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EMOTIONAL INTENSITY: SOME COMPONENTS AND THEIR RELATIONS TO EXTRAVERSION AND NEUROTICISM

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Summary—Several models of the relation between affect intensity or emotional intensity and temperament were tested in a large sample ($N = 1553$) using the Emotional Intensity Scale (EIS) developed by Bachorowski & Braaten (1994) and the Eysenck Personality Inventory (EPI). Analyses revealed the necessity of separating negative emotional intensity into an anger/frustration component and a non-anger (worry, guilt, sadness) component when examining how temperament variables like extraversion and neuroticism are related to emotional intensity. Implications of this distinction for models of emotional intensity are discussed. Results for *intensity* measures manifested a number of sharp contrasts with results found in other studies for *frequency* measures of positive and negative affect. The pattern of the relations between emotional intensity (both positive and negative) and neuroticism, found here, throws light on the basic nature of neuroticism. © 1998 Elsevier Science Ltd. All rights reserved

The relation between temperament and emotional experience is an important aspect of any theoretical account of individual differences in personality. A number of investigators have focused on the intensity of affective or emotional experience as an important key to differences in temperament. Emotional intensity is usually regarded as reflecting individual differences in the strength of emotional responses to the same or similar emotional stimuli (Larsen & Diener, 1987; Larsen, Diener & Emmons, 1986). One of the more widely used measures of emotional intensity has been the Affect Intensity Measure (AIM) developed by Larsen & Diener (1987). A more recent measure is the Emotional Intensity Scale (EIS) developed by Bachorowski & Braaten (1994). The fundamental idea underlying the development of both measures is the testable proposition that some individuals tend to experience all their emotions (both positive and negative) more intensely than others.

The construct of affect intensity and its measures have been criticized on several grounds. Williams (1989) factor analysed the AIM, finding four factors and no "general factor that is sufficiently large nor sufficiently weighted equally by both negative and positive affect items to justify the use of only a single overall score" (p. 1098). Bachorowski & Braaten (1994) point out that the response format of the AIM seems to confound frequency and intensity of experienced affect, which, of course, undermines the goal of obtaining a relatively pure measure of affect intensity.

Cooper & McConville's (1989, 1993; see also McConville & Cooper, 1995) critique focuses primarily on a statistical artifact in the procedure used by Diener, Larsen, Levine & Emmons (1985) to compute a measure of affect intensity from subjects' day-to-day mood ratings over a period of time. Cooper & McConville argue that the intensities of positive and negative affects are best captured by the respective means on ratings of positive and negative affect. Furthermore, any individual differences in intensity common to the two kinds of affect could be captured by some measure of the variability of an individual's affect ratings. In addition to this argument, however, they also suggest that the construct of affect intensity as measured by the AIM is not a unitary construct and is, indeed, simply a mixture of extraversion (E) and neuroticism (N) with extraversion reflecting positive affect intensity and neuroticism reflecting negative affect intensity.

Bachorowski & Braaten (1994) developed the EIS to provide a measure of emotional intensity that would be unconfounded with the frequencies with which positive and negative affect were experienced. The scale consists of 30 items, of which 14 tap positive emotional intensity and 16 tap negative intensity. Bachorowski & Braaten (1994) point out that the construct of affect intensity has important theoretical connections with several models of the psychobiological basis of temperament. It is important, in making these connections, to distinguish between positive and negative

affect intensity. Factor analyses of mood and emotional intensity items have consistently revealed separate positive and negative affect factors (Meyer & Shack, 1989; Williams, 1989). Thus, any consideration of the relation between temperament and emotional intensity must address the question of whether positive intensity is related in the same way as negative intensity to temperament variables. Several models make different predictions about the relations of extraversion and neuroticism to positive and negative emotional intensity.

One influential approach (Cooper & McConville, 1989, 1993; Costa & McCrae, 1980; Larsen & Ketelaar, 1991; Meyer & Shack, 1989; Warr, Barter & Brownbridge, 1983; Watson & Clark, 1984) is based on findings that extraversion measures tend to be more strongly associated with positive affect (PA) and neuroticism measures more strongly associated with negative affect (NA). Although these findings have been obtained with measures of PA and NA that primarily tap frequency rather than intensity of affect, the theoretical accounts of the results often rely on interpretations of Gray's (1981, 1987a, 1994) theory that would apply to intensity as well as frequency of affect.

If the arguments and findings regarding PA and NA associated with this approach (Larsen & Ketelaar, 1991) apply as well to positive and negative emotional intensity, one might expect to find that E would be positively related to positive intensity and unrelated to negative intensity. Similarly, N would be positively related to negative intensity and unrelated to positive intensity. We will refer to this model as the Larsen & Ketelaar model.

A second model is the arousal regulation theory of affect intensity proposed by Larsen & Diener (1987), which makes rather different predictions about the relations between the temperament variables, E and N and emotional intensity. Drawing upon ideas from stimulus intensity modulation theory (Petrie, 1967), Larsen & Diener suggest that individuals use the intensity of experienced affect to regulate their levels of arousal so as to maintain a preferred level. Because "arousal level" is tied, at least in Eysenck's (1967) theory, to E, the arousal regulation theory would predict that E would have a positive relation to affect intensity. Moreover, this relation should hold for both positive and negative emotional intensity. Larsen & Diener also argue that affect intensity should also correlate positively with N and present evidence suggesting that it does when affect intensity is measured by the AIM.

A third model was proposed by Bachorowski & Braaten (1994), who apply the framework for understanding the relation between temperament and behavior that was suggested by Wallace, Bachorowski, & Newman (1991) to emotional intensity. The Wallace, Bachorowski & Newman (WBN) model represents a synthesis of Gray's and Eysenck's theories. The WBN model follows Gray (1981, 1987b; Fowles, 1987) in seeing E as reflecting the relative strength of a Behavioral Approach (or Activation) System (BAS) as compared to that of a Behavioral Inhibition System (BIS). That is, extraverts tend to have a stronger BAS than BIS, whereas introverts have a stronger BIS than BAS. In the WBN model neuroticism is seen as reflecting the reactivity of a Non-specific Arousal System (NAS) that 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/flight.

Following the WBN model, Bachorowski & Braaten (1994) argue that N ought to be positively related to the typical intensity with which emotions (both positive and negative) are experienced. Extraversion, on the other hand, should be positively related to positive emotional intensity and negatively related to negative emotional intensity. Because of the opposite relations for E with positive and negative intensity, the WBN model seems to suggest that E would be uncorrelated with a measure of overall emotional intensity.

Although both the Larsen & Ketelaar model and the WBN model rely on aspects of Gray's theory, the model proposed by Gray (1970, 1994) (Corr, Pickering & Gray, 1995) leads to predictions that are distinguishable from the three previous models. Gray has argued that individual differences in BAS and BIS sensitivities form dimensions that are rotated, by about $30°$ from the E and N dimensions, respectively, with BAS sensitivity running from $E-/N-$ to $E+/N+$ and BIS sensitivity running from $E+/N-$ to $E-/N+$. If positive emotional intensity is identified with activity in the BAS and negative intensity with activity in the BIS, the $30°$ rotation of the axes suggests that E should be positively related to positive intensity and negatively related to negative intensity, with the latter relation being roughly half as strong as the former. On the other hand, N should be positively related to both positive and negative intensity, with the latter relation being roughly twice as strong as the former.

Table 1. Predicted relations between E, N and emotional intensity for several models

	Model	Positive intensity	Negative intensity	Overall emotional intensity
E	Larsen & Ketelaar	+	0	0 or weak +
	Arousal regulation	+	+	+
	WBN	+	−	0
	Gray	+	weak −	0 or weak +
N	Larsen & Ketelaar	0	+	0 or weak +
	Arousal regulation	+	+	+
	WBN	+	+	+
	Gray	weak +	+	+

Note: Positive, negative and zero relations are indicated by +, − and 0, respectively.

The predicted relations between E and N and positive and negative emotional intensity made by these various approaches are summarized in Table 1. The examination of these predicted relations was one focus of the present study.

There is another aspect of Gray's model, however, that raises questions about the two-dimensional (positive and negative) approach to the theory and measurement of emotional experience. Gray (1994) postulates three, rather than two, basic emotion systems. The BAS and BIS respond to *conditioned* stimuli for reward and punishment and are associated with emotions like hope/elation and anxiety/fear, respectively. The third system, the fight/flight system (FFS), responds to *unconditioned* aversive stimuli and is associated with emotions like anger (in the case of fight) and/or panic (in the case of flight). Therefore, the question of the unidimensionality of negative affect or emotional intensity needs to be examined carefully. Gray's model suggests that negative emotional intensity itself may be divided into components that are associated with separate punishment mechanisms. It seems quite possible that these components might relate differentially to temperament variables. Is the relation, for example, between fear intensity and extraversion the same as that between anger intensity and extraversion? This is an issue that seems to have received relatively little attention among investigators of temperament and emotion. There is increasing evidence that anger and fear produce reliably distinguishable patterns of autonomic nervous system activity (Levenson, 1994; Levenson, Ekman & Friesen, 1990; Sinha, Lovallo & Parsons, 1992). It is possible that different kinds of negative emotional intensity will be related in different ways to basic temperament variables like E and N. The negative intensity scale of the EIS includes a number of items that deal with anger/frustration intensity along with items measuring other kinds of negative intensity. Therefore, the question of differential relations of anger and non-anger negative emotional intensity with E and N were addressed in the present study.

METHOD

Participants

Participants were 1553 college students (594 men and 959 women) enrolled in introductory psychology classes, who participated in the study as part of a regular class activity.

Procedure and measures

Participants completed three questionnaires in one session. The Eysenck Personality Inventory (EPI) (Eysenck & Eysenck, 1964) was used to measure extraversion (E) and neuroticism (N), along with the commonly used EPI subscales for impulsivity (I) and sociability (S) (Rocklin & Revelle, 1981). The Emotional Intensity Scale (EIS) (Bachorowski & Braaten, 1994) was used to measure emotional intensity. EIS scores have been found to be useful and reliable predictors in recent studies (Bachorowski & Owren, 1995; Bachorowski & Rosen, 1997). A third unrelated questionnaire followed the EPI and EIS and will not be discussed here.

The EIS consists of 30 items, each with five response alternatives. Fourteen of the items assess intensity of positive emotions such as happiness and pleasure and 16 assess intensity of negative

Robert M. McFatter

emotions such as worry, guilt and anger. In the instructions for the EIS participants are asked to imagine themselves in common situations and choose a response that best describes how they usually feel. For example, a typical positive intensity item is: "Someone compliments me. I feel: (1) It has little effect on me; (2) Mildly pleased; (3) Pleased; (4) Very pleased; (5) Ecstatic—on top of the world."

When participants omitted answering an item on one of the scales the score for that scale was treated as missing. In all analyses only data from participants who had no missing scores for the variables in that analysis were used. Thus, the ns vary slightly from analysis to analysis.

RESULTS AND DISCUSSION

An initial principal factor analysis (with squared multiple Rs on the diagonal) was carried out on the items of the EIS to examine its basic factor structure. The first eight eigenvalues were 6.12, 1.54, 1.09, 0.54, 0.44, 0.25, 0.20 and 0.17. A scree plot, as well as the Eigenvalues > 1 criterion, indicated a three factor solution. Varimax rotation of three factors produced a solution (Table 2) in which all of the 14 positive intensity items loaded on one factor, while the 16 negative intensity items were split cleanly into two factors, one comprised of five anger/frustration items, the other comprised of the remaining 11 negative intensity items (guilt, anxiety, worry, etc.).

The separation of the negative intensity items into an anger/frustration factor and a non-anger negative intensity factor lends support to the notion derived from Gray's theory that these two kinds of negative emotional intensity may reflect separate emotion systems. To examine the possibility that different types of emotional intensity manifest different dynamics with regard to personality, separate scales were constructed for positive intensity (PI), non-anger negative intensity (NI) and anger negative intensity (AI). To make scores on these scales more comparable, each participant's responses to the 14 PI items were averaged to obtain a PI score. Similarly, responses to the 11 NI

Table 2. Varimax rotated factor pattern for EIS items

Item	Factor 1	Factor 2	Factor 3	Communality
10	**0.596**	0.077	0.276	0.44
8	**0.572**	0.229	0.109	0.39
14	**0.523**	0.055	0.276	0.35
2	**0.506**	0.072	0.229	0.31
22	**0.501**	**0.316**	0.002	0.35
24	**0.489**	0.156	0.297	0.35
27	**0.382**	0.243	0.056	0.21
4	**0.309**	**0.334**	0.016	0.21
18	**−0.446**	−0.236	−0.127	0.27
29	**−0.464**	−0.091	−0.149	0.25
15	**−0.570**	−0.062	−0.122	0.34
19	0.185	**0.516**	0.111	0.31
21	0.127	**0.516**	0.120	0.30
3	0.007	**0.494**	0.045	0.25
16	−0.047	**0.489**	0.062	0.24
9	0.127	**0.452**	−0.003	0.22
30	**0.371**	**0.450**	0.104	0.35
7	0.004	**0.418**	0.071	0.18
1	0.152	**0.413**	0.082	0.20
13	0.189	**0.336**	0.158	0.17
5	−0.140	**−0.352**	−0.181	0.18
11	−0.249	**−0.352**	−0.073	0.19
25	−0.269	**−0.372**	−0.103	0.22
26	−0.161	**−0.392**	−0.120	0.19
17	−0.173	**−0.444**	−0.150	0.25
20	0.116	0.182	**0.689**	0.52
12	0.180	0.085	**0.619**	0.42
6	0.194	0.147	**0.608**	0.43
28	0.221	0.205	**0.594**	0.44
23	−0.186	−0.086	**−0.420**	0.22

Percent of variance explained by each factor: Factor 1 = 11.08%, Factor 2 = 10.52%, Factor 3 = 7.61%.
Note: Loadings > 0.30 have been highlighted in bold.

items and the 5 AI items were averaged to obtain NI and AI scores, respectively. Thus, the three scores for each participant were all on a 1–5 scale. Coefficient α's for the four scales (PI, NI, AI and total EIS) were, respectively, 0.79, 0.82, 0.76 and 0.88.

Correlations

A gross comparison of the predictions of the various models in Table 1 may be made by examining the correlations among the EIS and personality variables. Table 3 shows these correlations for the EIS scales, as scored by Bachorowski & Braaten (1994), as well as the new negative intensity subscales, NI and AI, identified in the present study.

With regard to the relation between extraversion and the different types of intensity in the total sample, Table 3 shows that E is positively related ($r = 0.19$, $P < 0.0001$) to positive intensity, negatively related ($r = -0.18$, $P < 0.0001$) to negative intensity, and unrelated ($r = 0.02$) to anger intensity. Furthermore, E is unrelated ($r = 0.01$) to the global EIS score. This pattern is similar for the male and female subsamples as well. These results are consistent with the predictions of the WBN model and (to a somewhat lesser extent) Gray's model, but not the arousal regulation theory or the Larsen & Ketelaar model. It is worth noting that the present results suggest that Bachorowski & Braaten's (1994) failure to find the negative relation between E and negative intensity that their model predicts may have been due to the fact that they included anger intensity items in their negative intensity scale as well as their small sample size.

Table 3 also shows that neuroticism is positively related to all types of intensity, but more weakly related (in accordance with Gray's, theory) to PI ($r = 0.18$, $P < 0.0001$) than to either NI ($r = 0.56$, $P < 0.0001$) or AI ($r = 0.45$, $P < 0.0001$). Generally, all the approaches mentioned in the introduction would predict the strong positive relations between N and the negative intensities, NI and AI. However, the positive relation between N and PI (as well as the extraversion results) tends to undermine approaches (Cooper & McConville, 1989, 1993; Costa & McCrae, 1980; Larsen & Ketelaar, 1991; Meyer & Shack, 1989) that see positive affect intensity as reflecting E but not N and

Table 3. Correlations among scales of the EPI and EIS

	EIS	EIS–POS (PI)	EIS–NEG	NI	AI	Mean	SD
Total Sample (ns range from 1510–1552)							
EIS	1.00					3.59	0.44
EIS–POS	0.84***	1.00				3.79	0.44
EIS–NEG	0.91***	0.53***	1.00			3.40	0.57
NI	0.86***	0.51***	0.94***	1.00		3.35	0.62
AI	0.67***	0.38***	0.75***	0.47***	1.00	3.50	0.71
E	0.01	0.19***	-0.14***	-0.18***	-0.02	13.57	4.17
N	0.47***	0.18***	0.59***	0.56***	0.45***	12.26	4.64
S	0.01	0.21***	-0.16***	-0.16***	-0.10***	7.37	2.88
I	0.00	0.09**	-0.07*	-0.15***	0.10***	4.86	1.77
Male Sample (ns range from 578–594)							
EIS	1.00					3.40	0.43
EIS–POS	0.86***	1.00				3.68	0.45
EIS–NEG	0.89***	0.53***	1.00			3.12	0.53
NI	0.82***	0.48***	0.92***	1.00		3.02	0.57
AI	0.67***	0.40***	0.75***	0.43***	1.00	3.35	0.75
E	0.05	0.22***	-0.13*	-0.19***	0.03	13.89	4.16
N	0.39***	0.14**	0.53***	0.48***	0.41***	11.01	4.66
S	0.03	0.23***	-0.16***	-0.18***	-0.06	7.35	2.90
I	0.02	0.11*	-0.07	-0.16***	0.11*	5.06	1.75
Female Sample (ns range from 932–956)							
EIS	1.00					3.71	0.40
EIS–POS	0.83***	1.00				3.85	0.41
EIS–NEG	0.89***	0.49***	1.00			3.57	0.52
NI	0.85***	0.48***	0.93***	1.00		3.57	0.56
AI	0.66***	0.33***	0.76***	0.47***	1.00	3.59	0.67
E	0.02	0.20***	-0.13***	-0.16***	-0.03	13.38	4.17
N	0.46***	0.15***	0.59***	0.55***	0.44***	13.04	4.45
S	-0.01	0.21***	-0.18***	-0.17***	-0.14***	7.39	2.87
I	0.04	0.11**	-0.02	-0.10*	0.13***	4.74	1.78

Note: The ns for these correlations range from 1510–1552.
* $P < 0.01$. ** $P < 0.001$ *** $P < 0.0001$.

negative affect intensity as reflecting N but not E. But more will be said on this issue in connection with the regression results reported later.

It is worth noting that the positive relation found here between N and positive emotional intensity contrasts sharply with the negative relation found in other studies between N and positive affect (PA) as measured, for example, by Watson's (1988) PANAS. McFatter (1994) found N to be negatively correlated with PA ($r = -0.36$) and positively correlated with NA ($r = 0.54$). The contrast between the two relations N and PA vs N and PI, suggests that when it comes to *frequency* of positive affect, which is measured by PA and not PI, neurotics report less frequent PA than stables. On the other hand, with regard to *intensity* of positive affect, measured by PI, neurotics report more intense positive affect. This same striking contrast between frequency and intensity measures of affect shows up in the correlation between PI and NI ($r = 0.51$, $P < 0.0001$) in the present results. Studies of frequency measures of affect generally show weak to moderately *negative* correlations between PA and NA, e.g., $r = -0.33$ (McFatter, 1994), and $r = -0.28$ (Watson, 1988).

Regression analyses

Regression analyses were carried out to provide a more thorough understanding of the relations among the variables in this study. The emotional intensity scales of the EIS were used as criterion variables with the predictors being E, N and a dummy-coded gender (G) variable (0 = males, 1 = females). Because previous research (Hotard, McFatter, McWhirter & Stegall, 1989; McFatter, 1994) has indicated the possibility of interactive and curvilinear effects among variables of this sort, all possible cross products among the predictors were used in the models as well. The variables E and N were first standardized ($M = 0$, $SD = 1$) and then cross product terms were created. In the initial analyses squared terms for E and N were included along with their cross products with gender. None of the analyses revealed significant squared terms or interactions with squared terms; hence, these terms were not included in the models reported here.

Table 4 shows the results of the regression analyses predicting total EIS, PI, NI and AI from E, N and Gender. Figures 1–4 are plots of these regression equations for individuals at the mean and one standard deviation above and below the mean on E and N. In interpreting the regression equations in Table 4 it is important to bear in mind that because of the coding used for gender the lower order effects, E, N, and E × N and their associated significance tests are for males (G = 0). The interactions of these effects with G test whether the effects are different for females than for males.

As Table 4 and Figs 1-4 indicate, for individuals at the mean on E and N, females reported significantly higher emotional intensity than males for all of the intensity measures with NI showing the largest gender difference (0.411, $P < 0.0001$). These results are consistent with previous findings on various measures of emotional intensity (Bachorowski & Braaten, 1994; Fujita, Diener & Sandvik, 1991; Gross & John, 1995; Larsen & Diener, 1987).

Table 4. Regression equations predicting total EIS, PI, NI, and AI from E, N, and gender

| | Criterion Variable | | | |
	EIS	PI	NI	AI
Intercept	3.450	3.695	3.097	3.437
E	0.045(2.81**)	0.122(6.91***)	−0.077(−3.79***)	0.061(2.22*)
N	0.171(10.98***)	0.064(3.74***)	0.265(13.34***	0.314(11.85***)
Gender(G)	0.230(11.26***)	0.150(6.63***)	0.411(15.79***)	0.101(2.90**)
E × N	0.035(2.27*)	0.042(2.47*)	0.031(1.60)	0.031(1.17)
E × G	−0.011(−0.55)	−0.025(−1.10)	0.029(1.11)	−0.044(−1.26)
N × G	0.024(1.20)	0.010(0.43)	0.050(1.95)	−0.001(−0.04)
E × N × G	−0.041(−2.06*)	−0.062(−2.78**)	−0.027(−1.05)	−0.025(−0.75)
R^2	0.29	0.11	0.42	0.21
N	1496	1505	1511	1519
MSE	0.138	0.170	0.226	0.408

* $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

Note: Values in parentheses are *t*-ratios. MSE = mean square error. Unstandardized coefficients are reported here from an analysis in which E and N were standardized variables.
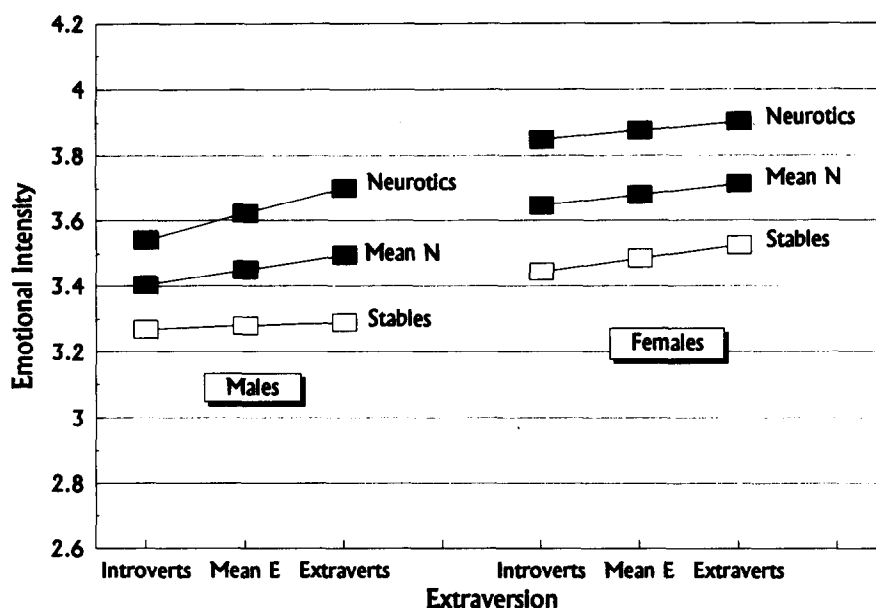
Fig. 1. Predicted overall emotional intensity as a function of E and N, based on the regression equation in Table 4. Low, medium, and high values of E and N are at −1, 0 and +1 SD from the means of each, respectively.
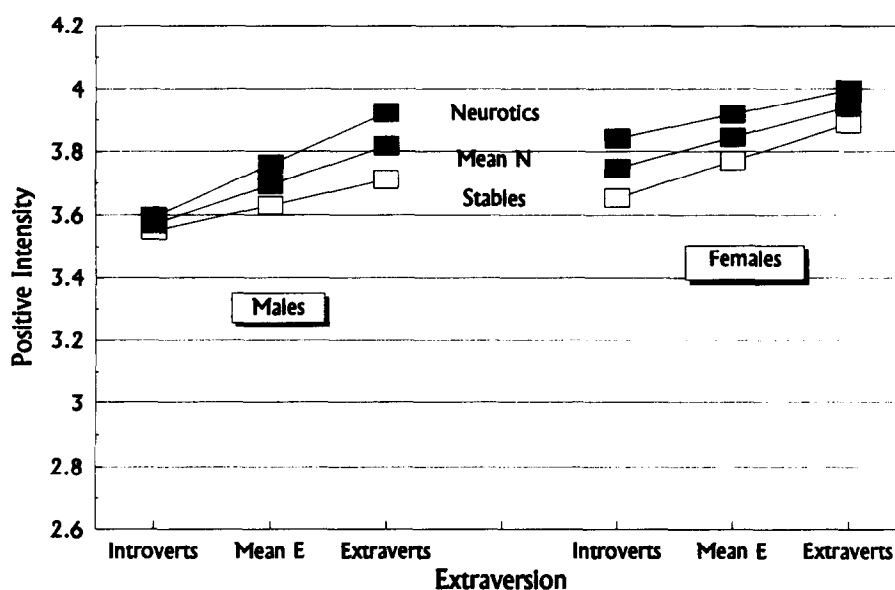

Fig. 2. Predicted positive emotional intensity as a function of E and N, based on the regression equation in Table 4. Low, medium, and high values of E and N are at −1, 0 and +1 SD from the means of each, respectively.

Table 4 reveals that when N is controlled at its mean (N = 0) there are significant extraversion effects among males for all the emotional intensity variables. It is particularly worth noting that the direction of this relation is positive for anger intensity but negative for non-anger negative intensity. These differential relations with E suggest again that it is probably not reasonable to simply lump AI and NI together as overall negative emotional intensity. The E × G interaction terms are all non-significant, indicating that the extraversion effects are similar for males and females.

As Table 4 indicates, the E × N interactions were significant ($P < 0.05$) among males for both
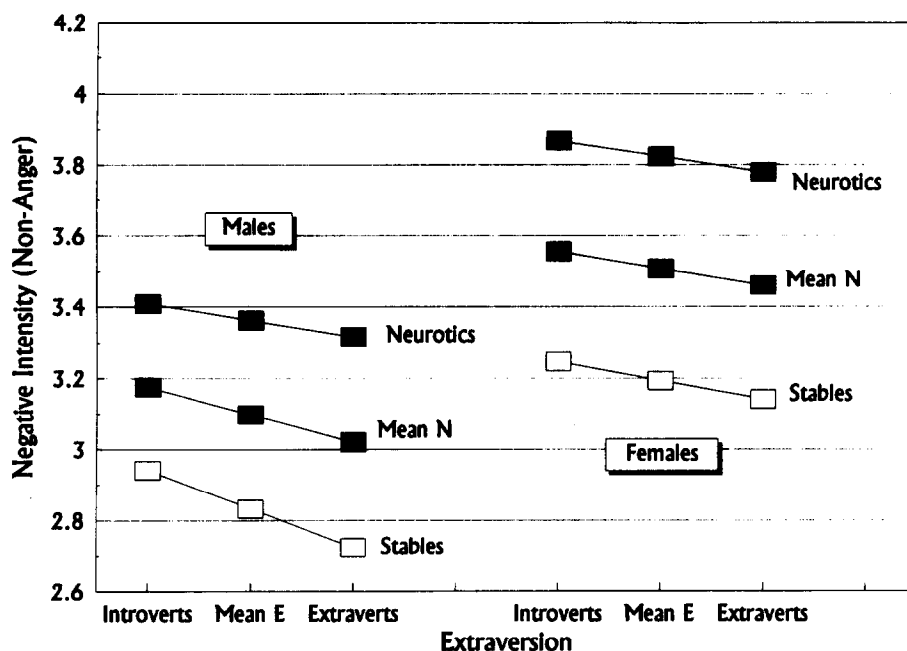
Robert M. McFatter

Fig. 3. Predicted non-anger negative emotional intensity as a function of E and N, based on the regression equation in Table 4. Low, medium, and high values of E and N are at -1, 0 and $+1$ SD from the means of each, respectively.
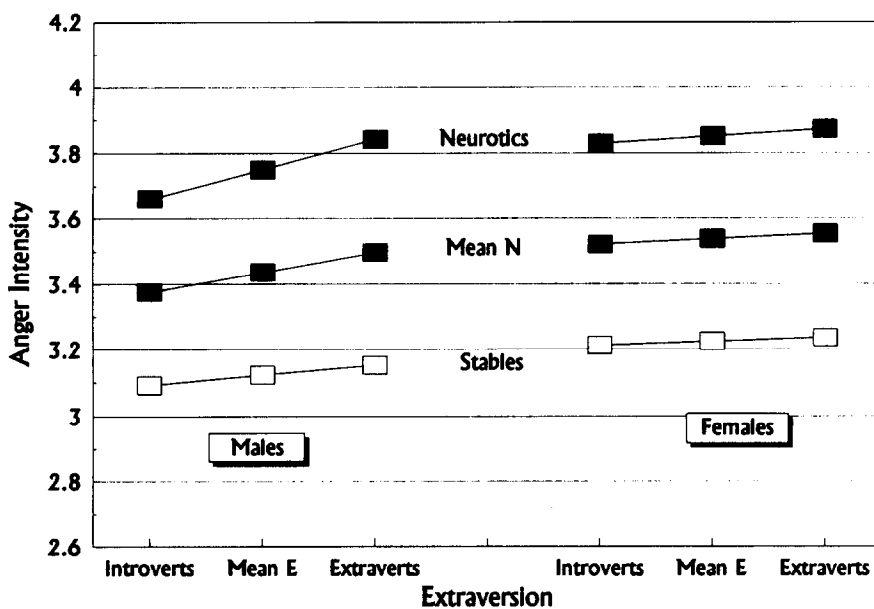

Fig. 4. Predicted anger intensity as a function of E and N, based on the regression equation in Table 4. Low, medium, and high values of E and N are at -1, 0 and $+1$ SD from the means of each, respectively.

EIS and PI. The pattern of these interactions is revealed by Figs 1 and 2 and is similar to that reported by Hotard *et al.* (1989) and McFatter (1994), namely, the positive relation of E to emotional intensity is stronger among neurotics than among stables. The significant three-way interactions in Table 4 indicate that the E × N interactions only occurred among male subjects.

The regression results reported here are not consistent with the notion that positive affect is unrelated to neuroticism and negative affect is unrelated to extraversion (Cooper & McConville,

1989, 1993; Costa & McCrae, 1980; Larsen & Ketelaar, 1991; Meyer & Shack, 1989). Although PI was more strongly related to E than N, it was also significantly positively related to N ($P < 0.001$) for both males and females. Also, although NI was more strongly related to N than to E, it was also significantly negatively related to E ($P < 0.001$ and $P < 0.01$ for males and females, respectively). The results found seem more consistent with what would be expected on the basis of Gray's theory or the WBN model.

Neuroticism and positive emotional intensity

The positive relation between N and PI found here is theoretically important for models such as the WBN model that see neuroticism as reflecting general (including positive) emotional reactivity. Because of the importance of this result, correlations between N and the 14 individual positive intensity items were examined. Significant positive relations (after taking into account reverse scoring for some of the items) were found between N and the individual positive intensity items for 10 of the 14 PI items on the EIS (*rs* from 0.08–0.22, $P < 0.003$). The other four PI items all had small and non-significant relations with N. Therefore, this result was not due to a few unusual items.

Although the WBN model's claim that N reflects "reactivity of the non-specific arousal system" and hence, general emotional intensity (Bachorowski & Braaten, 1994), receives support from these results, additional analyses suggest that N involves more than general emotional reactivity. A comparison of the partial relation of PI to N (controlling for NI) with the zero order relation of PI to N was informative. PI and N correlated *positively*, $r(1522) = 0.18$, $P < 0.0001$, as did PI and NI, $r(1526) = 0.51$, $P < 0.0001$. But when PI and NI were used together to predict N the partial relation between PI and N was significantly *negative*, $P < 0.0001$. This suggests that it is the variance that PI shares with NI that accounts for the positive correlation between PI and N. The fact that the partial relation of PI with N (controlling NI) is significantly negative indicates that more is involved in neuroticism than simply "generalized emotional reactivity" as reflected in overall emotional intensity scores. That is, after controlling for variability in neuroticism that may be accounted for by a construct such as Wallace *et al.*'s, (1991) "reactivity of the non-specific arousal system", variability in neuroticism is also related to the *valence* of the emotional experience with positive intensity tending toward lower neuroticism and negative intensity tending toward higher neuroticism.

A new variable, DIFF ($=$ PI–NI), was created to reflect the valenced intensity difference. If EIS is taken as a measure of generalized emotional reactivity and DIFF is taken as a measure of the valenced intensity difference, the correlations found indicate that neuroticism is related roughly equally to the two ($r = 0.47$, $P < 0.0001$ and $r = -0.49$, $P < 0.0001$, respectively). A multiple regression predicting N from both also yielded very similar partial effects for the two measures (partial *rs* $= 0.39$ and -0.41, respectively). The negative relations between DIFF and N indicate that the *relative* positivity of emotional intensity is negatively related to N. Thus, WBN's idea that N reflects general (both positive and negative) reactivity of the NAS accounts only partially for N's relations to emotional intensity.

GENERAL DISCUSSION

The results reported here generally support Gray's theory and the WBN model over the alternatives presented in Table 1. It is important to note that the predicted relations with negative emotional intensity only became apparent after negative intensity was separated into non-anger negative intensity and anger/frustration intensity factors. Therefore, these kinds of negative intensity need to be considered separately in any theoretical account of emotional intensity. The fact that Gray's theory predicts the three factors found here and to a reasonable degree the relations between them and the personality variables, weighs strongly in its favor. The finding of differential relations of temperament variables between PI and NI suggests that models (e.g. arousal regulation theory) that see affect intensity as such a unitary construct that positive and negative intensity are expected to be indistinguishable in their relations with other variables are probably not adequate accounts of emotional intensity.

A most striking aspect of the present study is how results for the *intensity* measures examined in

this study contrast with those found in other studies for *frequency* measures of positive and negative affect. Whereas frequency measures of positive affect tend to be (often weakly) negatively correlated with neuroticism, intensity of positive affect was found here to be significantly positively associated with N. Moreover, the usual weakly negative relation between frequency measures of PA and NA becomes a fairly strong ($r = 0.51$) positive relation between intensity measures of positive and negative affect. The present results are consistent with results found by Carver & White (1994), who reported a positive correlation of 0.28 ($P < 0.0001$) between two of their scales (the BAS Reward Responsiveness and BIS scales). Carver & White constructed these scales to measure sensitivities of the BAS and BIS, which they expected to be independent of one another. The scale items, however, appear to measure positive and negative emotional intensity, respectively, which, although likely to be strongly affected by sensitivities of the BAS and BIS, might also reflect the activity of a third general emotional intensity dimension. These results all together suggest that, although positive and negative emotional intensity probably have somewhat different biological underpinnings, there is common variation between them that is related to neuroticism, perhaps via the reactivity of the NAS as the WBN model suggests.

Anger/frustration intensity

The weak but positive (at least for males) relation between anger intensity and E contrasts with the negative relation between non-anger negative intensity and E. Gray's theory (along with the WBN model) predicts the latter relation, but seems unclear with regard to how anger intensity (associated with the FFS) and E should be related. The finding of a positive relation between anger intensity and E, however, may be interpreted as consistent with the WBN model. If, in accordance with the WBN model (Newman, 1987; noting his emphasis on the active response set of extraverts), negative cues, including cues for the removal of expected reward (frustration), stimulate not only the BIS but also (perhaps via the NAS), in those with a strong BAS, a general tendency toward action, that tendency might manifest itself in the form of anger or aggression. Thus, one might expect that anger intensity could be related to E and N in a way more similar to positive intensity than non-anger negative intensity. This seems to be the case, at least for E, in the present data.

This kind of reasoning is consistent with Berkowitz's (1993) analysis of anger and emotional aggression. Berkowitz presents evidence that any unpleasant experience/affect is associated with the anger/aggression syndrome. He also proposes, citing Davidson's (Davidson & Tomarken, 1989) emphasis on approach/withdrawal as a fundamental dimension of emotional responses, that "all negative emotion states are not alike; in some, such as fear and. disgust, withdrawal tendencies predominate, whereas approach tendencies are stronger in other negative states such as anger. It might be, then, that decidedly unpleasant feelings accompanied by *relatively strong approach inclinations* are especially apt to activate the anger/aggression network" (p. 39, emphasis added). "Relatively strong approach inclinations" would, of course, be characteristic of extraverts according to Gray's theory or the WBN model.

Davidson's and his colleagues (Davidson, 1992; Tomarken, Davidson, Wheeler & Doss, 1992; Wheeler, Davidson & Tomarken, 1993) studies of frontal brain activation asymmetry find that positive emotional states are associated with relatively stronger activation in the left frontal area, whereas negative emotional states are associated with relatively stronger activation of the right frontal area. The evidence from these studies also tends to indicate that anger has the same relation to brain activation asymmetry as fear and other negative emotions (e.g. disgust and sadness). This might appear to undermine Berkowitz's suggestion that anger is related to an approach system whereas fear is related to a withdrawal system. However, it does so only if one insists on identifying frontal brain activation asymmetry with approach/withdrawal. I wonder whether Davidson's (1992) application of "approach/withdrawal" terminology to his frontal activation systems is really warranted. Perhaps terminology reflecting simple valence of emotion rather than action tendency would be more justifiable from the evidence.

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