaustive list of the possible negative events that may be experienced by adolescents. There are several major content areas that may be underrepresented on the LEIA, including academic difficulties, social and interpersonal problems, parental divorce, and physical and sexual abuse.

A major issue to be addressed in future research is how genetic effects influence negative life events. Detecting genetic effects on negative life events is only one step in this process; how genetic effects are induced for negative life events is the next, perhaps more important step. By examining the genetic relation between negative life events and personality, this study offered one tentative hypothesis: the genetically influenced predispositions of individuals lead them to engage in certain behaviors that bring about undesirable life events. It may be assumed that a process of evocative or active genotype–environment correlation is occurring, whereby the genetically influenced characteristics of the individual are influencing how and which environments are experienced (Scarr and McCartney, 1983). Longitudinal research, incorporating both desirable and undesirable life events, is imperative for both the validation and the generalization of the directionality underlying this assumption.

APPENDIX: ITEMS FROM THE LIFE EVENTS INTERVIEW FOR ADOLESCENTS (LEIA)

Family Life Events (FAM; 28 Items)

1. Has your family ever moved to a new house or apartment?
2. Was your family ever evicted from a house or apartment?
3. Have you ever moved to a new school district?
10. Have any of your pets died?
11. Have any of your close relatives died?
12. Did you ever go to live with another parent or guardian?
15. Have any of your brothers or sisters ever run away from home?
16. Has your family ever had problems with money?
17. Has your family ever received money from a government agency (welfare, food stamps, AFDC, disability)?
18. Have there been times when your parents (or other adults living in your home) argued a lot?
19. Have your parents ever lived apart because they couldn't get along?
20. Have your parents ever dated other people?
21. Has a new adult come to live with your family?
22. Have either of your parents not been available very much?
23. Have any of your brothers or sisters not been available very much?
35. Have any of your brothers or sisters gotten into trouble because of their use of drugs or alcohol?
36. Has your mother ever had trouble because of her use of drugs or alcohol?
37. Has your father ever had trouble because of his use of drugs or alcohol?
41. Has your mother or father ever been arrested?
41b. Has your mother or father ever been sent to jail?
42. Have any of your brothers or sisters ever been arrested or sent to jail?
45. Has your mother or father ever been treated for an emotional or mental problem?
46. Has your mother or father ever been hospitalized because of an emotional or mental problem?
47. Have any of your brothers or sisters ever been treated for an emotional or mental problem?
48. Have any of your brothers or sisters ever been hospitalized because of an emotional or mental problem?
49. Has anyone in your family ever tried to kill himself or herself?
50. Has anyone in your family killed himself or herself?
54. Has a member of your family ever been a victim of violence (mugging, sexual attack, or robbery)?

Independent Non-Family Life Events (INF; 9 Items)

7. Have any of your close friends ever moved away?
8. Was a close friend of yours ever seriously ill or injured?
9. Has a close friend of yours died?
24. Has your body begun to change or develop due to puberty?
25. Have you been teased because your body is changing too slowly or too quickly?

26. Have you started wearing braces?
27. Have you started to get pimples?
29d. Did your girlfriend or wife have a miscarriage?
51. Were you ever mugged or robbed?

Nonindependent Non-Family Life Events (18 Items)

4. Have you ever been suspended from school?
5. Did you ever not make an afterschool activity (sport, club, or group) that you wanted to participate in?
6. Have you ever had a serious problem with a close friend?
13. Have you ever moved away from home to live on your own?
14. Have you ever run away from home?
28. Have you started dating?
28b. Have you and a girlfriend ever broke up?
29. Did you ever get your girlfriend or wife pregnant?
29b. Have you become a parent?
29c. Did your girlfriend or wife have an abortion?
30. Have you moved in/begun to live with your girlfriend?
31. Have you gotten married?
32. Have you tried to get a job and failed?
33. Have you started a job?
33b. Have you ever lost a job?
38. Have you ever been in trouble with the police?
39. Have you ever had to go to court?
40. Were you ever sent to a juvenile detention center?

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