Executive Self, Self-Esteem, and Negative Affectivity: Relations at the Phenotypic and Genotypic Level

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Complementary approaches examined the relations among executive self, self-esteem, and negative affectivity. A cross-sectional ($N = 4,242$) and a longitudinal ($N = 158$) study established that self-esteem mediated the relation between executive self and negative affectivity. A 3rd study ($N = 878$ twin pairs) replicated this pattern and examined genetic and environmental influences underlying all 3 phenotypes. Covariation among the 3 phenotypes reflected largely common genetic influences, although unique genetic effects explained variability in both executive self and negative affectivity. Executive self was influenced by shared environmental influences unique from those affecting self-esteem and negative affectivity. Nonshared environmental influences accounted for the majority of variance in each construct and were primarily unique to each. The unique genetic and nonshared environmental influences support the proposition that the executive self, self-esteem, and negative affectivity capture distinct and important differences between people.

Keywords: self-esteem, negative affect, executive self, behavior genetics

The self occupies a prominent role in psychology. Interest in the self has a long history (James, 1890/1955; Mead, 1934; Rosenberg, 1965), and research on the self shows little sign of waning (Baumeister & Vohs, 2004; Leary & Tangney, 2003; Sedikides & Gregg, 2003). Knowledge about the self has been augmented more recently by biologically oriented approaches, such as work on links between the prefrontal cortex and processes involved in self-regulation (Davidson & Irwin, 1999) and work pertaining to genetic influences on self-esteem (Neiss, Sedikides, & Stevenson, 2002). Our investigation complements and extends these approaches by focusing on both phenotypic and genotypic analyses of the self.

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Much of current research on the self in personality and social psychology examines two components of the self-system: executive self and self-esteem. The *executive self* refers to the agentic aspect of the self-system (Baumeister, 1998; Gramzow, Sedikides, Panter, & Insko, 2000; Sedikides & Skowronski, 2003), the part involved actively in monitoring itself, choosing how to behave, and enacting chosen responses. The executive self encompasses several phenomena, including control beliefs, control strategies, and self-regulation. Control beliefs refer to people's conviction that they can control many aspects of their lives (mastery) and their confidence in effecting change (self-efficacy or agency; Bandura, 1986; Lachman & Weaver, 1998). Changing the environment to suit the self (primary control) and changing the self to fit the environment (secondary control) are strategies on which people rely to meet control motivations (Brandstädter, Rothermund, & Schmitz, 1998; Rothbaum, Weisz, & Snyder, 1982; Wrosch, Heckhausen, & Lachman, 2000). Secondary control overlaps with the broader concept of self-regulation, which refers more generally to attempts to alter the self to meet a desired outcome (Baumeister & Vohs, 2003; Tangney, Baumeister, & Boone, 2004). *Self-esteem* is the overall evaluation of the self (Blascovich & Tomaka, 1991; Sedikides & Gregg, 2003), reflecting how much individuals accept and like themselves.

Executive self and self-esteem are two important aspects of the self-system. People are motivated to protect and enhance their

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self-esteem (Sedikides & Green, 2000, 2004; Sedikides & Strube, 1997) as well as to maintain control (Bandura, 1986; Weary, Gleicher, & Marsh, 1993). Questions, however, still remain regarding the functions of the executive self and self-esteem. One possible function for both might be as a protective factor against distress (Metalsky, Joiner, Hardin, & Abramson, 1993; Pyszczynski, Greenberg, Solomon, Arndt, & Schimel, 2004). In the current study, we addressed this broad issue by investigating the relations among executive self, self-esteem, and negative affectivity.

We combined phenotypic and behavioral genetic perspectives to clarify those relations. We carried out a cross-sectional and a longitudinal study in an effort to specify whether executive self or self-esteem is better conceptualized as a mediator in a model with negative affectivity as the outcome. In a third study, we replicated the mediational analysis with a twin sample and investigated the relations among executive self, self-esteem, and negative affect using a multivariate behavioral genetic model. Using the behavioral genetic model, we investigated common genetic and environmental effects linking the three phenotypes.

Study 1

Individuals' experiences and perceptions of the self have clear affective implications. Lack of control and feelings of helplessness put people at an increased risk for depressive symptoms (Chorpita, Brown, & Barlow, 1998; Kistner, Ziegert, Castro, & Robertson, 2001), whereas feelings of mastery are associated with greater life satisfaction (Lachman & Weaver, 1998) and lower occurrence of depressive symptoms (Hobfoll, Johnson, Ennis, & Jackson, 2003). People with higher levels of self-esteem have lower levels of negative affect and higher levels of positive affect (Aspinwall & Taylor, 1992; Tarlow & Haaga, 1996), enjoy greater life satisfaction (Diener & Diener, 1995; Sedikides, Rudich, Gregg, Kumashiro, & Rusbult, 2004), and report lower levels of depressive symptoms (J. E. Roberts, Kassel, & Gotlib, 1995; Sedikides et al., 2004). Both aspects of the self-system—executive self and self-esteem—relate to individuals' overall affective experience. We wished to examine further the contribution of the executive self and self-esteem to negative affectivity.

Despite a rich history of research in these areas, questions remain concerning the origins and nature of the relations between executive self, self-esteem, and negative affectivity. We considered two alternative phenotypic models that speak to these relations. One model posits that self-esteem mediates the link between executive self and negative affectivity. The other model proposes that the executive self mediates the link between self-esteem and negative affectivity. The mediational models allowed us to evaluate whether the influence of the self-system on negative affectivity operates primarily through the direct relation between one aspect of the self-system (executive self vs. self-esteem) and negative affectivity.

Self-Esteem as Mediator

Various viewpoints suggest that self-esteem is related more proximally to negative affectivity than is the executive self. Conceptually, feelings of low self-esteem are seen as both a symptom (American Psychiatric Association, 1994) and a cause (J. E. Roberts & Monroe, 1992) of depression. Several theories of self-esteem highlight links between affect and self-esteem. Terror management theory (Pyszczynski et al., 2004) describes the function of self-esteem as an anxiety buffer to protect psychological well-being; Tesser (2000) conceptualizes affect as a primary mechanism in self-esteem regulation, and sociometer theory views changes in affect as a primary consequence of self-esteem's role as an index of inclusionary fitness (Leary, Tambor, Terdal, & Downs, 1995). Thus, research points to a fundamental link between self-esteem and affect.

Information-processing models of self-regulation (Carver, 1979; Carver & Scheier, 1990) provide a framework for understanding the relation between the executive self, self-esteem, and negative affectivity. Individuals perceive the environment, evaluate the fit between actual and desired states, and attempt to reduce discrepancies. This corresponds to the agentic and self-regulatory aspects of the executive self. Individuals then evaluate the effectiveness of their behavior, assessing whether they have brought the self closer to the desired outcome. Success or failure in meeting individual goals has consequences for self-esteem and, ultimately, overall affective state.

Executive Self as Mediator

The above model provides one plausible explanation of the link between the executive self, self-esteem, and negative affectivity. A case can be made for an alternative model, however. It is possible that aversive social conditions lower self-esteem, but general negative affect ensues because negative self-appraisals lead people to question their ability to change the situation or render them less likely to take action. In other words, executive self is the mechanism through which the self-system influences negative affectivity. Research on depressive mood points to the importance of attributional style and perceived control as potential risk factors (Gotlib & Abramson, 1999). Depressed individuals have lower perceptions of personal control than do nondepressed individuals (Alloy & Abramson, 1982). Decreases in mastery over time are associated with increased depressive mood (Hobfoll et al., 2003). We might expect, therefore, that weaker functioning of the executive self explains the link between self-esteem and negative affectivity.

Overview

In Study 1, we focused on observed relations between the self and negative affectivity. We addressed several relevant questions. First, is the executive self associated with negative affectivity? Second, is self-esteem associated with negative affectivity? Third, how do the executive self and self-esteem relate jointly to negative affectivity? In particular, does one mediate the effects of the other?

Method

Sample and Procedure

Participants for the analyses were drawn from the National Survey of Midlife Development in the United States (MIDUS). This is a study of a nationally representative sample sponsored by the John D. and Catherine T. MacArthur Foundation Research Network on Successful Midlife Development (Brim et al., 2000). The MIDUS survey was administered to 7,189 noninstitutionalized, English-speaking adults between the ages of 25 and 74 years. The 7,189 participants comprised three subsamples: 4,242 adults

obtained through a random-digit dialing (RDD) process (the RDD sample), 951 siblings of RDD participants, and 1,996 twins (MIDMAC, 2000). In Study 1, we used the RDD sample. Of these participants, the average age was 46.37 years ($SD = 13.37$), with ages ranging from 25 to 74 years. The majority (74%) of participants were of White ethnicity. Of the participants, 51% were men. Participants reported relatively high levels of education: 62% had at least some college education. Most participants were married (61%); an additional 19% were divorced or separated, 14% were never married, and 6% were widowed.

Measures

The MIDUS survey included a large number of psychological, health, social, and demographic variables (MIDMAC, 2000). Participants were asked some questions during an initial phone interview. The majority of data came from questionnaires mailed subsequently to participants. We drew on variables that matched our theoretical interest—namely, executive self functioning, self-esteem, and negative affectivity. We used exploratory factor analysis to provide empirical guidance concerning the suitability of our composite scales. We describe this process in more detail in the *Results* section.

Executive self. We selected variables to capture the agentic and self-regulatory functions of the executive self (Baumeister, 1998). We identified three scales that assessed control over the self and environment: Mastery, Persistence in Goal Striving/Primary Control, and Reappraisal/Secondary Control. Mastery contained four items assessing general sense of efficacy in carrying out goals (Lachman & Weaver, 1998). Persistence in Goal Striving consisted of five items reflecting persistence in the face of obstacles. Theoretically, this measure assesses use of a primary control strategy to change the external world to fit with own needs and desires (Wrosch et al., 2000). Reappraisal included four items reflecting compensatory control strategies that protect the self (i.e., secondary control; Wrosch et al., 2000). A full list of items is available on request from Michelle B. Neiss.

Self-esteem. We assessed self-esteem with four items: three items from the Personal Acceptance subscale of Ryff's (1989) psychological well-being and one item measuring satisfaction with self. These items tap into participants' self-appraisals.

Negative affectivity. For this study, we conceptualized negative affectivity as a general dispositional tendency to experience negative mood (Watson & Clark, 1984). Several subscales indexed general negative affectivity: Neuroticism, Depressive Symptoms, and Negative Affect. Neuroticism, drawn from the personality scales that were constructed for the MIDUS survey, consisted of four adjectives (Lachman & Weaver, 1997). Depressive symptoms indicate the number of symptoms that participants experienced over a particular 2-week period. Negative affect was assessed with six-item scales developed specifically for the MIDUS questionnaires (Mroczek & Kolarz, 1998). Participants indicated how often they felt each emotion over the past 30 days. The scales included emotions across a range of intensity and were developed with item response models and factor analysis (Kessler et al., 2002).

Results

Exploratory Factor Analysis

After identifying items that met our theoretical conceptualization of executive self, self-esteem, and negative affectivity, we sought empirical validation of the potential composite variables. We performed factor analysis on items from each scale separately. We z scored all items prior to factor analysis to handle different response scales.

Executive self. We entered items from the three scales (Mastery, Persistence in Goal Striving/Primary Control, and Reappraisal/Secondary Control) into a principal components factor analysis with varimax rotation. The results yielded three factors with eigenvalues greater than one, each one corresponding to a different scale. However, the first factor accounted for the majority of variance explained (37%) with an eigenvalue greater than four. Inspection of the scree plot demonstrated that the first factor was the primary factor. In both a three-factor or two-factor solution, several items loaded equally on all factors or moderately (greater than .30) on a second factor, suggesting that neither of these solutions was entirely clean. Given these findings, we adopted a one-factor solution as best describing the relation among the items. Table 1 shows the items and factor loadings for a one-factor solution. We kept all items for the executive self composite scale based on adequate factor loadings in this solution.

Self-esteem. A principal components analysis of the four self-esteem items yielded only one factor with an eigenvalue greater than one, which accounted for 53% of the variance. Factor loadings for the self-esteem items are shown in Table 2. We concluded that these four items tapped a single underlying dimension of self-esteem.

Negative affectivity. A principal components analysis of the negative affect, neuroticism, and depressive symptom items yielded two factors with eigenvalues greater than one. However, the first factor accounted for 45% of the variance, and inspection of the scree plot demonstrated that the first factor was the primary factor. In addition, a few items loaded equally on both factors, suggesting that a two-factor solution was not entirely clean. Given these findings, we adopted a one-factor solution as best describing the relation among the items. Table 3 shows the items and factor loadings for a one-factor solution. We kept all items for the full negative affect composite scale based on adequate factor loadings in this solution.

Mediational Analysis

We created composite scales by taking the mean z score of items for each subscale. We used a log transformation to reduce the influence of outliers for all three variables (Tabachnick & Fidell, 2001).

We tested alternate models in which executive self versus self-esteem played a mediational role. Table 4 presents the results from

Table 1
Factor Loadings: Executive Self Items, One-Factor Solution in Study 1

Item	Factor 1
Mastery: I can do anything I want	.59
Mastery: I find a way to succeed	.57
Mastery: I determine what I am able to get	.47
Mastery: Future depends on me	.43
Persist: Where there's a will	.68
Persist: Change for better	.70
Persist: Get lots done	.54
Persist: Solve problems	.68
Persist: Rarely give up	.60
Reappraisal: Learn from difficulties	.60
Reappraisal: Different way of looking at things	.59
Reappraisal: Find bright side	.69
Reappraisal: Find positive	.68

Table 2
Factor Loadings: Self-Esteem Items, One-Factor Solution in Study 1

Item	Factor 1
I like my personality	.71
Pleased with my life story	.80
Disappointed with life	.68
Satisfied with self	.71

two series of hierarchical regression analyses. In each set of hierarchical regressions, the independent variable was entered in Step 1, and the mediator was added in Step 2 (Baron & Kenny, 1986). Both executive self ($\beta = -.34$, $p < .001$) and self-esteem ($\beta = -.53$, $p < .001$) were related to negative affectivity in separate bivariate regressions (Step 1). People reporting weaker executive self or lower self-esteem also reported higher negative affectivity.

In the second step of the regression analyses, both executive self and self-esteem were entered simultaneously. The top half of Table 4 provides the standardized regression coefficient for a model in which self-esteem served as the independent variable, executive self as the mediator, and negative affectivity as the outcome. The bivariate relation between self-esteem and negative affectivity showed little reduction with the introduction of executive self functioning in Step 2. In contrast, the lower half of Table 4 illustrates that the bivariate relation between executive self and negative affectivity was lowered substantially when self-esteem was introduced into the model. Overall, these results are consistent with the view that self-esteem mediates the relation between executive self and negative affectivity. Although both executive self and self-esteem are related to negative affectivity, the influence of the executive self is accounted for by self-esteem. Lowered self-esteem, then, seems to be the process through which the self-system influences negative affectivity.

Figure 1 illustrates the mediational model with a path diagram. This model shows that participants with stronger executive self also reported higher levels of self-esteem. Higher values of both executive self and self-esteem were associated with higher levels of negative affectivity. Self-esteem did not mediate fully the relation between executive self and negative affectivity, but it did explain a substantial portion of the relation (i.e., $|[.46 \times -.48]|/.34 = 65\%$). In addition, Sobel's test (Baron & Kenny, 1986) indicated that the indirect effect ($a \times b$) was significant ($Z = -20.4$, $p < .001$).

Table 3
Factor Loadings: Negative Affectivity (NA) Items, One-Factor Solution in Study 1

Item	Factor 1
NA: Sad	.75
NA: Nervous	.75
NA: Restless	.71
NA: Hopeless	.77
NA: Everything an effort	.74
NA: Worthless	.75
Neuroticism: Moody	.56
Neuroticism: Worrying	.63
Neuroticism: Nervous	.66
Neuroticism: Calm	.47
Depressive symptoms	.52

Table 4
Study 1: Mediation Regression Analyses With Negative Affectivity as the Dependent Variable

Variable	Step 1 B	Step 2 B
Model 1: Executive self as mediator		
Self-esteem	−.53***	−.48***
Executive self		−.13***
R^2	.28***	.30***
ΔR^2		.02***
Model 2: Self-esteem as mediator		
Executive self	−.34***	−.13***
Self-esteem		−.48***
R^2	.12***	.30***
ΔR^2		.18***

Note. $N = 3{,}674$ individuals. Higher values of self-esteem and executive self reflect more positive views of the self and greater feelings of control, respectively. High values of negative affectivity reflect greater neuroticism, depressive symptoms, and negative affect.
*** $p < .001$.

Discussion

In this study, we examined the phenotypic relation between executive self, self-esteem, and negative affectivity. With negative affectivity as the outcome, we compared the mediational role of self-esteem and executive self. The results suggested that self-esteem mediated the relation between executive self and negative affectivity. Individuals with stronger executive self reported more positive self-views. Also, more positive self-esteem and stronger executive self were related to lower levels of negative affectivity. Furthermore, the direct relation between executive self and negative affectivity was reduced substantially, but not entirely, when self-esteem was included in the model. These findings are consistent with prior research suggesting that weak perceived control/mastery and low self-esteem are risk factors for negative affect or depression (Hobfoll et al., 2003; J. E. Roberts et al., 1995).

The inclusion of a direct measure of executive self provides a unique addition to the existing literature. Although prior research

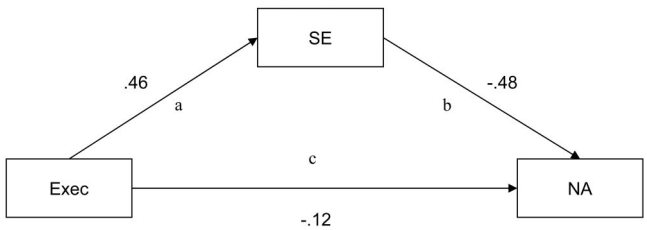

Figure 1. Path diagram illustrating self-esteem (SE) as mediator of relation between executive self (Exec) and negative affectivity (NA): Study 1.

has examined affective correlates of phenomena related to executive self (e.g., attributional style, learned helplessness, self-efficacy), we included a measure that assessed multiple aspects of the executive self. This allows the findings to be placed within a larger theoretical framework. The results indicate that although the agentic aspect of the self-system does relate to affective outcomes, the link is primarily through the evaluative aspect of the self-system (i.e., self-esteem).

The pattern of our results differs from some aspects of previous research, in which hopelessness (Metalsky et al., 1993) or perceptions of control (Scarpa & Luscher, 2002) mediated the link between self-esteem and depressed mood. Nonetheless, our results converge with other lines of research. In a recent review, Baumeister, Campbell, Krueger, and Vohs (2003) concluded that level of self-esteem corresponds to emotional experiences. Pyszczynski et al. (2004) noted that almost all theories of self-esteem suggest a strong link between self-esteem and affect. Our findings add the notion that both aspects of the self-system—executive and evaluative—have affective consequences, although most of them are carried through self-esteem. The underlying psychological process may proceed from behavior to evaluation to affect. That is, people actively engage in behavior and assess the implications of that behavior for the self. Negative evaluations, such as lack of progress toward a goal, may lead to lower self-esteem and then generalized negative affectivity.

Yet, the divergence of our findings from a portion of past literature (Metalsky et al., 1993; Scarpa & Luscher, 2002) may reflect our conceptualization of executive self and negative affectivity, or it may reflect the cross-sectional nature of the Study 1. The cross-sectional, self-report nature of our study constrains our ability to make causal conclusions from these results. In addition, we were unable to examine more complex processes. For example, low self-esteem may contribute to weak executive self functioning over time. In turn, weak executive self functioning may play an important direct role in the persistence of depressive symptoms. The following longitudinal study was designed to address these potential limitations.

Study 2

The findings from Study 1 suggest that, in a cross-sectional analysis, self-esteem mediates the effects of executive self on negative affectivity. To examine whether these relations are robust, we applied a more stringent test using longitudinal data from a separate sample. The data set allowed the testing of the effects of executive self and self-esteem measured at two earlier time points on negative affectivity measured later.

Method

Sample and Procedure

Participants were married couples who took part in a three-phase longitudinal study of marital relations. The questionnaires described below were administered at three time points, with each time point separated by 4 months. A total of 79 couples participated at Time 1, 67 couples at Time 2, and 54 couples at Time 3. With the exception of one lesbian couple, the couples were involved in heterosexual marriages. Participants were recruited through advertisements in local newspapers and notices posted around the University of North Carolina at Chapel Hill campus. Announcements briefly described the project, indicated that the study involved three research sessions over an 8-month period, noted that couples would be paid $50 for taking part in each session, and provided contact information. When couples contacted us, we provided further information about project activities, determined whether couples wished to take part, and scheduled appointments for Time 1 sessions.

At Time 1 of the study, the average age of these participants was 33.85 years (SD = 10.77), with ages ranging from 22 to 76 years. The majority (80%) of participants were of White ethnicity. The majority had at least 4 years of college education (45% obtained advanced or professional degrees, 37% completed 4 years of college, 10% completed 2 years of college, and 8% completed high school only). Their personal annual salaries averaged about $25,000; the relatively low mean salary reflects the sizable proportion of participants who were pursuing graduate degrees. Participants had been married to one another for 5.94 years on average, and the majority did not have children (73% no children, 11% one child, 8% two children, 8% more than two children).

Measures

We followed the same procedure in each time point. Ten days prior to scheduled laboratory sessions, we mailed couples questionnaires to be separately completed in advance and brought to the session. These questionnaires included measures of self-esteem, executive self, and negative affectivity. On arrival at the laboratory, participants completed activities irrelevant to the purpose of this study. For the first two time points, couples were partially debriefed, reminded of upcoming project activities, paid, and thanked for their assistance. Finally, during the final time point, couples were thoroughly debriefed, paid, and thanked for their assistance.

Executive self. To measure executive self, we used an 11-item abbreviated version of a dispositional measure of self-control (Tangney et al., 2004). This instrument assesses individual differences in the ability to exert self-control over various domains in a person's life and has good internal consistency: α (for three time points, respectively) = .82, .80, and .82. Example items include questions about experienced difficulty breaking bad habits or a wish for greater self-discipline. Responses range from 0 (*do not agree at all*) to 8 (*agree completely*).

Self-esteem. We measured self-esteem with one of the most frequently used means of assessing this construct, Rosenberg's (1965) 10-item instrument (0 = *do not agree at all*, 8 = *agree completely*; α [for three time points, respectively] = .89, .89, and .90).

Negative affectivity. We measured negative affectivity through assessment of psychological adjustment using a subset of Derogatis's (1994) Symptom Checklist–90–R. This instrument consisted of combination of the 13-item Depression subscale and the 10-item Anxiety subscale, in which participants rated the degree to which they experienced each of 23 symptoms during the past 4 months (e.g., loss of sexual interest or nervousness; 0 = *not at all*, 8 = *extremely*; α = .94 for all three time points).

Results and Discussion

We tested the mediation models using linear regression in Stata 8.4 (Stata Corporation, 2004). The design of the marital study was based on couples; hence, the individuals entering the analysis were not independently sampled. Accordingly, we adopted the Huber–White sandwich estimator procedure when the standard errors of the regression estimates were calculated (Maas & Hox, 2004).

The longitudinal nature of the data in the marital study allowed the mediation models to be tested with measures taken at three separate time points. There were 105 participants with data on all these measures at all three time points. In the first analysis, we examined executive self scores at Time 2 as a potential mediator of the effects of self-esteem at Time 1 on negative affectivity at Time 3 (see Model 1, Table 5). The results show that executive self at

Table 5
Study 2: Mediation Regression Analyses With Negative Affectivity at Time 3 as the Dependent Variable

Variable	Step 1 B	Step 2 B
Model 1: Executive self at Time 2 as mediator		
Self-esteem at Time 1	−.51***	−.45***
Executive self at Time 2		−.14
R^2	.25***	.26***
ΔR^2		.01
Model 2: Self-esteem at Time 2 as mediator		
Executive self at Time 1	−.33***	−.15
Self-esteem at Time 2		.40***
R^2	.11***	.23***
ΔR^2		.12***

Note. $N = 105$ individuals. Tests of significance are based on Huber–White sandwich estimators of the standard errors of regression coefficients. Higher values of self-esteem, executive self, and negative affectivity reflect higher levels of each construct.
*** $p < .001$.

Time 2 had no effect (in addition to that of self-esteem at Time 1) on negative affectivity at Time 3. By contrast, there is clear evidence that, in this longitudinal analysis, self-esteem carried the effects of executive self at Time 1 on negative affectivity at Time 3 (see Model 2, Table 5). The full mediation model is shown in Figure 2. Sobel's test (Baron & Kenny, 1986) revealed that the indirect effect ($a \times b$) was significant ($Z = -3.19$, $p < .001$).

In summary, we examined the phenotypic relation between executive self, self-esteem, and negative affectivity. With negative affectivity as the outcome, we compared the mediation role of self-esteem and executive self over time. The pattern of results replicates that from Study 1. The mediation of the effects of executive self on negative affectivity is via self-esteem. This pattern held for singletons in Study 1 and for couples in Study 2. The additional use of longitudinal data in Study 2 strengthens confidence that self-esteem accounts for the majority of the relation between executive self and negative affectivity. The possible origins of these relations in biological and experiential factors were investigated in the next study.

Study 3

We sought to extend further the analyses of the relations among executive self, self-esteem, and negative affectivity by identifying genetic and environmental sources of covariation among the three. To do this, we used a multivariate behavioral genetic approach to identify genetic and environmental effects linking the three aspects. This approach allowed us to address more complex questions. Do these three share common genetic antecedents or are genetic influences unique to each? Are the environmental effects present primarily shared or nonshared influences? Do environmental effects reflect a common influence on executive self, self-esteem, and negative affectivity, or are environmental effects more specific to each? The answers to such questions can guide research and theories concerning the etiological underpinnings of these variables. Furthermore, this approach integrates a genetic perspective with a social/personality psychological view on the self. Incorporating both perspectives deepens our understanding of the self.

Behavioral genetic studies allow researchers to identify genetic and environmental sources of variance in a variable. Genetic effects include all those influential factors with an origin in genetic differences between people (Reiss, 1995). Environmental sources include shared environmental effects that serve to make siblings more alike, and nonshared environmental effects that make siblings differ and are person specific. Multivariate behavioral genetic analyses go beyond apportioning the variance of a specific behavior into genetic and environmental components by identifying the sources of *covariance* between multiple phenotypes (Neale & Cardon, 1992). That is, the covariance between two or more characteristics can be due to common genetic influences or common environmental influences. Common influences within the multivariate models reflect genetic or environmental influences that affect multiple phenotypes. For example, a common genetic factor may influence the executive self, self-esteem, and negative affectivity all together, or each may show separable unique genetic influence.

Identifying the source of covariation between phenotypes can be an initial step in understanding underlying causal processes. A common shared environmental effect for executive self, self-esteem, and negative affect might imply that warm and responsive parental treatment serves to facilitate greater feelings of mastery, to promote a more positive self-image, and to protect against negative feelings in general. Alternatively, overcontrolling parents may foster a sense of helplessness (Chorpita et al., 1998), whereas warm parents may foster higher self-esteem. In other words, the pattern of genetic or environmental covariation between executive self, self-esteem, and negative affectivity may provide clues to shared or distinct etiology.

Genetic effects may map onto multiple behaviors and traits. Common genetic effects may point to an underlying common temperamental core for various constructs. Some researchers have questioned whether many related personality traits are in fact measures of the same underlying core construct (Judge, Erez, Bono, & Thoresen, 2002; Watson & Clark, 1984). Judge et al. (2002) found that self-esteem, locus of control, self-efficacy, and neuroticism were all markers of a higher order construct. This higher order construct, postulated to represent a broader view of neuroticism, accounted for much of the variance in each of the variables. Similarly, Watson, Suls, and Haig (2002) argued that self-esteem and depression form two ends of a bipolar continuum, itself a lower order level of the personality dimension of neuroti-

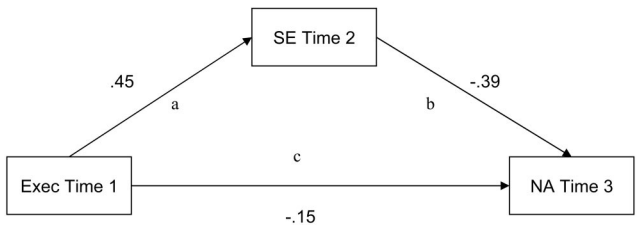

Figure 2. Path diagram illustrating self-esteem (SE) as mediator of relation between executive self (Exec) and negative affectivity (NA): Study 2.

cism/negative affectivity. It may be that innate, heritable differences account for a large portion of the overlap between self and affective constructs by their influence on the higher order factors. The presence of a common, genetically influenced temperamental core may result in researchers imbuing phenotypic correlations (including those in Studies 1 and 2) with a misleading causal interpretation. Behavioral genetic analyses provide one method of probing further the nature of the relations underlying multiple personality traits.

Prior behavior genetic research on the self-system and affectivity comes largely from univariate studies. Such research points to substantial genetic influence on self-esteem and various indices of negative affectivity but does not address the relations among executive self, self-esteem, and negative affectivity. Genetic influences explain typically 30%–50% of the variance in self-esteem, with the remaining portion attributable to nonshared environmental influences (Neiss et al., 2002; Neiss, Sedikides, & Stevenson, in press). Neuroticism (Pedersen, Plomin, McClearn, & Friberg, 1988), depressive symptoms (S. B. Roberts & Kendler, 1999), and negative affect (Baker, Cesa, Gatz, & Mellins, 1992) show similar patterns, with genetic influences explaining a substantial portion of the variance and nonshared environmental influences explaining the majority of variability between people. Fewer studies have examined genetic influences on executive self. Finkel and McGue (1997) reported that genetic influences accounted for 30%–50% of the variance in social potency (i.e., forcefulness, decisiveness) and control (i.e., careful, rational), two characteristics somewhat related to executive self. They did not find evidence for shared environmental influences on these two personality characteristics, but nonshared environmental influences were substantial.

In an attempt to address the genetic relation between self-esteem and depression, Kendler, Gardner, and Prescott (1998) reported that the genetic influences on self-esteem remain even after controlling for depressive symptoms. This research supports the idea that self-esteem is separable from negative affect at a genetic level but does not model directly the genetic and environmental links between the two. In general, univariate approaches provide little insight into the connections between phenotypes. In one multivariate analysis, S. B. Roberts and Kendler (1999) examined the covariation among self-esteem, neuroticism, and depression. A common genetic factor among all three explained most of their covariation. After taking into account this common genetic factor, neuroticism showed a separate genetic link to depression. Self-esteem, however, showed no remaining genetic link with depression. In other words, the genetic link between self-esteem and depression was accounted for entirely by genetic influences that had an impact on all three phenotypes. Additional genetic influences linked neuroticism and depression. This pattern suggests a greater role for genetics in the association between neuroticism and depression than between self-esteem and depression. The study found no evidence for shared environmental effects. There was a link between the nonshared environmental influences on neuroticism and those on self-esteem, but the majority of nonshared environmental influences were unique to each phenotype. Thus, it may be that unique events in people's lives influence neuroticism and self-esteem separately. However, interpretation of nonshared environmental effects must be made somewhat cautiously, as estimates of nonshared environment include measurement error.

Little other research speaks to the genetic and environmental architecture underlying executive self, self-esteem, and negative affectivity. A study of identical female twins discordant for depression found that the depressed twin also reported lower self-esteem and less mastery (Kendler & Gardner, 2001). Given that the identical twins shared all their genes and were raised in the same family, these results raise the possibility that nonshared environmental influences mediate the association between the self and negative affectivity. However, the study did not assess specifically the extent of nonshared environmental influences common to the self and negative affectivity.

We used a multivariate behavior genetic design to investigate the genetic and environmental links underlying executive self, self-esteem, and negative affectivity. This approach apportions the covariance between variables into genetic and environmental components. In doing so, the analysis provides insight into possible common origins of the different aspects of the self-system and negative affectivity. The analysis can identify points of uniqueness as well, with the potential to detect genetic and environmental factors affecting primarily one phenotype.

Method

Sample and Procedure

We used the twin sample from the MIDUS survey. Twins were recruited in a separate two-part sampling design. A representative national sample of approximately 50,000 households was screened for the presence of a twin. Cooperating twins provided contact information for their cotwins. An initial phone interview of twin participants assessed self-reported zygosity and served as a recruitment attempt. To assist in genotyping cases of uncertain zygosity, twins were asked to supply DNA samples from inside cheek scrapings. Twin participants were contacted a second time for a longer phone interview and were then mailed the MIDUS questionnaire.

A total of 998 twin pairs were recruited for the MIDUS survey, consisting of 910 pairs of discernible zygosity. Twin pairs of unknown zygosity were not included in this analysis. In some cases, multiple twin pairs from the same family participated. We limited our sample to only one pair per family. When multiple pairs from a family completed both the telephone and questionnaire, we chose one pair at random. If some pairs within a family included individuals who failed to return the survey, then preference was given to a pair in which both twins completed the survey. This selection process yielded a sample of 878 pairs: 344 identical or monozygotic (MZ) twin pairs (160 female pairs, 184 male pairs) and 534 fraternal or dizygotic (DZ) twin pairs (189 female pairs, 115 male pairs, 230 mixed-sex pairs). The average age of these participants was 44.82 years (SD = 12.07), with ages ranging from 25 to 74 years. The majority (94%) of participants were of White ethnicity. Of the participants, 44% were men. Participants reported relatively high levels of education: 59% had at least some college education. Most participants were married (72%); an additional 13% were divorced or separated, 12% were never married, and 3% were widowed.

Measures

Measures were identical to those used in Study 1. Similarly, we used a log transformation to reduce the influence of outliers for all three variables (Tabachnick & Fidell, 2001). We dropped two MZ twins whose z scores on one or more variables were less than 3.5 after transformation.

Results and Discussion

Gender and age effects can serve to increase twin resemblance. Age was related to both self-esteem (r = .09, $p < .001$) and

negative affectivity ($r = -.16$, $p < .001$). Older adults reported higher levels of self-esteem and lower levels of negative affectivity. Gender was significantly related to negative affectivity, with women reporting greater negative affectivity, $t(1587) = -2.17$, $p < .001$. Therefore, we controlled for the main effects of age and gender. Nevertheless, the presence of significant gender differences in negative affectivity rendered problematic the inclusion of opposite-sex DZ pairs in the analyses. Subsequent behavioral genetic analyses include only same-sex DZ pairs.

Mediational Analysis

The first step in the analyses involved investigating the phenotypic relation among executive self, self-esteem, and negative affectivity to test the mediational model proposed in Study 1 and tested longitudinally in Study 2. As in Study 2, we tested the mediation models using linear regression in Stata 8.4 (Stata Corporation, 2004). The twins were not independently sampled. Accordingly, we adopted the Huber–White sandwich estimator procedure when the standard errors of the regression estimates were calculated (Maas & Hox, 2004). We analyzed data from both members of the twin pair. We tested alternate models in which executive self or self-esteem played a mediational role. Table 6 presents the results from two series of hierarchical regression analyses. The results replicated our previous findings in Studies 1 and 2: Self-esteem mediated the relation between executive self and negative affect. As found previously, individuals reporting weaker executive self or lower self-esteem also reported greater negative affect (see Figure 3).[1] Sobel's test indicated that the indirect effect was significant in this sample as well ($Z = -10.99$, $p < .001$).

Behavior Genetic Analyses

Next, we investigated the genetic and environmental influences on executive self, self-esteem, and negative affectivity. Our ultimate goal was to understand the genetic and environmental connections among the variables. Before conducting multivariate analyses, however, we carried out preliminary univariate behavior genetic analyses.

Table 6
Study 3: Mediation Regression Analyses With Negative Affectivity as the Dependent Variable

Variable	Step 1 B	Step 2 B
Model 1: Executive self as mediator		
Self-esteem	−.45***	−.42***
Executive self		−.07*
R^2	.20***	.23***
ΔR^2		.03
Model 2: Self-esteem as mediator		
Executive self	−.28***	−.07*
Self-esteem		−.42***
R^2	.09***	.23***
ΔR^2		.14***

Note. $N = 1{,}296$ individuals. Tests of significance are based on Huber–White sandwich estimators of the standard errors of regression coefficients. Higher values of self-esteem, executive self, and negative affectivity reflect higher levels of each construct.
* $p < .05$. *** $p < .001$.

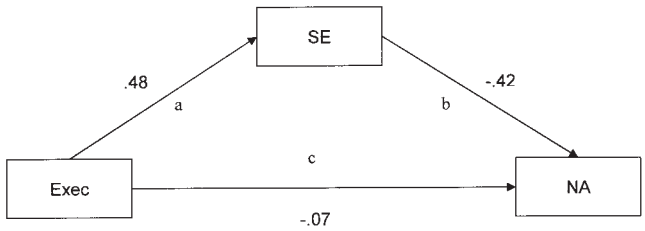

Figure 3. Path diagram illustrating self-esteem (SE) as mediator of relation between executive self (Exec) and negative affectivity (NA): Study 3.

The logic underlying this type of twin study relies on the comparison of similarity between MZ twins and DZ twins. MZ twins share all genes that vary between individuals, whereas DZ twins share, on average, half of those genes. Twins reared in the same family are assumed to be influenced equally by those environmental influences that increase similarity among siblings (*equal environment assumption*). Given that siblings are equally influenced by shared environment, if MZ twins are more alike than DZ twins, then this pattern can be attributed to their greater genetic resemblance, thus providing evidence for heritable influences. If, however, the MZ twins are no more similar than the DZ twins, then there is no evidence for heritable influences on the trait.

Table 7 presents descriptive information and correlation matrices separately for DZ and MZ twins. Bold lines demarcate the cross-twin correlations, both within and between traits. Focusing on the cross-twin correlations within each variable (along the diagonal of the dotted box, outlined by single lines), reveals that MZ twins resembled each other to a greater degree than did DZ twins. This pattern provided preliminary evidence for genetic effects on executive self, self-esteem, and negative affectivity.

Structural equation models provided estimates of the proportion of variance attributable to genetic (a), shared environmental (c), or nonshared environmental (e) influences. Nonshared environment includes influences that make siblings dissimilar, as well as measurement error. Table 8 presents model fitting results, parameter estimates, and confidence intervals for the estimates. In each case, genetic influences explained a substantial portion (38%–44%) of the differences between individuals in executive self, self-esteem, and negative affect. Nonshared environmental influences explained the largest proportion of variance in all three models. The model did not fit well to self-esteem, as evidenced via a significant chi-square. Dropping the shared environment path, however, did

[1] Although we acknowledge the complexity of the relation between negative affect and positive affect, we wish to point out that our affect measures were not intended to follow Watson, Clark, and Tellegen's (1988) formulation of positive affect and negative affect. Nevertheless, in all three studies, indices of positive affect or subjective well-being behaved virtually identical to (albeit in the reverse direction) indices of negative affect in the mediation analyses. Thus, for economy of exposition, we decided to present results with only negative affect rather than provide redundant parallel analyses with both positive and negative affect.

Table 7
Descriptive Information and Twin Resemblance for Executive Self, Self-Esteem, and Negative Affectivity in Study 3

Variable	Exec_1	SE_1	NA_1	Exec_2	SE_2	NA_2
			DZ twins			
Exec_1	—					
SE_1	.37***	—				
NA_1	−.27***	−.44***	—			
Exec_2	.20**	.01	−.11	—		
SE_2	.17**	.14*	−.15**	.49***	—	
NA_2	−.08	−.14*	.24***	−.23***	−.43***	—
M	.09	.06	−.06	−.01	−.02	.02
SD	.94	.87	.97	1.03	.99	.92
			MZ twins			
Exec_1	—					
SE_1	.55***	—				
NA_1	−.33***	−.50***	—			
Exec_2	.41***	.35***	−.26***	—		
SE_2	.30***	.48***	−.32***	.50***	—	
NA_2	−.18**	−.29***	.42***	−.33***	−.51***	—
M	−.06	.01	−.06	−.01	.06	−.01
SD	.97	1.00	.93	1.00	1.00	.91

Note: The correlations demarcated within the bold, solid-line boundary are the cross-twin correlations both within and between traits. Greater monozygotic (MZ) than dizygotic (DZ) values for these correlations indicate the possible role of genetic factors for variance in a trait and in covariance between traits respectively. $Twin_1$ and $Twin_2$ are differentiated by the endings _1 and _2, respectively. $n = 262$ DZ pairs; $n = 310$ MZ pairs (sample size decreased because of listwise deletion of missing data). Exec = executive self; SE = self-esteem; NA = negative affectivity.
* $p < .05$. ** $p < .01$. *** $p < .001$.

produce a model that passed the exact fit test, $\chi^2(4, N = 572) = 8.69$, $p < .07$. In fact, shared environmental influences were not statistically significant in any model and could be dropped from each.

We sought next to ascertain the genetic and environmental architecture underlying the relation among executive self, self-esteem, and negative affect. In a multivariate analysis, the basic logic from the univariate analyses is extended to the overall pattern of relations among variables. Genetic influences on multiple variables in common are implicated when the MZ cross-correlation (i.e., the correlation between one twin's score on a variable with the other twin's score on a second variable) is greater than the DZ cross-correlation. Conversely, if the cross-correlation is similar across MZ and DZ twins, then there is evidence for common shared environmental effects. The cross-correlations can be found within the boxes of Table 7, in the off-diagonal positions. Inspection of the correlations reveals that the MZ cross-correlations are larger than the DZ cross-correlations.

We used a Cholesky decomposition to model the genetic and environmental factors underlying the relations among executive self, self-esteem, and negative affectivity. Figure 4 illustrates our basic model for just one member of a twin pair. A Cholesky decomposition is a triangular decomposition. In this model, the first set of genetic and environmental factors represents factors common to all three variables (a1, c1, e1). The second set of factors underlies only executive self and negative affectivity (a2, c2, e2). The third set of factors represents genetic and environmental influence unique to negative affectivity (a3, c3, e3).

The ordering of variables affects the interpretation of the model (Loehlin, 1996). On the basis of the mediation analysis presented above, executive self was placed second in the order. By doing this, we investigated whether genetic and environmental influences explain any modest direct relation between executive self and negative affectivity after accounting for the genetic and environmental influences that also have an impact on self-esteem. We expected that the effects between executive self and negative affectivity would be relatively small compared with the effects common to executive self, self-esteem, and negative affectivity. This expectation was based on the fact that executive self has little direct relation with negative affectivity. The presence of minimal genetic and environmental influences linking directly executive self and negative affectivity would replicate the findings from the earlier phenotypic analyses. The model fit the data well, as evidenced by a nonsignificant chi-square, $\chi^2(24, N = 572) = 29.34$, $p < .21$, and a low (.03) root-mean-square error of approximation (RMSEA).

Table 9 provides standardized path estimates and total genetic and environmental effects for the full Cholesky model. The column under "Factor 1" refers to the common effects that influence executive self, self-esteem, and negative affectivity. The column under "Factor 2" refers to effects leading to both executive self and negative affectivity, whereas the column under "Factor 3" refers to the effects unique to negative affectivity.

The top third of the table provides the genetic path estimates. The genetic factor common to all three variables shows large-to-moderate genetic loadings (i.e., .43, .65, and −.38, for executive self, self-esteem, and negative affectivity, respectively). The negative loading to negative affectivity reflects the direction of the phenotypic relations: Genetic influences that contribute to higher

Table 8
Univariate Model Fitting Results and Parameter Estimates in Study 3

Variable	χ^2	*p*	df	RMSEA	a^2	95% CI	c^2	95% CI	e^2	95% CI
Executive self	2.74	.43	3	.023	.41	.13–.49	.00	.00–.23	.59	.51–.69
Self-esteem	8.69	.03	3	.062	.45	.28–.52	.00	.00–.14	.55	.47–.64
Negative affectivity	1.21	.75	3	.000	.38	.11–.51	.04	.00–.27	.57	.49–.67

Note. df = degree of freedom; RMSEA = root-mean-square error of approximation; CI = confidence interval; a^2 = genetic influences; c^2 = shared environmental influences; e^2 = nonshared environmental influences.

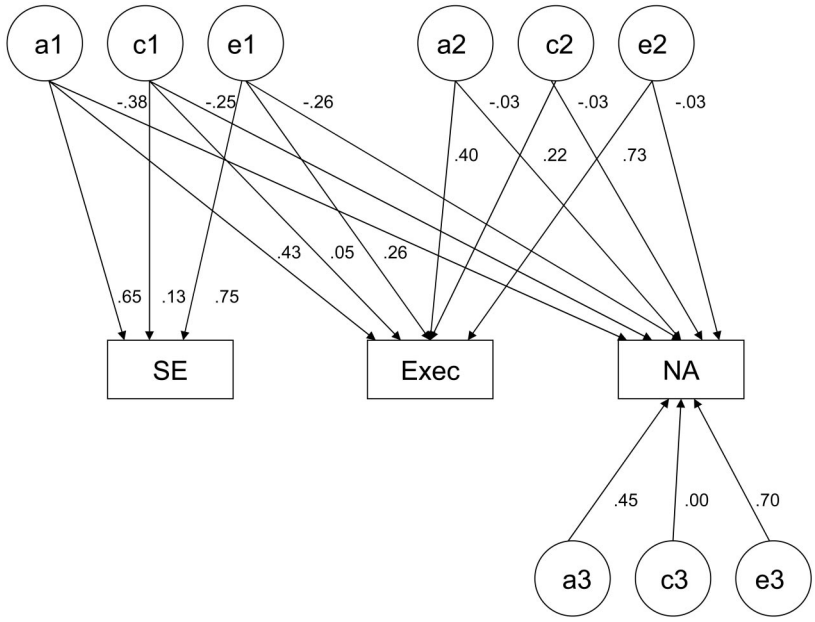

Figure 4. Cholesky model of genetic and environmental factors underlying self-esteem (SE), executive self (Exec), and negative affectivity (NA). In this model, the first set of genetic and environmental factors represents factors common to all three variables (a1, c1, e1). The second set of factors underlies only executive self and negative affectivity (a2, c2, e2). The third set of factors represents genetic and environmental influence unique to negative affectivity (a3, c3, e3).

executive self or self-esteem lead to lower negative affectivity. Although the genetic factor on executive self and negative affectivity shows a moderate loading to executive self (.40), it has a very low loading on negative affectivity (−.03). Stated otherwise, this factor suggests that executive self shows genetic effects separable from those shared in common with self-esteem and negative affectivity. However, the genetic links between executive self and negative affectivity are carried almost entirely by the common genetic factor influencing all three variables. Negative affectivity shows a moderate unique genetic influence (.45). Overall, the

Table 9
Cholesky Model: Standardized Parameter Estimates and Confidence Intervals (CIs) in Study 3

Variable	Factor 1	Factor 2	Factor 3	Total estimate	95% CI around total
	a1	a2	a3	a^2	
Self-esteem	.65			.42	.23–.52
Executive self	.43	.40		.35	.08–.48
Negative affectivity	−.38	−.03	.45	.35	.08–.50
	c1	c2	c3	c^2	
Self-esteem	.13			.02	.00–.18
Executive self	.05	.22		.05	.00–.26
Negative affectivity	−.25	−.03	.00	.06	.00–.29
	e1	e2	e3	e^2	
Self-esteem	.75			.56	.48–.64
Executive self	.26	.73		.60	.52–.70
Negative affectivity	−.26	−.03	.70	.58	.50–.68

Note. In this model, the first set of genetic and environmental factors represents factors common to all three variables (a1, c1, e1). The second set of factors underlies only executive self and negative affectivity (a2, c2, e2). The third set of factors represents genetic and environmental influence unique to negative affectivity (a3, c3, e3). a^2 = total genetic influences; c^2 = total shared environmental influences; e^2 = total nonshared environmental influences.

common genetic factor accounted for a large proportion of the genetic influence on executive self and negative affectivity: 53% of the genetic variance in executive self and 41% of the genetic variance in negative affectivity (because of the constraints of the model, all of the genetic influence on self-esteem is modeled via the common factor).

The middle portion of Table 8 provides the shared environmental estimates. These results suggest that self-esteem and negative affect have common shared environmental influences (c1 paths), whereas shared environmental influences on executive self are separable and unique to executive self. However, these results must be interpreted with caution, as shared environmental estimates were quite small and statistically insignificant. Dropping all six shared environmental paths did not significantly worsen model fit, $\chi^2(30, N = 572) = 29.88$, $p < .47$; Akaike's information criterion = −30.12; RMSEA = .02. The change in chi-square between the full model and one with no shared environmental influence was nonsignificant, which leads us to conclude that shared environmental effects do not explain individual differences in or covariation between executive self, self-esteem, and negative affect.

The last three rows of Table 9 provide the nonshared environmental estimates. The first common nonshared environmental factor showed the strongest effect to self-esteem, with relatively small effects to executive self and negative affectivity. The second factor was largely specific to executive self. Nonshared environmental influences on negative affectivity stemmed primarily from the nonshared factor specific to negative affectivity. Overall, these results suggest that nonshared environmental effects were primarily unique to each variable. The modest overlap present stemmed from the common factor underlying all three.

The total portion of variability ascribed to genetic, shared environmental, or nonshared environmental influences can be calculated by summing the squared path estimates across each row. These totals correspond closely to the univariate analyses. The multivariate model allowed for specification of the genetic and environmental links between the variables. The multivariate analysis used the full set of 15 covariances per zygosity group rather than the single covariances in the univariate analyses. Note that some discrepancy in the magnitude of the relation between executive self and negative affectivity exists because we used different samples for the phenotypic and behavior genetic analyses.

We tested one final model. The pattern of results suggested strongly that the paths between executive self and negative affect were minimal. In fact, we could drop the shared environment paths (as described above) and the remaining direct genetic and nonshared environmental paths between executive self and negative affect (Factor 2 paths) from the model, yielding a reduced model with overall good fit, $\chi^2(32, N = 572) = 32.52$, $p < .44$; Akaike's information criterion = −31.48; RMSEA = .02. In other words, we concluded that executive self does not display any genetic or environmental link with negative affect over and above those effects shared with self-esteem.

General Discussion

One of the difficulties with the literature relating aspects of the self to negative affect is the wide diversity in models concerning the relations among the three aspects. For example, self-esteem has been conceptualized as both cause (J. E. Roberts et al., 1995) and effect (Kistner et al., 2001) of depression, as well as essentially the same as depression (Watson et al., 2002). We sought to illuminate the underlying nature of the covariation between the self-system and negative affect by apportioning the covariance into both common and unique genetic and environmental components. This type of analysis can guide causal hypotheses. For example, if covariation between the three aspects is due to common genetic influences, then it may point to a common genetic risk rather than a causal chain from phenotype to phenotype. Similarly, common nonshared environmental influences may explain the connections between phenotypes.

The behavior genetic analyses provided another layer of complexity to the results. All three phenotypes demonstrated significant genetic influences. This pattern is consistent with previous behavioral genetic research on self-esteem and negative affectivity. The finding that the executive self is genetically influenced represents a novel contribution, in that prior behavior genetic studies have not measured genetic influence on executive self per se. Shared environmental estimates were not significant. These results suggest that genetic influences provide the primary explanation for sibling resemblance in executive self, self-esteem, and negative affectivity. Finally, nonshared environmental influences explained the majority of variance in each variable.

The multivariate analyses help illuminate the sources of covariation between executive self, self-esteem, and negative affectivity. A common genetic factor influencing all three phenotypes showed substantial genetic overlap among them, explaining close to half of the total genetic variance in both executive self and negative affectivity. Much of the covariation among the three aspects can be attributed to these shared genetic influences. One implication of this finding is that specific genes that influence some indicators of negative affectivity, such as depression or neuroticism, may be linked also to executive self and self-esteem. For example, the serotonin transporter gene has been linked to both neuroticism (Jang et al., 2001) and affective disorders (Collier et al., 1996). Possible links between this gene and the self could be explored in future molecular genetic research. The common genetic overlap also provides a cautionary note to causal theories linking the self and negative affectivity. A common genetic risk may provide the primary explanation of the links among executive self, self-esteem, and negative affectivity. This possibility calls for research on the causal links among the three aspects within the framework of a genetically informed design. This could include the study of the changes in negative affectivity, self-esteem, and executive self in MZ twin pairs discordant for severe negative life events. A similar approach has been used to examine the relation among the nature of life events, genetic vulnerability, and anxiety and depression (Eley & Stevenson, 2000). Modeling the common genetic influences allows for greater understanding of how these aspects relate to one another.

The pattern of strong common genetic effects may be seen to support the claim that measures of the self and affectivity assess a higher order common factor (Judge et al., 2002; Watson et al., 2002). The common genetic effects, in particular, may point to an underlying temperamental core to these constructs. However, recognition of the common genetic factor should not overshadow the finding that executive self and negative affectivity were influenced by separate genetic factors. This suggests that, although the three

characteristics share genetic influences, part of what makes them unique lies in genetic influences specific to executive self and negative affectivity.

The lack of shared environmental influences is consistent with a large body of behavioral genetic research. We note that, like all twin studies, these analyses rely on the equal environment assumption: MZ and DZ twins are assumed to be influenced equally by those environmental influences that increase similarity among siblings. In other words, even if parents treat MZ twins more alike than they do DZ twins, perhaps because they look more alike, then this treatment does not explain the greater resemblance among MZ twins. One way to test this assumption is to see whether twins who report greater closeness or more similar treatment in childhood are more alike. Past research using this type of approach supports the equal environment assumption in analyses of both self-esteem (Kendler et al., 1998) and depression (Kendler, Pedersen, Johnson, Neale, & Mathe, 1993), although it has not been studied in measures of executive self.

The equal environment assumption is not violated merely if parents treat MZ twins more alike. Similar treatment may be caused by similarity in child temperament rather than solely the other way around. In fact, past research has shown that parental treatment may be related to child behavior because of genetic reasons (Rowe, 1983). For example, maternal negativity shows evidence of nonpassive, genotype-environmental correlations, whereby mothers seem likely to be responding negatively to their children due more to the child's genetically influenced temperament than to the mother's own temperament or parenting style (Neiderhiser et al., 2004).

The nonshared environmental influences were largely unique to each phenotype, although some modest common effects were present. The common nonshared environmental paths were smaller than the common genetic paths. This pattern suggests that nonshared environmental influences explained less of the covariation among executive self, self-esteem, and negative affectivity. Overall, however, nonshared environmental influences did explain a substantial portion of individual differences in the three aspects. Nonshared environment includes error, so some of the effects may reflect measurement error specific to each variable or even common error. Nevertheless, the substantial magnitude of the nonshared environmental influences suggests generally that much of what explains executive self, self-esteem, and negative affectivity can be ascribed to influences not shared by family members. Furthermore, these influences are primarily unique to each characteristic.

Twin and sibling studies can be useful in identifying specific nonshared environmental effects. The modest common nonshared environmental effects underlying all three aspects may be particularly useful to explore further in future research. It may be through these paths that the effects of warm or controlling parenting will be found. One strategy to identify these effects would be to investigate whether the sibling with weaker executive self and self-esteem, and higher levels of negative affect, also reports more controlling or less warm parental treatment. Plomin, Manke, and Pike (1996) found that, among adolescents, the sibling with a more positive self-concept also reported more positive and less negative parental treatment. Perceived parental control was not related to adolescents' self-worth. Relatedly, Kendler and Gardner (2001) reported that higher levels of paternal protectiveness, maternal protectiveness, and maternal authoritarianism were associated with depression among adult twins. A multivariate design measuring the influence of these parental effects on the self and negative affectivity may help to clarify their common nonshared environmental influences.

Given that participants in our study were adults, nonshared environmental effects may likely be the result of specific events or stressors in their lives. That is, stressors or negative experiences may precipitate weaker executive self, lower levels of self-esteem, and higher levels of negative affect. Future research could investigate this type of hypothesis by combining behavior genetic designs with specific measures of the environment. Kendler and Gardner's (2001) study of adult identical twins discordant for depression found that affected twins reported more frequent stressful life events and less social support from relatives, and they were also more likely to have had a divorce. These effects could plausibly influence the executive self and self-esteem, thus explaining some of the nonshared environmental link among all three aspects. However, exposure to life events can be genetically influenced (Kendler, Neale, Kessler, Heath, & Eaves, 1993). The use of MZ twin pairs could help disentangle genetic and environmental effects. Thus, for example, if one MZ twin experiences a negative life event, then subsequent changes in executive self, self-esteem, and negative affect can be compared with the cotwin. In this type of approach, cotwin controls allow researchers to specify nonshared environmental effects. The use of a genetically informed design would be necessary to evaluate effectively the role of stressful life events in explaining relations among the three aspects.

We expected the links between executive self and affectivity only (i.e., the second grouping of factors in the Cholesky model) to be quite small because of the small direct phenotypic link between executive self and negative affect. This is what we found. Both our genetic and phenotypic analyses, then, support the same conclusion: The relation between executive self and negative affect is mediated by self-esteem.

Conclusion

In three samples recruited separately, we found that self-esteem mediates the relation between executive self and negative affect. The results based on cross-sectional data were supported by an analysis of longitudinally gathered data. The behavioral genetic analyses complemented the phenotypic analyses by providing a greater understanding of the sources of covariation among the three aspects. Much of the correlation between the self and negative affectivity can be ascribed to genetic influences, with substantial genetic overlap among the three aspects. In addition, both the executive self and negative affectivity were influenced by separable genetic factors. Furthermore, nonshared environmental influences were largely unique to each phenotype. These unique influences bolster the notion that executive self, self-esteem, and negative affectivity capture distinct and important differences between people.

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