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Interactions in Predicting Mood From Extraversion and Neuroticism

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Many researchers have found evidence that, when only marginal distributions are examined, extraversion is related primarily to positive affect, whereas neuroticism is related primarily to negative affect. Recent findings have suggested that extraversion and neuroticism interact in predicting mood so that marginal relations could be misleading. The present study used extraversion (and its components, sociability and impulsivity) along with neuroticism in regression equations including interactive and curvilinear components to predict measures of positive and negative affect. Results confirm earlier findings that extraversion and neuroticism interact in predicting both positive and negative affect. The interaction pattern was similar to previous findings: Both positive and negative affect were strongly related to extraversion only among neurotic subjects.

The relation between mood and personality has received a good deal of attention over the years. Evidence has accumulated to the point that some investigators have argued that certain general conclusions should enjoy broad consensus (Meyer & Shack, 1989). One of these general conclusions is that for both personality and mood indicator domains, a two-factor structure seems to account for most of the variance (e.g., Bradburn, 1969; H. J. Eysenck & Eysenck, 1985; Watson & Tellegen, 1985).

With regard to personality, H. J. Eysenck has long argued that the two broad factors of extraversion (E) and neuroticism (N) are fundamental trait dimensions (see H. J. Eysenck & Eysenck, 1985, for a recent statement). Others (e.g., Gray, 1972, 1981, 1987b) prefer to interpret a rotation of Eysenck's two dimensions but usually argue that it is the same two-factor space that is under consideration.

The case that self-reported mood manifests a common two-factor structure across a wide variety of studies has been most forcefully made by Watson and Tellegen (1985). They called the two dimensions of mood positive affect (PA) and negative affect (NA) and argued that these two dimensions are "now firmly established as the basic structure of English-language affect at the general factor level" (p. 219). Watson and Tellegen argued that mood descriptors such as *excited, active, elated, enthusiastic, peppy,* and *strong* are typical of the PA dimension, whereas items such as *distressed, fearful, jittery, nervous, hostile,* and *scornful* are typical of the NA dimension. Other mood descriptors fall around the circumference of a circular structure in the two-dimensional space defined by the orthogonal PA and NA dimensions. If the horizontal and vertical dimensions are PA and NA, respectively, then the two dimensions rotated at 45-degree angles from the horizontal and vertical reflect the alternative mood dimensions of activated–unactivated and pleasant–unpleasant that have been found by a number of investigators (Diener, Larsen, Levine, & Emmons, 1985; Meyer & Shack, 1989; Russell, 1979; Watson & Tellegen, 1985). This two-factor structure is called a *circumplex*. The importance of the two-factor mood circumplex structure lies in the fact that the relations among a large number of mood measures can be described simply and rather well with only two dimensions. Relations among these mood items are unchanged regardless of whether the two dimensions are considered to be PA and NA or activation and pleasantness. Larsen and Diener (1992) provided an insightful analysis and critique of the circumplex model of affect.

A number of investigators looking at the relation of personality factors to mood factors have concluded that extraversion measures tend to be more strongly associated with PA, whereas neuroticism measures are more strongly associated with NA (Costa & McCrae, 1980; Emmons & Diener, 1986; Larsen & Ketelaar, 1989, 1991; Meyer & Shack, 1989; Warr, Barter, & Brownbridge, 1983; Watson & Clark, 1984; Williams, 1990).

Costa and McCrae (1980) proposed a "model of happiness" that explicitly asserts that differences among individuals in PA and NA, over the course of time, are a direct result of differences in the stable traits of extraversion and neuroticism, respectively. "Extraversion . . . predisposes individuals toward positive affect, whereas neuroticism . . . predisposes individuals toward negative affect" (p. 673). They argued that "over time, the small but persistent effects of traits emerge as a systematic source of variation in happiness, whereas situational determinants that vary more or less randomly tend to cancel each other out" (p. 676).

Meyer and Shack (1989) factor analyzed mood and personality items together and concluded that a two-dimensional mood–personality space (with PA and E sharing a common dimension and NA and N sharing another common dimension) well described the relation between mood and personality. A 45-degree rotation of the E–PA and N–NA axes reflected the other commonly reported (e.g., Diener et al., 1985; Russell, 1979; Watson & Tellegen, 1985) mood dimensions of engagement–disengagement (or activation) and pleasantness–unpleasantness.

A variation on Costa and McCrae's (1980) approach has been proposed by Williams (1990). Williams's model is based on distinguishing pervasive effects of E and N from intermittent effects of these personality variables. Pervasive effects are those

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that are continuously present across situations and therefore affect only long-term mood averages. Intermittent effects are personality effects triggered by particular events and affect both mood averages and mood variations. Williams agreed with Costa and McCrae that E broadly and actively affects PA, whereas N broadly and actively affects NA; however, Williams saw N as associated with increased mood variability (both PA and NA) whereas E is associated with decreased mood variability (especially for NA). Williams found evidence that both E and N pervasively affect both PA and NA (cf. Costa & McCrae), but the model, like Costa and McCrae's, is a linear, additive one that rank orders the personality types neurotic introverts → neurotic extraverts, stable introverts → stable extraverts on NA and just the reverse on PA.

Extraversion × Neuroticism Interactions and Mood

All of the investigations described above examined only linear, additive relations among the variables involved. That is, the possibility of interactive or curvilinear relations among the variables was not considered. Hotard, McFatter, McWhirter, and Stegall (1989) found evidence in several studies for an interaction between E and N in predicting subjective well-being (SWB), such that E was only strongly associated with SWB for subjects high on N. Among stable (low N) subjects, the relation between E and SWB was weak or nonexistent. Pavot, Diener, and Fujita (1990), despite a relatively small sample size (N = 136), were also able to detect some evidence of the same interactive pattern in their data. Very few studies other than these have even attempted to examine the data for Extraversion × Neuroticism interactions in predicting mood. McCrae and Costa (1991) did include several interactive terms in their regression analyses and found a number of them to be statistically significant. They, however, treated these as Type I errors and did not discuss them further. Hepburn and Eysenck (1989) also looked for Extraversion × Neuroticism interactions in predicting mood variables by using median splits on E and N in analyses of variance (ANOVAs). They found no significant interactions, but the sample size was so small (N = 29) that this can hardly be considered an adequate test.

Hotard et al. (1989) did not address the issue of whether interactive effects of E and N in predicting SWB could also be found in the components of SWB that many researchers prefer to use, namely PA and NA. Moreover, it is not clear what the implications of an interaction between E and N in predicting mood would be for the unified two-dimensional mood–personality space identified by Meyer and Shack (1989). Part of the motivation for the present study was to clarify this issue. It is clear, however, that an interaction between E and N as predictors of SWB, and perhaps PA and NA, does present problems for the model of happiness proposed by Costa and McCrae (1980). If, for example, extraversion is related to PA only among neurotics, then it becomes difficult to argue, as Costa and McCrae did, for a simple model in which extraversion generally predisposes individuals to PA. If there is an interaction between E and N in predicting NA such that, for example, high extraversion is associated with higher NA among stables but lower NA among neurotics, a negligible correlation between E and NA would not indicate that extraversion has little to do with NA. It would merely reflect the canceling of the two relations when neuroticism is ignored. The findings of Hotard et al. suggest that such interactions in predicting SWB may well exist and require a reexamination of Costa and McCrae's model.

Sociability and Impulsivity

The trait of extraversion, especially as it is measured by the Eysenck Personality Inventory (EPI; H. J. Eysenck & Eysenck, 1964), is often considered to consist of two subtraits, sociability and impulsivity. The exact relation of impulsivity to E and other higher order factors has occasioned much discussion (e.g., Diaz & Pickering, 1993; H. J. Eysenck & Eysenck, 1985; S. B. G Eysenck & Eysenck, 1977; Gray, 1987a; Rocklin & Revelle, 1981), but it remains clear that extraverts generally tend to score higher on impulsivity measures than do introverts. Among researchers using the EPI to measure E and N, it has become common to identify impulsivity and sociability subscales of E (see, e.g., Revelle, Humphreys, Simon, & Gilliland, 1980). A number of studies of conditioning and studies in which arousal was the theoretical variable of interest have found that the impulsivity component of extraversion, rather than sociability, showed the strongest relations in the theoretically predicted directions (H. J. Eysenck & Levey, 1972; Frcka & Martin, 1987; O'Gorman & Lloyd, 1987; Revelle et al. 1980; Zinbarg & Revelle, 1989).

Studies of mood and extraversion have not focused much attention on the distinction between the impulsivity and sociability components of E. One study that did was that of Emmons and Diener (1986), who found that "sociability but not impulsivity was strongly related to positive affect, whereas impulsivity tended to correlate more with negative affect" (p. 1211). Emmons and Diener argued that it is reasonable to expect sociability to be associated with PA because "the attention and interest which other people display toward an individual satisfy certain basic needs, and are thus likely to lead to an increase in positive affect" (p. 1214). On the other hand, they argued, impulsive individuals who are unable to inhibit unwise impulses or who do not consider carefully the consequences of their actions would be likely to experience negative outcomes often and thus be prone to negative affect. Although these arguments seem able to handle Emmons and Diener's results, they do not generalize easily to account for the kind of interactive effects found by Hotard et al. (1989). Because there is now evidence that the relation between extraversion and SWB is moderated by level of neuroticism, it is appropriate to reexamine Emmons and Diener's findings, taking account of the possibility of such interactions in the components of extraversion. For example, are the relations between sociability, impulsivity, PA, and NA the same for both neurotics and stables? Although Hotard et al. did look at interactive relations among variables, they did not address the question of whether the E × N interaction they found in predicting SWB was due to the impulsivity or the sociability component of E. The present study was carried out to clarify this matter as well as those previously mentioned.

Method

Subjects

Subjects were 384 college students enrolled in introductory psychology classes, who participated in the study in exchange for bonus points toward their final grade. There were 136 men and 248 women.

Table 1
Regression Coefficients for Predicting Mood From E and N

	Criterion variable							
	W		BDI		PA		NA	
Predictor	Coefficient	*t*	Coefficient	*t*	Coefficient	*t*	Coefficient	*t*
Intercept	16.469	5.64**	9.442	1.94	2.949	5.10**	.228	0.50
E	.635	1.98*	−1.166	−2.17*	.088	1.39	−.015	−0.29
N	−.647	−2.68**	.403	1.00	−.131	−2.74**	.057	1.50
E × N	.034	3.30**	−.038	−2.22*	.004	2.08*	−.003	−1.99*
E^2	−.022	−2.12*	.049	2.81**	−.004	−1.69	.002	1.00
N^2	−.008	−1.15	.033	2.70**	.001	0.39	.003	2.34*
R^2	.38		.30		.20		.32	

Note. E = extraversion; N = neuroticism; W = well-being; BDI = Beck Depression Inventory; PA = positive affect; NA = negative affect. Other terms are squared (e.g., E^2).
* $p < .05$. ** $p < .01$.

Procedure and Measures

Subjects were recruited over the course of a number of semesters. Subjects in some semesters completed questionnaires containing a number of additional scales different from those completed by subjects in other semesters; however, all subjects completed all the measures to be discussed in this article.

We used the EPI (H. J. Eysenck & Eysenck, 1964) to measure extraversion and neuroticism. In addition, we scored the commonly used EPI subscales for impulsivity (I) and sociability (S) for each subject (Revelle et al., 1980).

Mood items were those of Watson's (1988) PANAS scale. This scale is composed of 20 mood items. Subjects were asked to indicate on a 5-point (0–4) scale how often in the past few weeks they had felt each particular mood. We provided the following anchors: *not at all or very seldom* (0), *every few days* (1), *about once a day* (2), *several times a day* (3), and *most of the time* (4).

Subjects also completed the BDI (Beck, 1967) and the Well-Being subscale (W) of the Differential Personality Questionnaire (DPQ; Tellegen, 1979). The Well-Being scale may be considered a general measure of overall subjective well-being.

Results and Discussion

Regression Analyses

To examine the relations between mood and the personality variables, E and N, regression equations predicting all the mood variables (W, BDI, PA, and NA) were estimated using E, N, and the quadratic and cross-product terms of E and N as predictors. As Lubinski and Humphreys (1990) have pointed out, it is important to include quadratic terms in equations examining cross-product interactions to rule out the possibility of spurious interaction effects resulting from simple curvilinearity in the relations among the predictors and criteria. Moreover, curvilinearity in the relations among personality and mood variables has been routinely ignored in earlier investigations, which tended to focus exclusively on simple correlations among variables or factor analyses of such correlations. Including the quadratic terms allows direct examination of this neglected area. Table 1 shows the results of these analyses,[1] and the means, standard deviations, and correlations for all variables in the analyses are presented in the Appendix.

For the overall measures of SWB and depression (W and BDI), the results were highly consistent with the findings of Hotard et al. (1989). That is, the E × N interaction terms were significant with appropriate signs in both the W and BDI equations: $t(378) = 3.30$, $p < .002$, and $t(378) = -2.22$, $p < .03$, respectively. Three-dimensional plots of these equations produced surfaces very similar to those presented by Hotard et al. (1989), indicating that, as they reported, extraversion was associated with SWB and depression only for neurotic individuals. The only subjects who tended to report low SWB or high depression were neurotic introverts.

In the equations predicting PA and NA (coefficient alphas for PA and NA in this sample were .87 and .85, respectively), both E × N interaction terms were also significant: $t(378) = 2.08$, $p < .04$, and $t(378) = -1.99$, $p < .05$, respectively.[2] Three-dimensional plots of the regression surfaces associated with these equations are shown in Figures 1 and 2. Figures 3 and 4 show predicted PA and NA contours for these surfaces along with scatterplots to indicate where the observations lie in the E–N plane.

As the figures indicate, the relations between personality and mood for PA and NA were very similar to those found for W and BDI. That is, it was only among subjects with high neuroticism scores that there was any appreciable relation between extraversion and PA or NA.

[1] Initial analyses were carried out including gender and all interactions with gender as predictors. None of the gender and interactions with gender effects were significant; therefore, results presented are for males and females combined.

[2] In interpreting Tables 1–3, it should be noted that when higher order terms, such as cross-products and squared terms, are in the regression equation, the coefficients and their significance tests for the simple terms such as E and N must not be interpreted as main effects in an analysis of variance because the significance tests for these terms are not scale-invariant. The significance tests for the cross-product and squared terms are, however, scale-invariant in these equations and, therefore, directly interpretable (see Aiken & West, 1991).

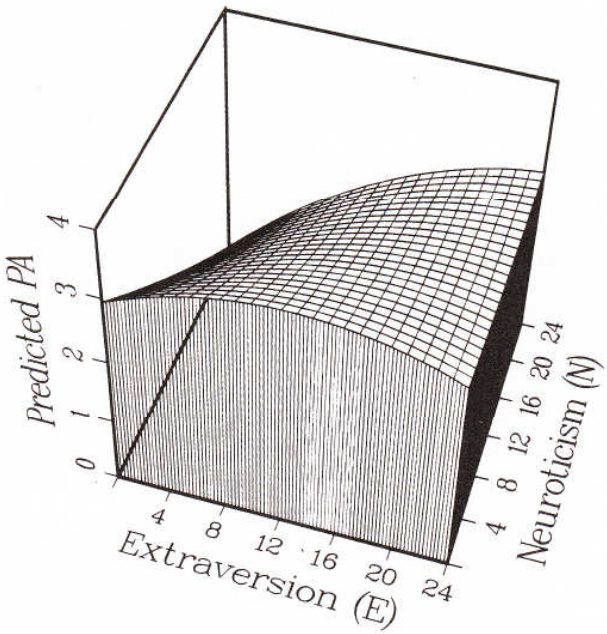

Figure 1. Predicted positive affect (PA) regression surface as a function of extraversion (E) and neuroticism (N) for the equation from Table 1.

To examine whether the E × N interaction found in predicting the mood variables could be traced to either the S or I components of extraversion, additional regression equations were estimated using S and I in place of E. Tables 2 and 3 give the results of these analyses.

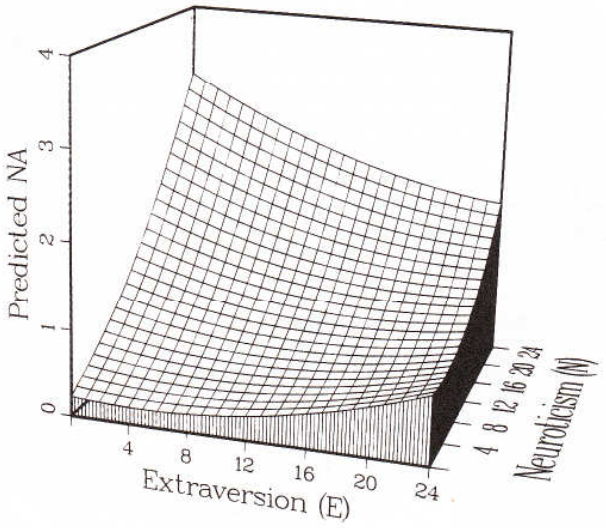

Figure 2. Predicted negative affect (NA) regression surface as a function of extraversion (E) and neuroticism (N) for the equation from Table 1.

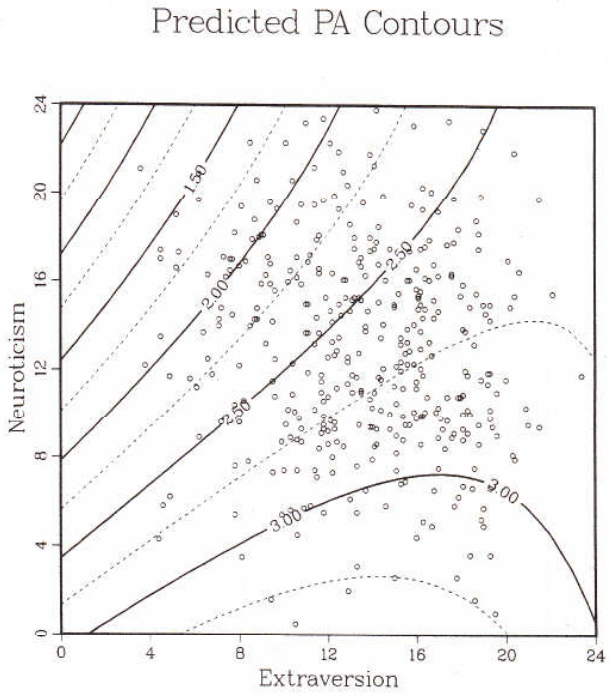

Figure 3. Predicted positive affect (PA) contours for the regression surface of Figure 1. Overlapping points in the scatterplot have been jittered to give a better indication of density of cases.

As Table 2 indicates, the I × N interaction was significant in three of the four mood equations (W, PA, and NA), with signs paralleling those for the E × N interactions shown in Table 1. Three-dimensional plots of the regression surfaces for these equations reveal the same patterns as those shown in Figures 1 and 2. That is, impulsivity appears to be related to mood only among high neurotics.

As Table 3 shows, two of the four S × N interactions (for W and NA) were clearly significant and a third (for BDI) approached significance ($p < .10$), with signs in the appropriate directions. Plots of the regression surfaces again tell the same story as Figures 1 and 2.

The fact that the E × N interaction manifests itself with both I and S in place of E indicates that the phenomenon is not something restricted to only one or the other of these components of extraversion.

It is also worth noting that the squared multiple correlation values are consistently lower for PA scores than for the other mood variables. Apparently, positive affectivity is less predictable from the personality variables included here than are the other mood measures.

Curvilinearity of Relations

The fact that the interactions in Tables 1–3 were significant even when quadratic terms were included in the equations indicates that the interactions found in this study and by Hotard et al. (1989) were not due to curvilinearity in the relations among

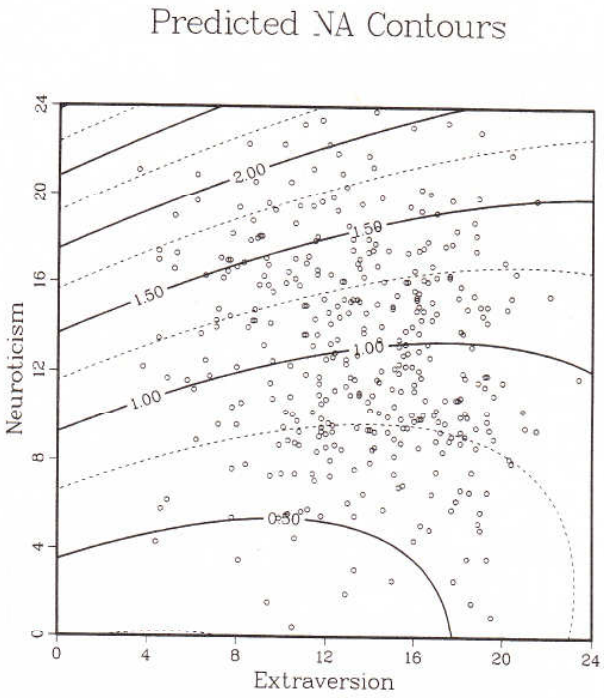

Figure 4. Predicted negative affect (NA) contours for the regression surface of Figure 2. Overlapping points in the scatterplot have been jittered to give a better indication of density of cases.

variables. It is important to note, however, that the relations among some of the personality and mood variables do appear to be significantly curvilinear. Significant quadratic terms were found in 9 of the 12 equations in Tables 1–3. Moreover, the pattern of significant quadratic effects appears rather consistent.

In predicting positive affect variables (PA and W), the impulsivity component of extraversion (but not the sociability component) manifests significant quadratic relations. In predicting negative affect variables (NA and BDI), neuroticism displays significant quadratic relations. Sociability does not appear to be curvilinearly related to any of the mood variables. Whatever quadratic effects E manifests appear to be due to the I component.

The general patterns of the quadratic effects are reflected in Figures 1 and 2. The curvilinear relation between E (or, more precisely, the I component of E) and PA is an inverted U, which appears most pronounced for low neurotics. For these low neurotics, the peak of the inverted U (highest level of PA) occurs somewhere in the middle range of E scores. For subjects with higher N scores, the peak PA values occur among subjects who are clearly extraverted.

The curvilinear relation between N and NA is such that the strength of the positive relation between N and NA becomes greater for subjects at higher levels of N.

Factor Analyses

Because the evidence seems to be clear that the relation between extraversion and mood is not the same at all levels of neuroticism, it becomes important to examine the personality–mood factor structure in a way that takes this into account. One way to do this is to factor personality and mood items separately for high and low neurotics. Separate principal factor analyses (using squared *R*s on the diagonal) for high (n = 181) and low (n = 203) neurotics were carried out on the pool of mood items and personality (E, N, S, and I) scores. High neurotics were defined as those with N scores greater than 13 on the EPI.

For both high and low neurotics, a scree plot suggested that three factors might be meaningfully extracted. The fact that three factors were indicated, rather than the usual two, was no doubt due to the inclusion of impulsivity scores in the analyses (when the analyses were carried out without impulsivity, two factors were indicated). Table 4 presents the first eight eigenvalues for the two analyses.

Varimax rotations to two factors were carried out for both low and high neurotics to examine the two-factor mood–per-

Table 2
Regression Coefficients for Predicting Mood From I and N

	Criterion variable							
	W		BDI		PA		NA	
Predictor	Coefficient	*t*	Coefficient	*t*	Coefficient	*t*	Coefficient	*t*
Intercept	20.616	9.43**	5.153	1.48	3.501	8.60**	.098	0.31
I	.921	1.67	−1.320	−1.50	.118	1.15	−.005	−0.06
N	−.619	−2.60**	.086	0.23	−.136	−3.06**	.050	1.45
I × N	.096	3.76**	−.056	−1.37	.014	2.94**	−.009	−2.34*
I^2	−.160	−3.10**	.182	2.20*	−.023	−2.41*	.010	1.27
N^2	−.013	−1.60	.038	3.01**	.000	0.02	.003	2.61**
R^2	.28		.26		.18		.32	

Note. I = impulsivity; N = neuroticism; W = well-being; BDI = Beck Depression Inventory; PA = positive affect; NA = negative affect. Other terms are squared (e.g., N^2).
* $p < .05$. ** $p < .01$.

Table 3
Regression Coefficients for Predicting Mood From S and N

	Criterion variable							
	W		BDI		PA		NA	
Predictor	Coefficient	*t*	Coefficient	*t*	Coefficient	*t*	Coefficient	*t*
Intercept	19.590	7.87**	4.144	1.01	3.216	6.59**	−.027	−0.07
S	−.147	−0.34	−.402	−0.56	.005	0.06	.078	1.17
N	−.412	−1.72	.256	0.65	−.090	−1.92	.049	1.32
S × N	.041	2.60**	−.050	−1.92	.004	1.17	−.005	−2.07*
S^2	.024	1.02	.039	1.03	.002	0.37	−.003	−0.79
N^2	−.010	−1.29	.032	2.54*	.000	0.24	.003	2.29*
R^2	.36		.29		.19		.32	

Note. S = sociability; N = neuroticism; W = well-being; BDI = Beck Depression Inventory; PA = positive affect; NA = negative affect. Other terms are squared (e.g., S^2).
* $p < .05$. ** $p < .01$.

sonality space identified by many other investigators. Figures 5 and 6 are plots of the factor patterns for the two groups.

One thing that is suggested by the two plots is that the two-factor structure is more clearly defined for the high neurotics than for the low neurotics. This is reflected not only in the general clustering of the items, but also in the overall sizes of the loadings and the variance accounted for by the factors in the two groups. For the low neurotics, the overall common variance was 10.75, whereas for high neurotics it was 12.41. The variance accounted for by the two factors in each group reflected this same pattern—7.09 (30% of the total variance) for low neurotics and 8.22 (34% of the total variance) for high neurotics. Thus, the two factors account for more of the variance among high neurotics than among low neurotics. Interestingly, the proportion of common variance accounted for by the two factors was the same (66%) for both groups.

Despite the difference in variance accounted for by the two factors in the two groups, it appears that the basic outline of the two-factor structure identified by Meyer and Shack (1989), Watson and Tellegen (1985), and others is evident among both low and high neurotics. Even so, differences among the solutions are intriguing. Notice that the extraversion (as well as both impulsivity and sociability) loadings on the NA factor are positive for low neurotics, but negative for high neurotics. These results suggest, as indeed does Figure 2, that among low neurotics, extraversion (and especially the impulsivity component) may even be slightly positively associated with NA. This tendency also appeared, and was noted, in data reported by Hotard et al. (1989; see their Figures 5 and 6, pp. 329–330).

The neuroticism loadings were low in both groups, as would be expected given the way the groups were selected (see, e.g., Gorsuch, 1974, p. 306).

Table 4
First Eight Eigenvalues for Principal Factor Analyses

Factor	Low neurotics	High neurotics
1	4.203	5.306
2	2.888	2.916
3	1.901	1.864
4	0.850	0.827
5	0.674	0.720
6	0.511	0.593
7	0.400	0.497
8	0.327	0.388

General Discussion

The results reported in this article provide support for the findings of Hotard et al. (1989) that the relation between mood and personality variables is interactive. Moreover, the results in-

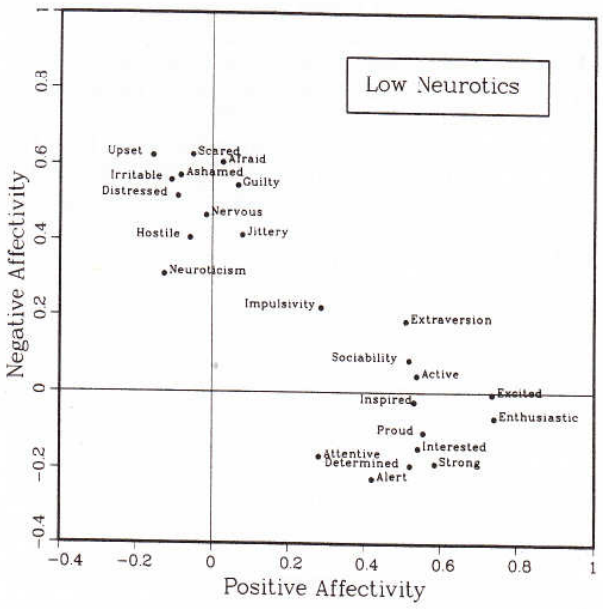

Figure 5. Mood–personality factor pattern for low neurotic subjects.

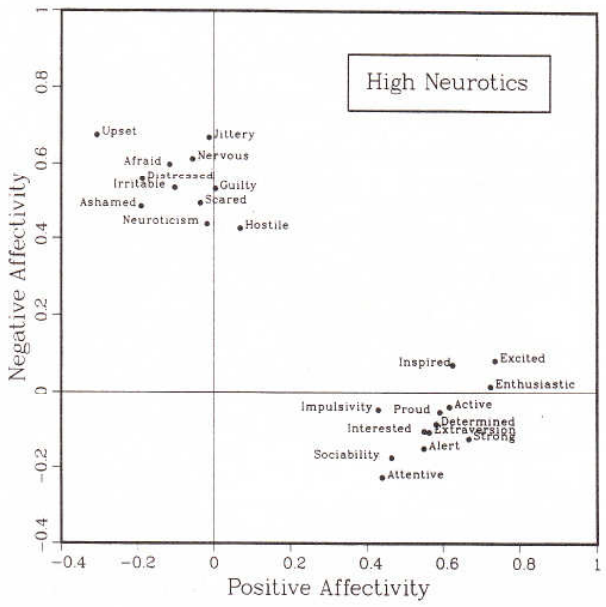

Figure 6. Mood–personality factor pattern for high neurotic subjects.

dicate that the interaction of E and N is predictive of both PA and NA. This is an important finding because PA and NA are often found to be relatively (although usually not completely) independent of one another.[3]

Costa and McCrae (1980) proposed their model of happiness (E and N are independent sources of variation in PA and NA, respectively) as an explanation of the finding that PA and NA are usually only weakly correlated. The present interaction results along with those of Hotard et al. (1989) and, to some extent, those of Pavot et al. (1990), pose problems for Costa and McCrae's model for the reasons mentioned in the introduction. Is there a theoretical understanding of the relation among E, N, and mood that can account for these results? One possibility may be outlined here.

A number of investigators (e.g., Larsen & Ketelaar, 1991; Pavot et al., 1990) have found the work of Gray (1981, 1987b) to provide a useful framework for thinking about the relation between mood and personality. Gray (see Fowles, 1987, for a lucid summary) argued for the existence of two neurologically based motivational systems, now commonly referred to as the behavior activation system (BAS) and the behavior inhibition system (BIS). The BAS is sensitive to cues signaling reward or the removal of expected punishment and activates behavior, whereas the BIS is sensitive to cues signaling punishment or the termination of expected reward and interrupts or inhibits behavior. In addition, Gray postulated a general or nonspecific arousal system (NAS) which responds to inputs from both the BAS and the BIS and serves to prepare the organism to respond forcefully and vigorously, either to obtain reward or for fight or flight.

Personality and mood theorists have proposed a variety of (often conflicting) ways of relating Gray's constructs to common measures such as E, N, PA, and NA. The approach that I have found most helpful in thinking about the results in this and other studies takes as its starting point the synthesis of Gray's and Eysenck's theories proposed by Wallace, Newman, and Bachorowski (1991).

Wallace et al. (1991), following Gray, identified an individual's level of E as reflecting the relative strength of the BAS as compared with the BIS. That is, extraverts tend to have a stronger BAS than BIS, whereas introverts have a stronger BIS than BAS. This means that extraverts in an approach–avoidance conflict would be more sensitive to the signals of reward or removal of expected punishment than they would be to the signals of punishment or removal of expected reward, and would therefore have a stronger tendency to act or respond than would introverts. Introverts in the same conflict situation would be more sensitive to the cues for punishment or removal of expected reward and would therefore be prone to inhibit responding and engage in inspection (see also Brebner & Cooper, 1974).

In contrast to Gray (1981, 1987b), Wallace et al. (1991) identified neuroticism with the reactivity of the NAS. They described neurotics as individuals whose arousal level is highly reactive to inputs from either the BIS or BAS. These individuals would therefore be expected to be in an invigorated state of arousal often and in response to both positive and negative cues. If we accept this interpretation of N, it is possible to provide an explanation for the interactive results found in the present and previous studies.

First, it is important to realize that, in Gray's model, the BAS reflects not only sensitivity to signals of reward, but also sensitivity to signals of removal of expected punishment. It is perhaps best to conceptualize a strong BAS as reflecting a tendency to act (both to obtain reward and to avoid punishment), whereas a strong BIS reflects a tendency not to act. The BIS would be sensitive both to punishment and to signals of the removal of expected reward, so that a high BIS individual does not simply pay little attention to reward; he or she could be very sensitive to whether a reward was present. When one conceptualizes it this way, the connection between the BAS–BIS balance (E) and mood is not as obvious as is sometimes assumed. In fact, there is little reason that higher BIS sensitivity (introversion) should be connected with NA to any great degree more than high BAS sensitivity (extraversion), except under conditions in which the tendency to inhibit responding is accompanied by high NAS activation (neuroticism) with its high readiness to respond. These conditions would seem to create a conflict for the individual, hence tension. The data support this reasoning if one takes the lack of an extraversion effect on NA for stables to reflect the fact that there is no obvious predictable relation between the BAS–BIS balance and mood apart from the activity of the NAS.

The argument is strengthened by Fowles's (1987) suggestion that BIS-dominant individuals (introverts) may often avoid by lifestyle choices many stressful situations that impulsive BAS-dominant individuals could get drawn into. Impulsive behavior, according to the present model and most others, would be most characteristic of individuals with a strong BAS and a highly re-

[3] The correlation between PA and NA in the present study was −.33, which compares with Watson's (1988) value of −.28 for the PANAS scales in similar format.

active NAS (neurotic extraverts). This kind of person might be expected to engage chronically in disinhibited behavior leading to relatively high levels of NA.

With regard to PA, it becomes even more difficult to see strong theoretical reasons for associating mood with BAS–BIS balance (E) when this balance is interpreted primarily as the tendency either to act or to inhibit behavior in approach–avoidance situations. This difficulty may explain the relatively low proportions of variance accounted for by the equations predicting PA. Certainly, of the 10 mood adjectives in the PA scale, at least 7 (*inspired, proud, interested, strong, alert, determined,* and *attentive*) do not seem to be strongly associated with a high activity level. Nonetheless, as the interactive pattern indicated, among neurotics (but not among stables) there was a positive relation between PA and E. It is important to note that this relation occurs because neurotic introverts report less PA than all other personality types. That is, it is not because neurotic extraverts report exceptionally high PA; rather, it is because neurotic introverts report exceptionally low PA. It may be that the chronic tension produced by a strong BIS coupled with a highly reactive NAS is incompatible with the mood states commonly identified as measures of PA.

These considerations, along with previous and present results, suggest that the common claim that extraversion is related to measures of PA but not NA, whereas neuroticism is related to measures of NA but not PA, is probably misleading. Although the claim may be true for simple zero-order correlations that describe only relations of marginal distributions, it does not accurately reflect how E and N are jointly related to PA and NA. An adequate theoretical understanding of the relation between personality and mood must be able to account for the complete pattern of associations between the variables, not merely the main effects. It is worth noting that I have focused on PA and NA in presenting the results because these are measures commonly used in mood studies. As Table 1 indicates, the pattern of interactive results found is even stronger when measures of SWB and depression are examined.

An important issue not addressed by studies such as the present one is the question of how E and N affect mood responses to manipulated positive and negative events. Larsen and Ketelaar (1989, 1991) have carried out useful experiments looking at this issue, but unfortunately did not report analyses that would allow examination of possible E × N interactions such as those found here. Studies are in progress to examine this issue more thoroughly.

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Appendix

Means, Standard Deviations, and Correlations for Variables in This Study ($N = 384$)

Variable	W	PA	NA	BDI	E	N	E × N	E^2	N^2	I^2	I × N	S^2	S × N
W	1.000												
PA	.624	1.000											
NA	−.445	−.325	1.000										
BDI	−.532	−.429	.525	1.000									
E	.449	.279	−.135	−.246	1.000								
N	−.439	−.358	.541	.473	−.116	1.000							
E × N	−.022	−.079	.321	.190	.560	.722	1.000						
E^2	.425	.260	−.124	−.219	.985	−.116	.546	1.000					
N^2	−.443	−.349	.552	.491	−.118	.976	.699	−.116	1.000				
I^2	.192	.129	−.025	−.046	.693	.001	.459	.710	−.003	1.000			
I × N	−.121	−.116	.332	.273	.411	.696	.861	.408	.678	.668	1.000		
S^2	.466	.304	−.208	−.257	.796	−.222	.334	.802	−.212	.289	.057	1.000	
S × N	.073	−.013	.214	.100	.559	.580	.894	.536	.555	.251	.606	.567	1.000
M	16.54	2.59	1.04	8.30	13.66	12.97	175.15	202.32	189.80	28.35	65.18	61.06	92.46
SD	4.79	.83	.71	7.51	3.96	4.64	78.96	105.81	122.31	17.70	33.60	37.88	45.43

Note. W = well-being; PA = positive affect; NA = negative affect; BDI = Beck Depression Inventory; E = extraversion; N = neuroticism; I = impulsivity; S = sociability. Other terms are squared (e.g., E^2).

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