Effortful Control as a Moderator of Reactive Temperamental Risk for Anxiety and Depression: A Short-Term Prospective Study

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Abstract

The purpose of this study was to examine prospectively a model of risk for anxiety and depression based on reactive and effortful aspects of temperament. Negative affectivity (NA), positive affectivity (PA), attentional control (AC), and anxious and depressive symptoms of 210 participants were monitored at 3 points across an 8-week period. Specifically, Time 1 (T1) AC was predicted to significantly moderate the association of T1 NA with Time 3 (T3) anxious and depressive symptoms when controlling for such symptoms at T1. Additionally T1 AC was predicted to significantly moderate the association of PA with T3 depressive symptoms when controlling for such symptoms at T1. Contrary to predictions, an NA X AC interaction was not found for anxious symptoms. T1 NA was a significant predictor of T3 anxiety regardless of level of AC. Results for depression were more consistent with expectations. However, rather than NA X AC and PA X AC interactions, results revealed a significant NA X PA X AC interaction. Examination of this interaction revealed that AC only significantly moderated the association between NA and depression when PA was high. At lower levels of PA, AC did not moderate the risk for depression associated with heightened NA. Limitations and directions for future research are discussed.

Effortful Control as a Moderator of Reactive Temperamental Risk for Anxiety and Depression: A Short-Term Prospective Study

Anxiety and depression are among the most widespread and potentially debilitating mental disorders, with estimated lifetime prevalence of at least one such disorder being as high as twenty percent (Kroenke et al., 2007). Given their high prevalence and potential human and economic costs, the prevention of such disorders is an important goal. Such a goal requires identification of the factors which predispose some people to develop such disorders. Recently, scholars have emphasized the importance of several interacting temperamental characteristics that appear to be associated with vulnerability to depression and anxiety (Lonigan & Phillips, 2001). Although research to date has supported this model (Lonigan, Vasey, Phillips, & Hazen, 2004), most studies have focused on children. Although several studies provide preliminary support for the value of this model in such adults (Dinovo & Vasey, 2008a; Dinovo & Vasey 2008b), these studies have been limited by their cross-sectional design. To test the long-term potential of the model for the prediction and prevention of anxiety and depressive disorders, more thorough and lengthy research was required. Therefore, the aim of the present study was to provide a longitudinal extension of prior work done by Vasey and colleagues. The results of this study should provide scientists with a better understanding of the pathways involved in the onset and maintenance of anxiety and depression and thus hold important implications for the prevention and treatment of these prevalent and incapacitating disorders.

As this research was designed in order to investigate certain factors involved in the onset and maintenance of anxiety and depression, the disorders must be examined more closely before discussing details of the research. ‘Anxiety’ is defined as the tendency of an individual to worry excessively and also by unnecessary or unnatural preoccupation with specific people, objects, or events (American Psychiatric Association, *Diagnostic and Statistical Manual of Mental*

Disorders, 4th ed., 1994). Examples of anxiety disorders include Generalized Anxiety Disorder (GAD), Obsessive-Compulsive Disorder, Panic Disorder, and phobias. Common symptoms of anxiety are restlessness, irritability, difficulty concentrating, fatigue, muscle tension, and sleep disturbance (*DSM-IV*, 1994). 'Depression', on the other hand, describes a mood disorder that is characterized by feelings of sadness that become a person's overarching state instead of a typical, fleeting mood. Depression disorders such as Major Depressive Disorder, Bipolar Disorders, and Dysphoria are characterized by symptoms such as feelings of unhappiness, altered appetite and sleep patterns, lethargy, feelings of guilt, and possibly suicidal thoughts or tendencies (*DSM-IV*, 1994).

In 2001, Lonigan and Phillips drew on the literature on infant and child temperament to offer a model positing that two reactive temperamental traits, namely negative affectivity (NA) and positive affectivity (PA), interact with one effortful, self-regulatory dimension of temperament (labeled effortful control or EC) to contribute to an individual's level of vulnerability to problematic levels of anxiety and/or depression. NA, which corresponds to the personality dimension of neuroticism, reflects a person's tendency to experience negative emotional reactions to stress; in short, a person who is high in NA is distress-prone. PA refers to an individual's tendency to be actively engaged with rewarding aspects of the environment and highly correlates with the personality trait of extroversion (Lonigan & Phillips, 2001). High levels of PA manifest through energized, enthusiastic, and active behavior, whereas individuals with low PA are not strongly drawn by signals of reward and instead are prone to withdraw from the environment in the face of stress. NA and PA reflect automatic or reactive processes and are stable characteristics which shape the way that individuals interact with and experience their environment. Research has shown that high levels of NA are a risk factor for both anxiety disorders and depression whereas low levels of PA are only a risk factor for depression (Clark, Watson, & Mineka, 1994).

Recent research suggests that EC, a third aspect of temperament, moderates the extent to which an individual is affected by his/her vulnerability associated with high NA and/or low PA (Lonigan et al., 2004; Rothbart & Sheese, 2007). EC represents a person's capacity to override automatic responses and substitute subdominant alternative responses; accordingly, EC reflects an individual's ability to supersede or compensate for automatic emotional reactions through reallocation of attention and resistance of intrusive and negative thoughts (Davidson & Irwin, 1999; Derryberry & Reed, 2002; Jones, Rothbart, & Posner, 2003).

Consistent with the model, previous research has demonstrated that EC moderates the associations of NA with concurrent symptoms of both anxiety and depression. Additionally, EC has been shown to significantly moderate the association between PA and concurrent levels of depression (Lonigan et al., 2004; see figure 1). Anxious symptoms are a result of aversive reactions to stress, which, as previously discussed, is a characteristic of high NA. When an individual is naturally prone to distress and worry, and cannot override these tendencies with effortful control, enduring symptoms of anxiety and depression are likely to develop. Furthermore, because individuals with low levels of EC and high levels of NA are already distress prone, the addition of low PA, or the tendency toward reduced approach or engagement with rewarding aspects of one's environment, may interfere further with healthy coping in response to stress. This combination of temperamental characteristics can make an individual feel overwhelmed and, with the inability to manage pressures due to low EC, consequently experience sadness and feelings of failure or depression.

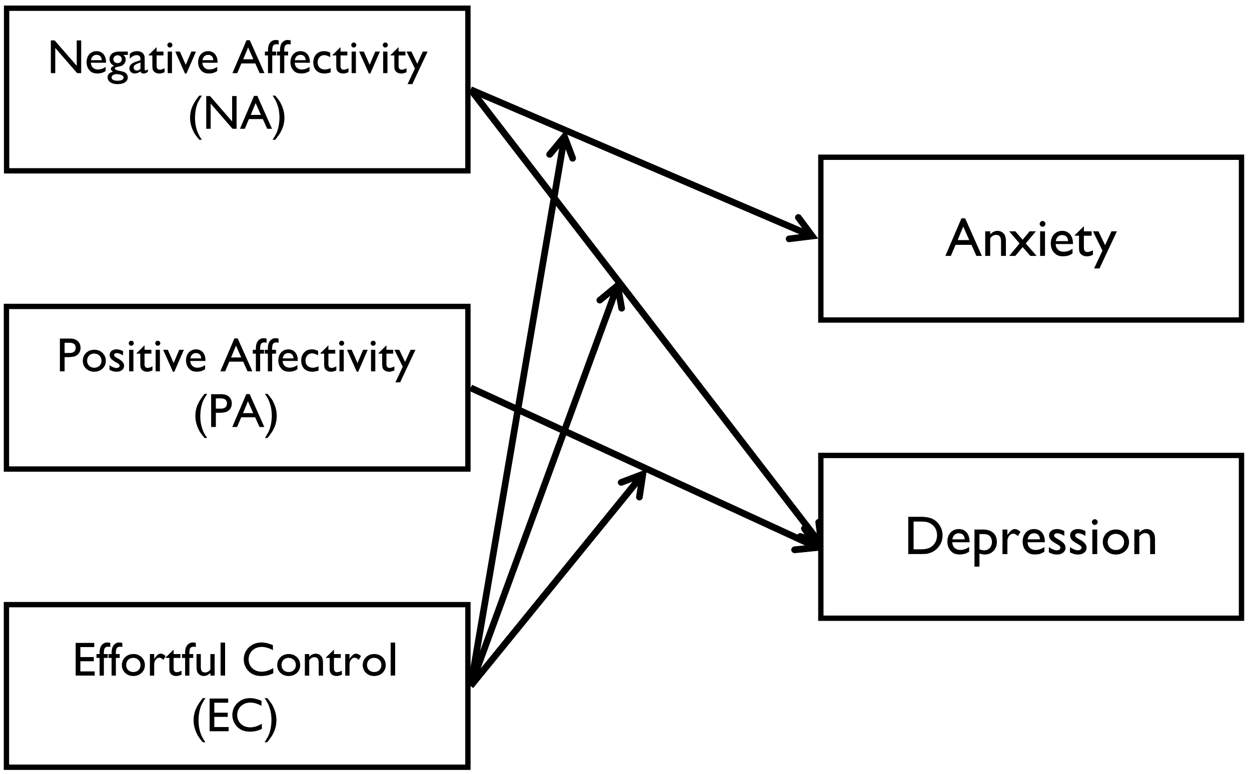

Figure 1. Visual representation of the relationships between NA, PA, and EC/AC, and their subsequent impact on anxious and depressive symptoms as proposed by the model under investigation.

The purpose of this study was primarily to examine the predictive power of this temperamental model of anxious and depressive risk over time. Previous research in the field has applied the model to children and adolescents both cross-sectionally and prospectively, with promising results (Caspi et al., 1995; Lonigan et al., 2004); however, prior to the present research, no adult cohort studies have examined how the model withstands the test of time. Because the model is intended to account for vulnerability to anxiety and depression, it is essential to test the model's ability to predict changes in anxiety and depression prospectively. If two individuals possess similar levels of NA and PA but differ drastically in EC, measurements of their anxious and depressive symptoms over time should also be significantly different. As EC represents the ability to compensate for negative or exaggerated reactions to stress, past research suggests that individuals with higher levels of EC should be more adequately prepared to deal with such stresses as college examinations as opposed to individuals with low EC who are unable to sequester their natural aversive reactions, as long as the individuals are comparable in levels of NA and PA (Caspi et al., 1995). In line with past results, it was hypothesized that low EC participants would become increasingly anxious and depressed as the quarter progressed and introduced new life stresses, but individuals with higher levels of EC would remain more consistent in their levels of anxiety and depression. That is, reactively vulnerable participants with low EC would experience a 'snowball' effect as the quarter continued, becoming more anxious or depressed in response to increasing demands and life trials and tribulations. In contrast, similarly reactively vulnerable participants with higher levels of EC should be better prepared to combat stress and should maintain a more constant level of anxiety and depression across the quarter, potentially even decreasing in anxiety and depression as new classes often introduce additional stresses that can elevate scores at the first testing session.

It is important to note that because attentional shifting and focusing is an essential portion of effortful control, attentional control (AC), the component of EC which directs an individual's attention, may also serve as a temperamental regulator (e.g. Vasey, Lonigan, Hazen, Ho, Hirai, & Anderson, 2002 as cited in Lonigan et al., 2004). Consequently, a measure of AC, the Attentional Control Scale (Derryberry & Reed, 2002), served as the measurement of participant's regulatory capacity in the present study.

These predictions can be demonstrated graphically, as shown in the following figures (see figures 2a, 2b, and 2c).

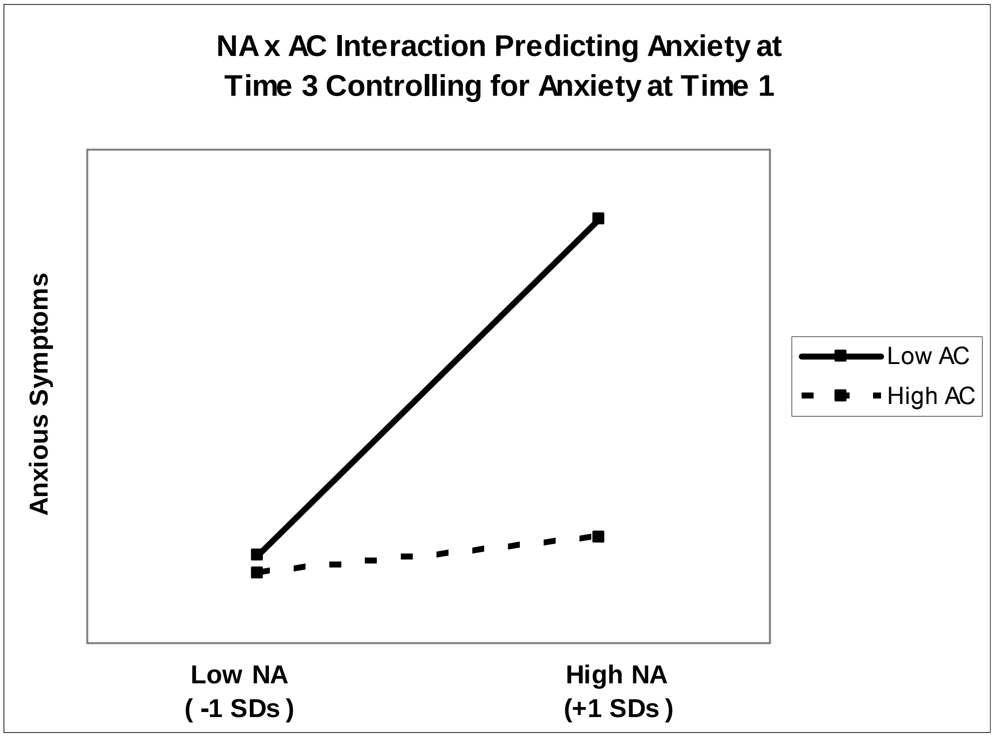

Figure 2a. Predicted NA x AC interaction for anxiety; graphical demonstration of hypothesized change in anxious symptoms over time at varying levels of NA and AC.

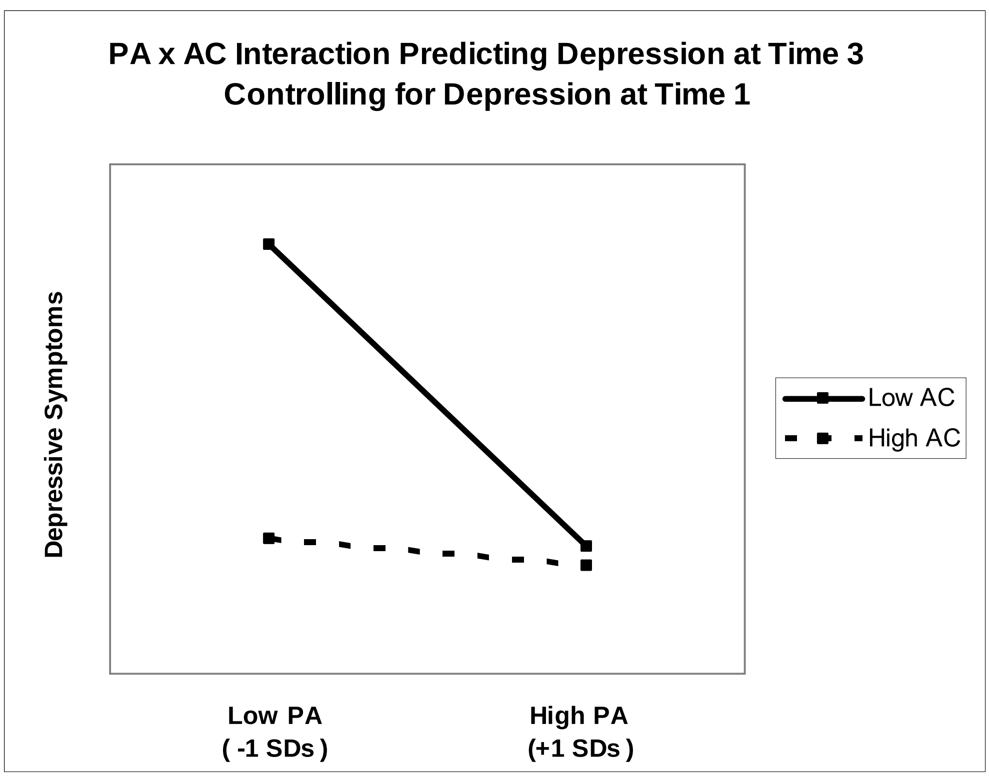

Figure 2b. Predicted PA x AC interaction; graphical demonstration of hypothesized change in depressive symptoms over time at varying levels of PA and AC.

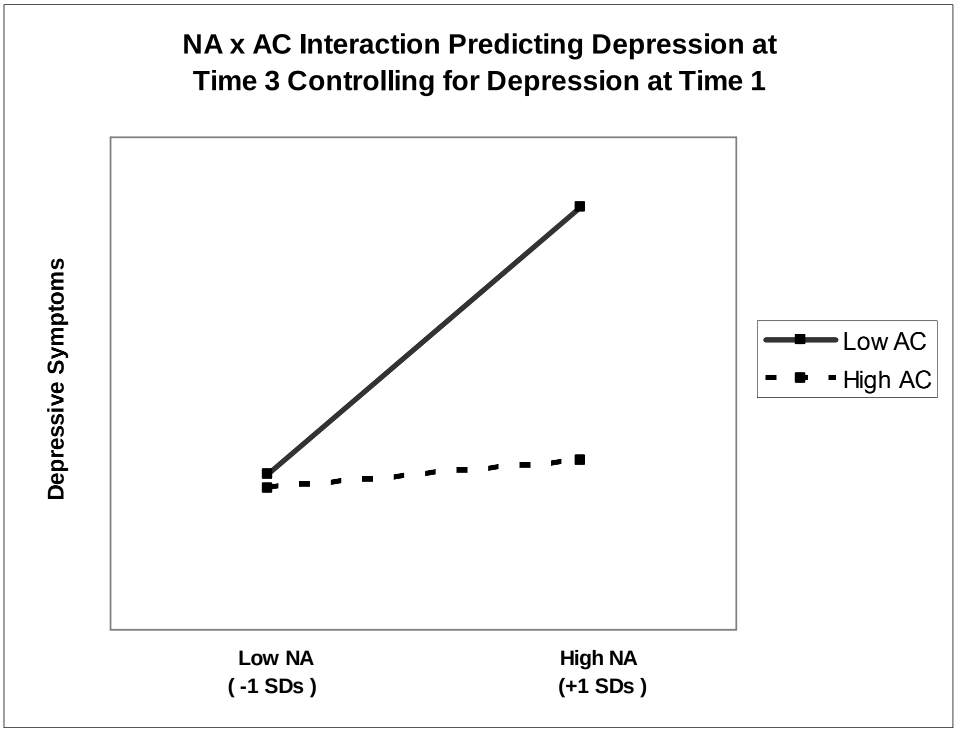

Figure 2c. Predicted NA x AC interaction for depression; graphical demonstration of hypothesized change in depressive symptoms over time at varying levels of NA and AC.

In conclusion, the researcher incorporated results of previous research to predict that participants high in NA at the first study session, or Time 1, would demonstrate the most anxious symptoms at subsequent data sessions (Time 3), participants with high levels of NA *and* low levels of PA at Time 1 would demonstrate the most depressive symptoms at Time 3, and both of these effects would be moderated by the participant's level of AC at Time 1. That is, it was anticipated that a participant with a high level of AC would have the capacity to override NA and PA systems and thus be less vulnerable to experiencing later anxious and depressive symptoms as compared to a participant with similar levels of NA and PA but lower levels of AC. When integrating the effects of time, the researcher hypothesized that only highly vulnerable participants with low levels of AC would significantly differ in their levels of anxiety and depression, and these levels should increase. However, other individuals should have remained relatively unchanged or potentially even have become less anxious or depressed, as hyperarousal experienced at the beginning of a new quarter may inflate initial anxiety and depressive reports. It is my intention to provide longitudinal evidence for this model, filling a gap in past research to bolster support for the present model by strengthening both its reliability and predictive power.

Methods

Participants

Two-hundred ten Ohio State University students who were enrolled in an Introductory Psychology course participated in the study in exchange for course credit. Participants were pre-selected for the study based on their scores on the Attentional Control Scale (ACS; Derryberry & Reed, 2002) in order to ensure that the sample included participants on the extreme ends of the AC distribution, as these individuals are of the greatest interest in this line of research. The ACS consists of 20 items rated on a scale of "1" to "4"; of these items, 11 are reversed during the process of obtaining an individual's total ACS score. Once the appropriate items are reversed, the 20 numerical responses are summed—this sum represents the participant's level of AC, with higher numbers indicating a greater degree of attentional control. Over the course of four OSU academic quarters, 773 individuals were screened to participate in this study. The range of scores was divided into quartiles, and the upper and lower cutoff scores (46 and below to qualify with "low AC", 57 and above to qualify with "high AC") were used to indicate potential participants in each screening sample. Individuals with a score on the ACS that fell in the appropriate ranges were contacted and invited to participate, and only those who accepted the invitation were included in the research sample. Although the tails of the distribution were over-sampled to guarantee that more "extreme" participants were included in the research, the ultimate AC distribution as measured at Time 1 was fairly normal; additionally, levels of NA and PA were allowed to vary freely and these variables also resulted in satisfactorily normal distributions.

Measures

The questionnaire packet consisted of a demographic sheet and ten questionnaires, although only four of them are of interest in the present analysis. The packet always began with the demographic sheet; however, the other ten questionnaires were ordered by chance to counterbalance any effects that one questionnaire may have had on subsequent survey answers.

The demographic questionnaire consisted of four common demographic questions (gender, age, year in school, and race) to be used for comparison in the final analysis. Additionally, the four crucial questionnaires included:

The Attentional Control Scale (ACS; Derryberry & Reed, 2002). The ACS uses 20 items to assess an individual's control of his or her attention, which is a critical aspect of EC. Questions such as "When I need to concentrate and solve a problem, I have trouble focusing my attention" are rated with a four-point scale (1 = "Almost never", 2 = "Sometimes", 3 = "Often", and 4 = "Always"), in order to achieve this goal. The scale is internally consistent (alpha = 0.88), is positively associated with indices of PA (r = 0.40), and is inversely associated with facets of NA (r = - 0.55) (Dinovo & Vasey, 2008b).

The Positive and Negative Affect Schedule – Trait form (T-PANAS; Watson, Clark, & Tellegen, 1988). The T-PANAS measures an individual's trait levels of NA and PA through the evaluation of 20 mood-describing adjectives (e.g. "determined" and "guilty") and how true they are for the participant on a typical basis, or "most of the time". These subscales, rated on a 5-point Likert scale, act as the primary measures of PA and NA in this study. The PA portion of the T-PANAS has displayed internal consistency between 0.88 and 0.90, and the NA subscale's internal consistency ranges from 0.84 to 0.87 (Watson et al., 1988). The PA and NA scales show modest correlations with one another (from -0.12 to 0.23), which indicates discrimination between the two factors. The T-PANAS has shown test-retest reliabilities of 0.68 for the PA subscale and 0.71 for the NA subscale.

The Beck Depression Inventory – Second Edition (BDI-II; Beck, Steer, & Brown, 1996). The BDI-II is a popular measure of depressive symptoms, providing 21 items with scores ranging from “0” to “3”. Each item presents a common tenet of depression, such as “Loss of Pleasure” and “Self-Dislike”, with “0” representing the absence of the symptom and “3” indicating the symptom is both present and very severe. The BDI-II is internally consistent (alphas range from 0.73 to 0.95) and has adequate test-retest reliability at one-week ($r = 0.93$) (Camara, Nathan, & Puente, 2000).

Depression Anxiety Stress Scales (DASS; Lovibond, 1998). The DASS presents 42 items designed to measure the participant’s levels of depression, anxiety (physiological fear symptomology), and stress (nervous tension and energy). Individuals consider experiences from the past week and rate items on a scale of “0” (“Did not apply to me at all”) to “3” (“Applied to me very much, or most of the time”). Reliability of the subscales is considered adequate, with 0.71 for depression, 0.79 for anxiety, and 0.81 for stress (Brown, Chorpita, Korotitsch, & Barlow, 1997).

Procedure

Each quarter, the prescreening questionnaire was distributed to four classes of students, and only students that completed and returned the questionnaire within the given time period (approximately five days) were considered. Of those, approximately one-half would qualify each quarter and be contacted; any students who qualified and wished to participate were included. Of the 773 individuals screened for the study, 385 qualified to participate and were contacted. The students indicated their interest in the study by signing up to attend a session (210 in all)—uninterested parties simply did not schedule an appointment to participate. Ninetyseven percent of participants (204 out of 210) attended the second session and 90% attended the third data collection session (189 out of 210).

The three data collection sessions occurred at weeks 2-3, 5-6, and 8-9 of the ten-week Ohio State University quarter. The first session began with a scripted description of the research study, followed by consent procedures. After the completion of the consent form, participants were secluded and given the questionnaire packet outlined above. At the conclusion of the first session, participants were given a copy of the signed consent form and told to anticipate the second appointment a few weeks later.

At the second session, the script was repeated to ensure that the participants had not forgotten the important information regarding their rights as research participants. After the conclusion of the speech, participants completed another copy of the study packet. The students were then thanked for their time and informed that the third session would occur in another few weeks.

The third session began similarly to the second, with the delivery of the script and completion of the study packet. However, at the conclusion of session three, participants were fully debriefed and given a copy of the debriefing form to keep. The debriefing included information about NA, PA, EC, and their relation to anxiety and depression, as well as a list of local psychological service centers in case the participant wished to pursue psychological counseling.

Results

For all measures used, descriptive statistics of the data sample are presented in Table 1. Correlations of relevant constructs can be found in Table 2.

Although 189 individuals completed all three sessions of the present study, one subject was excluded from the final data analysis; as a result, N = 188 in the following reports. Prior to data analysis the researcher had noted concerns over a questionable pattern of responses from one participant (including flip-flopping between extremes from one data collection session to the next) but had included all data in the initial analyses. However, examination of regression diagnostics revealed this case to be a high-influence outlier and therefore the participant's responses were omitted from the final analyses.

Hierarchical regression analyses were conducted to test the hypothesized NA x AC and PA x AC interactions. Throughout the regression analysis, a composite score was utilized to represent participants' levels of anxious and depressive symptoms as opposed to individual measures of these constructs. The anxiety composite consisted of the mean of an individual's DASS-Stress and DASS-Anxiety scores, while the depression composite was the mean of each participant's BDI-II and DASS-Depression scores. Composites were used instead of individual measures of anxious and depressive levels in order to avoid redundancy in the analysis and to improve the validity and reliability of the constructs in the results (Cook & Campbell, 1979; Rushton, Brainerd, & Pressley, 1983).

With regard to anxiety, the composite score at Time 3 served as the dependent variable. The analysis additionally included participant composite anxiety scores at Time 1, sex, NA, AC, and the NA x AC interaction. All variables were standardized before calculating interaction terms to reduce multicollinearity between predictors (Aiken & West, 1991).

In Step 1 the composite anxiety scores at Time 1 and sex were entered, Step 2 added the main effects of NA and AC, and Step 3 included the NA x AC interaction. The results of the regression analysis for anxiety may be found in Table 3.

As expected, the most important predictor in the regression analysis of anxiety at Time 3 was the participant's anxiety score at the first data collection ($t = 5.360$, $p < .001$); in addition, the predicted main effect of NA was also significant ($t = 3.179$, $p = .002$). However, contrary to prediction, the NA x AC interaction was not significant (p > .10; see figure 3). AC's main effect and sex differences were additionally found to be non-significant (ps > .10).

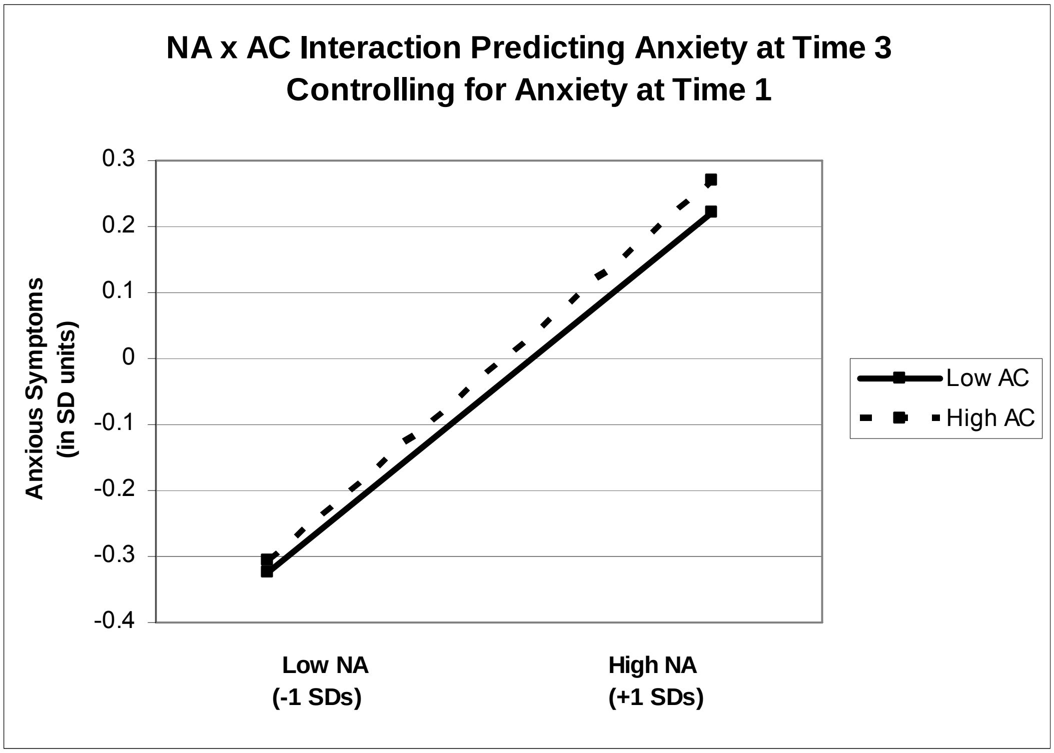

Figure 3. Graphical representation of the NA x AC interaction predicting change in anxiety at Time 3 controlling for anxiety at Time 1.

In the depression hierarchical regression model, the dependent variable was the participant's composite depression score at the third data collection session. Similar to the anxiety model, the composite score at Time 1 and sex were entered as the primary regression step to serve as a point of comparison. The second step added the main effects of NA, PA, and AC, and the third step additionally analyzed the expected interactions of NA x AC and PA x AC. From here, the other two potential interactions (NA x PA and the 3-way interaction NA x PA x AC) were entered into the model as the fourth and fifth steps, respectively. As prior research typically focused solely on the NA x AC and PA x AC interactions, initial predictions for the present study exclusively pondered these two 2-way interactions; however, during the data analysis period the final two interactions were included to ensure thorough examination of the model. Again, standardization of variables occurred early on in the analysis to decrease multicollinearity between predictor values (Aiken & West, 1991). For a complete summary of the numerical results of this depression regression analyses, refer to Table 4.

As with anxiety, the depressive composite score at Time 1 served as the most effective predictor of depression symptoms at Time 3 as expected (t = 4.503, p < .001). However, while it was predicted that significant results would be found in the NA x AC and PA x AC interactions, instead the 3-way interaction was significant (t = -2.108, p = .036). As a result, the outcome of the other main effects and 2-way interactions are not easily interpreted because the correlation between each temperamental variable and the dependent variable of depression at Time 3 varies depending on the level of the other two temperamental variables; for example, the NA x AC interaction looks different at different levels of PA (see figures 4a and 4b). As with anxiety, there were no significant sex differences indicated (p > .05).

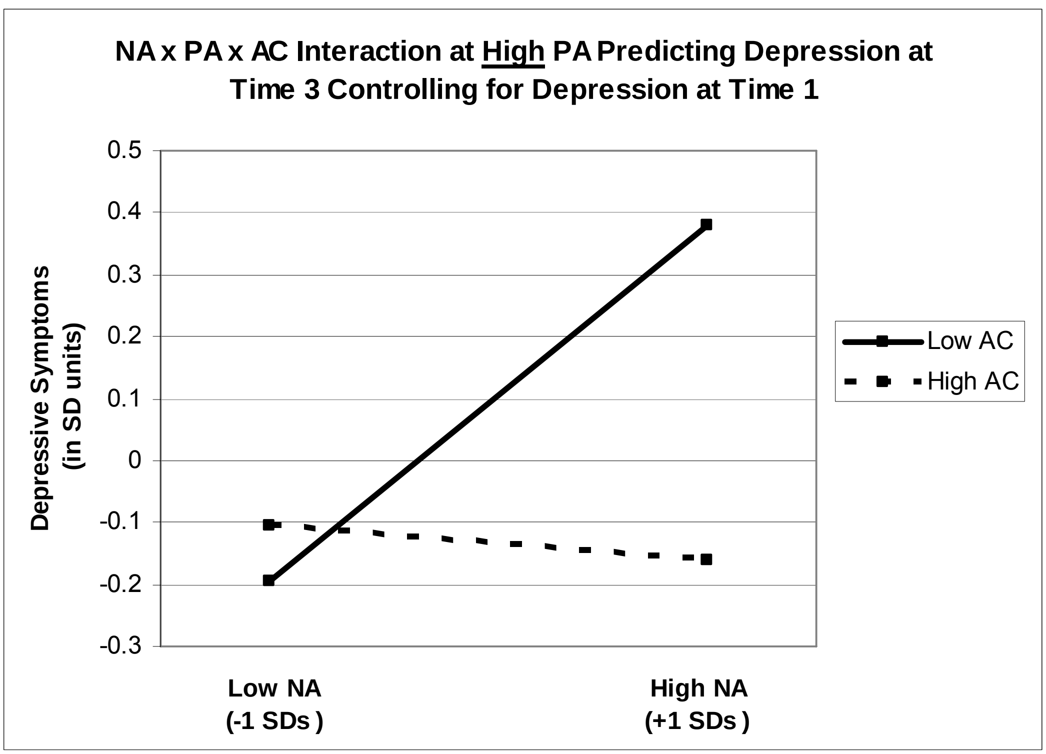

Figure 4a. Graphical representation of the NA x PA x AC interaction at **High PA** predicting change in depression at Time 3 controlling for depression at Time 1

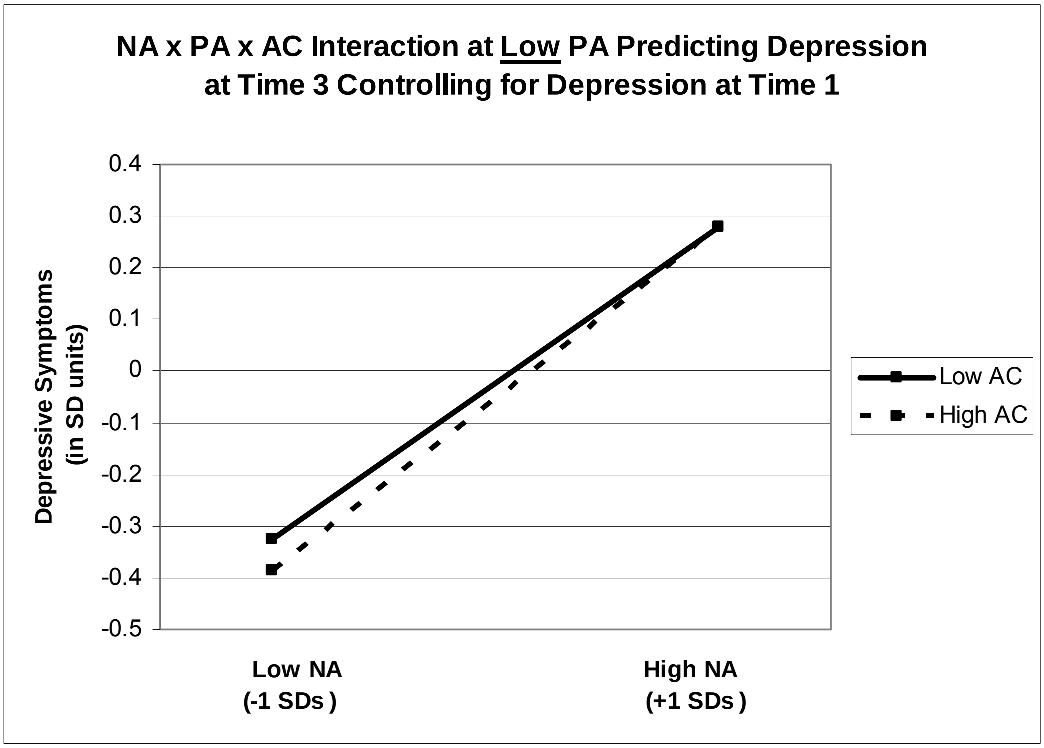

Figure 4b. Graphical representation of the NA x PA x AC interaction at **Low PA** predicting change in depression at Time 3 controlling for depression at Time 1

Discussion

Results of this study were largely consistent with predictions, although several unexpected findings also emerged. Consistent with predictions, NA measured at Time 1 was found to be a significant predictor of anxious and depressive symptoms across the study period even when controlling for such symptoms at Time 1. However, contrary to predictions, a significant main effect of PA measured at Time 1 was not found. Also, unexpectedly, the association between NA and later depressive symptoms was moderated by level of PA. This unexpected finding is discussed further below.

As predicted, EC (as represented by attentional control) did significantly moderate the effect of NA on later symptoms, although only for depression. In the case of anxiety, although high levels of NA significantly predicted anxiety symptoms over the study period, this association was not conditional upon level of effortful control. In the case of depression, high levels of NA at Time 1 significantly predicted depressive symptoms at Time 3 but this relation was conditional upon level of EC. More specifically, as expected, high levels of NA at Time 1 were significantly predictive of depressive symptoms at Time 3 but only at lower levels of EC. This pattern is consistent with a model in which high levels of EC are protective against reactive risk; however, because the study is a correlational design, causal interpretations must be speculative rather than certain.

Contrary to predictions, a significant PA x EC interaction predicting depression was not found—however, an unexpected NA x PA x EC interaction emerged. Whereas it was predicted that EC would moderate the association between depressive symptoms and high levels of NA and low levels of PA, it was rather the case that among individuals with both aspects of reactive vulnerability to depression (i.e., low PA and high NA) the moderating effect of EC was not found. In contrast, EC did significantly moderate the effect of high NA at higher levels of PA. In summary, the significant three-way interaction between NA, PA, and EC for depression showed that, at least in this sample, EC was a significant moderator of depression only when an individual's level of PA was high. While EC did not appear to have an effect on the expression of anxiety or low PA depression vulnerabilities, the pattern of results for depressive symptoms suggests that this model warrants further investigation so the mechanisms involved in this pattern of results may be better understood.

As noted above, the significant NA x PA and NA x PA x EC interactions for depression were unexpected. Based on the organization of the temperamental model under investigation, it is typical to interpret NA and PA as having independent additive effects on an individual's depressive symptoms. It is rare for the NA x PA interaction to be tested as such an interaction is not explicitly predicted by the tripartite model. However, such an interaction is an intriguing possibility that may be implied by the model. Although most studies to date have not tested such an interaction, those few studies which have have found it to be significant (e.g., Joiner & Lonigan, 2000). Therefore a test of this 2-way interaction was included in the present study as well as the 3-way interaction including EC. Consistent with the few previous tests of the NA x PA interaction, NA was found to be more strongly associated with depressive symptoms at low levels of PA. This pattern suggests that higher levels of PA may be protective against the effects of heightened NA. However, in the present case, that interaction was further moderated by level of EC. Both interactions suggest exciting new directions for future investigation. While these results would need to be replicated before alterations to the base theory (i.e., the tripartite model) are warranted, this initial set of results at least indicates that future researchers should include consideration of both the NA x PA and NA x PA x EC interactions in their analyses.

There are several possible interpretations of the 3-way interaction. First, it may suggest limits to the protective effects of high levels of EC. Thus, the confluence of the two depressive vulnerabilities (low PA and high NA) may be too potent for EC's moderation capacity to overcome. Second, this pattern of results may also suggest that high levels of PA buffer against vulnerability associated with heightened NA but that high levels of EC are necessary for such buffering to occur. Finally, the 3-way interaction may be an artifact resulting from the association between PA and EC. While it is ideal to have entirely independent constructs in linear regression analysis, PA and EC may be sufficiently correlated to cause interference in the results ($r = .465$). One of the more obvious consequences of this connection is the distribution of participants. Because NA and PA were allowed to vary freely in the sample, it was hoped that there would be a sufficient number of individuals representing all combinations of the three dimensions in question. However, examination of the data showed a lack of participants who were both low in PA and high in EC. This may be an idiosyncratic feature of this sample or it may be a result of meaningful overlap between EC and PA. For instance, both involve regions of the prefrontal cortex, which may intertwine their effects in such a manner that they are not as independent from one another as would be hoped. Intuitively the interdependence of PA and AC is understandable: If an individual is low in PA, which would present itself in the tendency to be disengaged from his or her environment, it seems less likely that this person would have high capacity for highly focused attention. However, an individual who is high in PA has greater room to be either high or low in AC, suggesting an asymmetrical association between the two dimensions. Indeed, such a pattern is observed in the distribution of participants in this sample. In order to prevent this potential roadblock from interfering with future investigations of the model, broadening EC to include other related constructs may be an effective strategy. For example, utilization of effortful control composite scores (including other aspects of EC in addition to AC, such as activation control and inhibitory control) could allow for more pronounced differentiation between the self-regulatory dimension and PA. Once the potential interference provided by the PA/AC correlation is accounted for, researchers may be reassured that the three-way interaction is a genuine effect and begin to investigate it with more certainty.

There were several limitations in the present study that should be addressed in future investigations. First, the present study was limited in terms of time frame—predicting change in anxiety and depression across an interval of only seven weeks is can be difficult because such symptoms are likely to be fairly stable (e.g. for depression symptoms reported at the first and third data sessions, $r = .77$). Lengthening the time span of the study would greatly facilitate opportunities to examine predictors of variations in anxiety and depression.

A second limitation of this study was its mono-method design, or the fact that it relied exclusively on self-report questionnaire measures of the constructs of interest. Future research should utilize alternative measures of reactive and effortful aspects of temperament. For example, EC could be measured using physiological measures of heart rate variability or performance-based measures of executive function. Solely using one type of measure can inflate correlations because of shared method variance, causing apparent effects which are actually the result of method effects rather than actual phenomena. Finally, because the study sample consisted of typical undergraduate students, the majority of the study's participants were not suffering from clinically significant anxious and/or depressive symptoms (although some of them likely were), thus limiting the extent to which the model currently relates to more severe levels of anxiety and depression. Therefore, including clinically diagnosed individuals in future studies will be invaluable for the extension of the model to clinical disorders.

Despite these limitations, the results of this study suggest the value of the proposed model for identifying those individuals who are most vulnerable to the development of anxiety and/or depression, thus fostering preventative measures against these disorders. Understanding how reactive and effortful temperamental characteristics interact to promote or protect against clinical levels of anxious and depressive symptoms is in itself a useful tool for comprehension of these mood disorders, but knowledge of their progression over time is particularly valuable. Current cognitive-behavioral therapies (CBT) boast improvement rates between 60% and 80% for anxiety patients (e.g., Beidel, Turner, & Morris, 2000; Bogels & Siqueland, 2006) but research has shown that the effects of CBT on depression are not as impressive as for other psychological disorders (Weisz, McCarty, & Valeri, 2006), leaving significant room for improvement. While affective education and cognitive restructuring are already implemented forms of cognitive-behavioral treatment for anxiety and depression, improved understanding of precisely how these temperamental characteristics interact over time could lead to more specific and hopefully more effective therapeutic treatments for those diagnosed with anxiety and/or depression if the patient has already developed anxious and/or depressive symptoms and it is too late to implement preventative strategies (Muris & Ollendick, 2005; Rothbart, Ellis, Rueda, & Posner, 2003). Simple temperamental questionnaires could identify what approaches would be most useful for a particular patient depending on his or her levels of negative and positive affectivity and regulatory ability, and customized CBT programs could be developed that tailor to the cognitive structure and vulnerabilities of each individual.

In conclusion, this study has begun to uncover the complexities encompassed in the relationships between temperamental reactivity and regulatory capacities and how they interact over time, and has laid the foundation for future investigations in the field. While some aspects of the model are not yet fully understood, it has already become clear that the model holds promising implications for the identification of at-risk individuals and the development of preventative interventions, to hopefully improve the lives of individuals vulnerable to these debilitating disorders.

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Table 1.

Descriptive Statistics

Variable/Characterisitic	N	Minimum	Maximum	Mean	Std. Deviation
Age	188	18	34	18.97	1.654
Attentional Control	188	29	74	52.98	11.006
Negative Affectivity	188	10	42	18.21	6.594
Positive Affectivity	188	20	50	36.78	5.895
BDI - Time 1	188	0	39	8.71	8.509
DASS - Depression - Time 1	188	0	34	4.62	6.518
DASS - Anxiety - Time 1	188	0	32	4.66	6.091
DASS - Stress - Time 1	188	0	38	10.22	8.896
BDI - Time 3	188	0	45	6.60	8.626
DASS - Depression - Time 3	188	0	39	3.86	6.675
DASS - Anxiety - Time 3	188	0	36	3.88	6.665
DASS - Stress - Time 3	188	0	41	8.66	9.203
Depression Composite - Time 1	188	-0.88	3.81	-0.05	0.915
Depression Composite - Time 3	188	-0.62	5.02	0.07	0.992
Anxiety Composite - Time 1	188	-0.97	3.26	-0.04	0.900
Anxiety Composite - Time 3	188	-0.70	3.91	0.08	0.968
Female	111				
Male	77				

Table 2.

Correlations of relevant constructs

	AC	PA	NA	BDI_T1	DASS Depr T1	Depr Comp T1	BDI_T3
PA	0.465	1.000					
NA	-0.513	-0.463	1.000				
BDI_T1	-0.526	-0.568	0.781	1.000			
DASS_ Depr T1	-0.406	-0.528	0.708	0.814	1.000		
Depr Composite T1	-0.489	-0.575	0.781	0.952	0.952	1.000	
BDI_T3	-0.434	-0.419	0.669	0.793	0.657	0.761	1.000
DASS_Depr T3	-0.346	-0.373	0.615	0.669	0.693	0.715	0.851
Depr Composite T3	-0.406	-0.411	0.667	0.760	0.702	0.768	0.962
DASS_Anxiety T1	-0.396	-0.358	0.699	0.691	0.673	0.717	0.591
DASS_Anxiety T1	-0.557	-0.427	0.773	0.748	0.736	0.779	0.604
Anxiety Composite T1	-0.509	-0.419	0.787	0.770	0.753	0.800	0.639
DASS_Anxiety T3	-0.321	-0.301	0.613	0.659	0.608	0.665	0.746
DASS_Stress T3	-0.432	-0.328	0.675	0.676	0.610	0.675	0.784
Anxiety Composite T3	-0.398	-0.333	0.681	0.706	0.644	0.709	0.809

	DASS Depr T3	Depr Comp T3	DASS Anx T1	DASS Stress T1	Anx Comp T1	DASS Anx T3	DASS Stress T3
DASS_Depr T3	1.000						
Depr Composite T3	0.962	1.000					
DASS_Anxiety T1	0.592	0.615	1.000				
DASS_Anxiety T1	0.561	0.605	0.750	1.000			
Anxiety Composite T1	0.616	0.652	0.935	0.935	1.000		
DASS_Anxiety T3	0.793	0.800	0.766	0.597	0.728	1.000	
DASS_Stress T3	0.793	0.820	0.668	0.737	0.751	0.789	1.000
Anxiety Composite T3	0.839	0.856	0.758	0.705	0.782	0.946	0.946

Every correlation in this table is significant at the 0.001 level (2-tailed).

Table 3.

Regression Analysis Results for Anxiety

Step and predictor	B	Std. Error B	Beta	ΔR^2	*df*
Step 1				**0.612*****	(2, 206)
Step 2				**0.012***	(2, 204)
Constant	-0.035	0.132			
Sex	0.024	0.089	0.013		
Anxiety Composite 1	**0.660*****	0.076	**0.653*****		
NA	**0.173****	0.072	**0.183****		
AC	0.025	0.051	0.027		
Step 3				0.001	(1, 203)

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

Table 4.

Regression Analysis Results for Depression

Step and predictor	B	Std. Error B	Beta	ΔR^2	*df*
Step 1				**0.590*****	(2, 185)
Step 2				**0.013**†	(3, 182)
Step 3				0.001	(2, 180)
Step 4				**0.007**†	(1, 179)
Step 5				**0.013***	(1, 178)
Constant	-0.060	0.144			
Sex	-0.001	0.093	0.000		
Depression Composite 1	**0.578*****	0.087	**0.572*****		
NA	**0.159***	0.078	**0.165***		
PA	-0.022	0.063	-0.023		
AC	-0.087	0.059	-0.090		
NA x AC	-0.070	0.066	-0.073		
PA x AC	-0.051	0.055	-0.055		
NA x PA	**-0.152***	0.060	**-0.192***		
NA x PA x AC	**-0.118***	0.048	**-0.197***		

† *p* <.10, * *p* < .05, ** *p* < .01, *** *p* < .001

Footnotes

[1] For depression, the expected interactions of interest are the two-way interactions of NA x AC and PA x AC. Prior research has assumed an additive effect between these two interactions to reach an individual's total depressive score (e.g. Lonigan, et al., 2004); therefore, following the example of previous researchers in the field, no predictions were made about the third two-way interaction of NA x PA or the possible three-way interaction (NA x PA x AC).