

Personality and Emotional Reactivity

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This study examined the relationship between personality and emotional reactivity. Extraversion and neuroticism were measured using the Eysenck Personality Inventory. Subjects were randomly assigned to receive either caffeine or placebo. Reported emotional experience was measured after subjects viewed positive and negative affect-eliciting filmclips, and facial expressiveness was measured from videotapes recorded while the subjects viewed the filmclips. Personality was associated with emotional reactivity among individuals who received placebo, but not among individuals who received caffeine. Among individuals who received placebo, higher levels of extraversion were associated with less reactivity to the negative stimuli, and higher levels of neuroticism were associated with less reactivity to positive stimuli. © 1995 Academic Press, Inc.

A growing body of research has been devoted to the exploration of the relationship between personality and emotion. Although more recent work (e.g., Watson & Clark, 1992) has examined the "Big Five" personality dimensions, most of the research in this area has focused on extraversion and neuroticism. Extraversion has typically been found to be associated with positive affect, and neuroticism has typically been found to be associated with negative affect (e.g., Costa & McCrae, 1980; Tellegen, 1985; Diener & Emmons, 1985). Personality may be linked to emotion for both temperamental and instrumental reasons (McCrae & Costa, 1991). A temperamental connection would be based on individual differences in personality influencing the likelihood of individuals responding in different ways to similar events. For example, the neurological underpinnings of extraversion may be associated with sensitivity to reward cues, which would make extraverts more likely than introverts to experience pleasant emotions. An instrumental connection would be based on individual differences in personality leading individuals to have experiences that differ

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in their likelihoods of eliciting different kinds of emotional reactions. For example, extraversion may be associated with the likelihood of engaging in activities that have a high likelihood of leading to reward, which would make extraverts more likely than introverts to experience pleasant emotions.

There are at least two reasons why additional research exploring the relationship between personality and emotional reactivity is warranted. First, the vast majority of the research examining the relationship between personality and emotion has been correlational in nature. As pointed out by Larsen and Ketelaar (1991), experimental procedures are particularly well suited to exploring the relationship between personality and emotion. Although Larsen and his colleagues have conducted several such studies (Larsen & Ketelaar, 1989, 1991; Bunce, Larsen, & Cruz, 1993), they have relied exclusively on self-report in order to measure emotional reactivity. Thus, there is a need for additional research that utilizes experimental procedures and measures emotional reactivity using multiple measurement strategies.

The second reason additional research is warranted is that the results of previous research have not all been consistent. Although extraversion has typically been found to be associated with reactivity to positive stimuli, and neuroticism has typically been found to be associated with reactivity to negative stimuli, Bunce *et al.* (1993) recently found a different pattern of results. The goal of the study conducted by Bunce *et al.* was to explore the relationship between personality and excitation transfer effects. Bunce *et al.* had subjects rate how slides made them feel under two different conditions, following an exercise manipulation and then again under control conditions. Bunce *et al.* found that extraversion was negatively correlated with the size of the excitation transfer effect to negative slides, and neuroticism was positively correlated with the size of the excitation transfer effect to positive slides. Thus, the typical associations between extraversion and positive affect and between neuroticism and negative affect were not found by these investigators.

The results of the Bunce *et al.* (1993) study suggest that: (1) extraversion may sometimes be associated with reactivity to negative stimuli, (2) neuroticism may sometimes be associated with reactivity to positive stimuli, and (3) the nature of the association between personality and emotional reactivity may be sensitive to arousal manipulations. There are at least two reasons to suspect that the relationship between personality and emotional reactivity may be influenced by arousal manipulations. First, arousal plays a central role in many models of both personality (e.g., Eysenck, 1967) and emotion (e.g., Thayer, 1989). Second, since cognitive performance has been found to be associated with interactions between personality and arousal manipulations (e.g., Revelle, Humphreys, Simon, &

Gilliland, 1980), why should emotional reactivity be expected to be different?

The possibility that there is an optimal level of arousal was proposed by Hebb (1955) and has been a central feature of theorizing and research in the areas of personality (e.g., Geen, 1984) and temperament (e.g., Strelau, 1983). Based on the premise that emotions serve an adaptive function that is important for survival and adaptation (e.g., Frijda, 1986; Lazarus, 1991), sensitivity to affect-eliciting events should be an important criterion in determining whether a particular level of arousal is optimal. Put another way, if arousal levels influence sensitivity to affect-eliciting events, the degree to which a particular level of arousal is optimal may be influenced by the manner in which that level of arousal affects sensitivity to affect-eliciting cues. If personality is related to both arousal level and emotion, it would be reasonable to expect that manipulating arousal would affect the manner in which personality is associated with emotional reactivity. Furthermore, discovering how the manipulation of arousal affects the relationship between personality and emotion could provide clues to understanding how and why personality and emotion are associated. For example, if a particular arousal manipulation affects the relationship between personality and emotion, it would suggest that the neural mechanisms that were affected by the arousal manipulation might play a role in linking personality and emotion.

The goal of this study was to examine the relationship between personality and emotional reactivity. We examined whether two personality dimensions, extraversion and neuroticism, were associated with emotional responses, measured using both self-report and facial expressiveness, to positive and negative affect-eliciting filmclips. In addition, we explored whether the relationship between personality and emotional reactivity would be influenced by an arousal manipulation frequently used in personality research, the administration of caffeine (e.g., Bullock & Gilliland, 1993; Smith, Wilson, & Jones, 1983).

METHOD

Subjects

Forty male and 34 female students at the University of Illinois participated in the study. All subjects were informed of the possible side effects of caffeine. Five potential subjects did not participate due to medical contraindications. Subjects ranged in age from 17 to 28 years ($M = 19.3$, $SD = 1.8$).

Procedure

Subjects were asked to refrain from consuming caffeine for 6 hours prior to the experiment. Subjects participated at either 9:00 AM or 5:00 PM.¹ A research assistant, who did not

¹ Analyses of variance using caffeine condition (caffeine vs placebo) and time of day

participate in the experimental session, randomly assigned subjects to one of two conditions: (1) the Caffeine condition, in which subjects received a sugar-free lemonade-flavored beverage to which caffeine was added; (2) the Placebo condition, in which subjects received a sugar-free lemonade-flavored beverage to which quinine (to approximate the bitterness of caffeine) was added. The quantity of caffeine given to subjects in the Caffeine condition depended on their reported weight. Subjects in the Caffeine condition received an average of 4.1 mg/kg of caffeine. The experiment was run double blind, with neither the subject nor the experimenter knowing whether the drink contained caffeine.

Subjects were asked to drink their beverage as soon as they arrived for the experiment. In order to measure personality, subjects completed the Eysenck Personality Inventory (EPI, Form B; Eysenck & Eysenck, 1964). The average extraversion score was 17.0 ($SD = 3.0$), and the average neuroticism score was 12.8 ($SD = 3.8$). As expected, extraversion and neuroticism were not significantly associated ($r = -.13$).

Thirty minutes after consuming the beverage, subjects completed a relatively brief measure of hemispatial bias, the results of which are reported elsewhere (Berenbaum & Williams, in press). Subjects were then shown four filmclips taken from commercially available films. Two of the filmclips, one taken from the film *Bill Cosby: Himself* and the other taken from the cartoon *Ali Baba Bunny* were intended to elicit positive responses. The Bill Cosby filmclip showed the comedian doing his standup comedy routine. The audio portion of the filmclip was edited in order to eliminate audience laughter. The other two filmclips were intended to elicit negative emotional responses. One of the unpleasant filmclips was taken from the film *Alien* and showed an alien creature bursting out of someone's stomach. The other unpleasant filmclip was taken from the film *Raiders of the Lost Ark* and showed a cave full of spiders and a pit full of snakes. The filmclips were all between 3 and 3 1/2 min long. The order in which the filmclips were shown was determined randomly for each subject.

Subjects watched the filmclips while seated in a comfortable chair, approximately 6 feet from a 20-inch color video monitor on which the filmclips were shown. The subjects were alone in the room while watching the films. After each filmclip, subjects completed a self-report form on which they indicated how disgusted and happy the filmclip had made them feel. Ratings were made on a 7-point scale anchored as follows: 1—not at all; 3—slightly; 5—moderately; 7—extremely. As expected, the positive filmclips elicited more happiness than did the negative filmclips, and the negative filmclips elicited more disgust than the positive filmclips. The analyses presented below examining reported emotion focused exclusively on reported happiness in response to the positive filmclips and reported disgust in response to the negative filmclips.

Subjects were videotaped while they watched the filmclips. The video camera was located behind a one-way mirror, though subjects had been told that they would be videotaped during the experiment. Facial expressiveness was rated by five undergraduate research assistants who were unaware of subjects' personality scores. Each judge rated how emotionally expressive each subject appeared during each filmclip.² The ratings were made on a 7-point scale identical to the one described above. Interrater reliability of the ratings, measured using the intraclass correlation with judges treated as random effects and the mean of the raters as the unit of reliability, was .87.

(morning vs afternoon) as independent variables, and the different emotional reactivity scores as dependent variables, did not reveal any main effects for, or interaction with, time of day. In addition, when the correlations between personality and emotional reactivity were computed separately for subjects tested in the morning and in the evening, none of the correlations differed significantly from one another.

² Due to technical problems and/or human error, facial expression ratings could not be made for nine subjects.

TABLE 1
CORRELATIONS AMONG MEASURES OF EMOTIONAL REACTIVITY

	Facial		Reported	
	Positive films	Negative films	Positive films	Negative films
Positive films—Facial		.51**	.36*	.03
Negative films—Facial	.72***		.16	.38*
Positive films—Reported	.45**	.19		.16
Negative films—Reported	.50**	.32*	.30*	

Note. Correlations above the diagonal are for the placebo condition, and correlations below the diagonal are for the caffeine condition. * $p < .05$, ** $p < .01$, *** $p < .001$.

RESULTS

Rather than analyze the four filmclips separately, we combined the two positive films and the two negative films. The correlations between pairs of variables that were combined ranged from .38 to .65, with a mean of .54. Because there were differences in the means and standard deviations of the different film scores, we converted the raw scores into standardized scores before summing across film scores.

As can be seen in Table 1, all of the emotional reactivity scores were positively correlated. In particular, there was a strong association between facial reactivity to the positive and negative affect-eliciting filmclips. As expected, there were moderate correlations between facial expressions and self-reports in response to similarly valenced filmclips. The correlations among emotional reactivity scores tended to be stronger in the caffeine condition than in the placebo condition. The only correlation that differed significantly between the two conditions was the correlation between facial responses to positive filmclips and reported responses to negative filmclips ($z = 1.99$, $p < .05$, two-tailed).

Next we examined the relationship between personality and emotional reactivity. As can be seen in Table 2, there were some significant associations between personality and emotional reactivity among individuals who received placebo, but no significant associations among individuals who received caffeine. Among individuals in the placebo condition, higher levels of extraversion were associated with lower levels of emotional reactivity in response to the negative affect-eliciting filmclips. This finding was consistent across both response modalities (self-report and facial expression). Extraversion was not significantly associated with emotional reactivity in response to positive affect-eliciting filmclips. Among individuals in the placebo condition, higher levels of neuroticism were associated with lower levels of emotional reactivity in response to the positive affect-

TABLE 2
CORRELATIONS BETWEEN PERSONALITY AND EMOTIONAL REACTIVITY

	Placebo		Caffeine	
	Extraversion	Neuroticism	Extraversion	Neuroticism
Positive films				
Facial expression	.009	-.31*	-.004	.11
Self-report	-.04	-.005	.17	.21
Negative films				
Facial expression	-.42**	.05	-.05	.24
Self-report	-.30*	.12	.15	.16

* $p < .05$, ** $p < .01$.

eliciting filmclips. However, this association was only detected in subjects' facial expressions; subjects' reported emotional responses to the positive stimuli were not associated with neuroticism.

Having found several significant associations between personality and emotional reactivity among subjects in the placebo condition but not among subjects in the caffeine condition, we examined the statistical significance of the differences in the correlations. Using two-tailed tests of significance, there was a trend for the correlation between neuroticism and facial responses to the positive films to differ between subjects in the placebo and caffeine conditions ($z = 1.65$, $p < .10$, 2-tailed). There were also trends for the correlations between extraversion and facial and reported responses to the negative films to differ between subjects in the placebo and caffeine conditions ($z = 1.61$, $p < .11$, 2-tailed, and $z = 1.90$, $p < .06$, two-tailed, for facial and reported responses, respectively).

Having found that extraversion and neuroticism were each differentially associated with reactivity to positive and negative affect-eliciting films among subjects in the placebo condition, we examined the statistical significance of the differences in the correlations. These analyses were conducted using the formula recommended by Meng, Rosenthal, and Rubin (1992). In the placebo condition, the correlation between neuroticism and facial responses to positive films differed significantly from the correlation between neuroticism and facial responses to negative films ($z = 2.07$, $p < .05$, 2-tailed). Similarly, in the placebo condition, the correlation between extraversion and facial responses to positive films differed significantly from the correlation between extraversion and facial responses to negative films ($z = 2.53$, $p < .05$, two-tailed).

Finally, we explored whether the correlations between personality and emotional reactivity differed between males and females. None of the correlations differed significantly across gender. However, there was a

trend for the significant associations described above to be somewhat stronger for females than for males. For example, when the three significant correlations presented in Table 2 were averaged separately for males and females, the average correlation among females was $-.51$, compared to an average correlation of $-.22$ among males.

DISCUSSION

One of the most impressive aspects of the results was that all of the different measures of emotional reactivity were positively correlated. In particular, facial responses to positive and negative filmclips were strongly correlated in both the placebo and caffeine conditions. In fact, all six of the correlations between facial responses to individual filmclips were statistically significant in the caffeine condition (average $r = .66$), and five of the six correlations between facial responses to individual filmclips were statistically significant in the placebo condition (average $r = .42$). Thus, these results provide support for an affect intensity dimension that is independent of the valence of the affect-eliciting stimulus and the valence of the emotional response (Larsen & Diener, 1987). Although the reported emotional responses were also positively correlated, they were not as strongly associated as were the facial responses. One possible explanation for the particularly strong associations among facial responses is that the degree to which individuals exhibit facial expressions in response to affect-eliciting stimuli may be influenced by individual differences in facial expression motor programs that are independent of the subjective experience of emotion (Berenbaum & Rotter, 1992).

Consistent with past research, the results of this study indicate that personality and emotional reactivity are associated with each other. Our finding that personality was associated with facial expressiveness indicates that the association between personality and emotional reactivity is not merely an artifact of common method variance due to subjects' self reports. Because we exposed all subjects to the same set of affect-eliciting stimuli, our results indicate that personality can be associated with emotion because of what McCrae and Costa (1991) called temperamental reasons. In other words, personality is not merely associated with emotion because personality characteristics lead individuals to obtain different experiences, but rather there appears to be something about personality characteristics which is associated with the manner in which individuals respond to affect-eliciting events.

We found that when arousal was not manipulated with caffeine, extraversion was negatively correlated with reactivity to the negative affecting-eliciting filmclips, and that neuroticism was negatively correlated with reactivity to the positive filmclips. One possible explanation for this pattern of results is that: (1) extraversion is sensitive to an approach-

withdrawal dimension of affect-eliciting stimuli, with extraverted individuals responding more strongly to stimuli that elicit approach behavior and introverted individuals responding more strongly to stimuli that elicit withdrawal behavior; (2) neuroticism is sensitive to a happiness–sadness dimension of affect-eliciting stimuli, with neurotic individuals responding more strongly to stimuli that elicit sadness and stable individuals responding more strongly to stimuli that elicit happiness; (3) extraversion is not sensitive to the happiness–sadness dimension; and (4) neuroticism is not sensitive to the approach–withdrawal dimension. This explanation is consistent with the results of past research. Past research has found that extraversion is positively correlated with positive affect, and approach behavior is probably associated with the high pole of positive affect as conceptualized by Watson and Tellegen (1985). Past research has also found that neuroticism is positively correlated with negative affect, and sadness covaries with the high pole of negative affect (Watson & Clark, 1992).

The explanation described above is consistent with the nature of the stimuli we used. The negative filmclips were expected to elicit primarily disgust and fear, two emotions which would typically be associated with withdrawal. The negative filmclips were not expected to elicit sadness or happiness. The positive filmclips were expected to elicit primarily happiness. Because of the nature of the positive filmclips, they were not expected to elicit approach or withdrawal. Thus, the negative affect-eliciting filmclips were associated with the withdrawal end of the approach–withdrawal dimension and were not associated with the happiness–sadness dimension. In contrast, the positive affect-eliciting filmclips were associated with the happiness end of the happiness–sadness dimension and were not associated with the approach–withdrawal dimension. We do not believe that the associations we found between personality and emotional reactivity are specific to the particular affect-eliciting stimuli used in this study. Rather, we predict that extraversion will be associated with reactivity to any set of stimuli that are sensitive to the approach–withdrawal dimension, and that neuroticism will be associated with reactivity to any set of stimuli that are sensitive to the happiness–sadness dimension. We recommend that future research examine the relationship between personality and emotional reactivity in response to stimuli which are sensitive to a variety of different dimensions, such as the approach–withdrawal dimension, the happiness–sadness dimension, and the positive and negative affect dimensions as conceptualized by Watson and Tellegen (1985).

It is likely that what we are calling a happiness–sadness dimension is similar to what others (e.g., Russell, 1980) have referred to as a pleasure–displeasure dimension. We have chosen to refer to this hypothetical dimension as happiness–sadness because our results suggest that neuroticism

is not associated with at least some stimuli that would be considered unpleasant, such as the negative filmclips we used. It is also worth noting that the approach-withdrawal dimension we are describing differs from a high vs low activation dimension. We would expect both approach and withdrawal to be associated with at least modest activation. Approach and withdrawal would not differ in their levels of activation, but rather would differ in the goal of the activation.

We found that the relationships between personality and emotional reactivity depended on whether individuals received caffeine or placebo. It was only among those individuals who received placebo that relationships between personality and emotional reactivity emerged. These results indicate that whatever underlies the connection between personality and emotional reactivity is affected by a caffeine manipulation. Such results are not surprising and are consistent with the hypotheses that: (1) arousal plays a role in both personality and emotion, and (2) the connection between personality and emotion is mediated by arousal. For example, it is possible that under ordinary circumstances introverts are particularly sensitive to affect-eliciting cues that are relevant to withdrawal because responding to such stimuli provides them with an effective means of modulating their arousal level. However, when their baseline arousal level is chemically manipulated, as was done in the caffeine condition, responding to withdrawal cues may no longer be an effective means of achieving their optimal arousal level. Consequently, introversion-extraversion and reactivity to affect-eliciting cues that are relevant to withdrawal would not be associated among individuals who have ingested caffeine. Alternatively, the ordinary baseline arousal level of introverts may make them particularly sensitive to withdrawal cues, which would account for the correlation between introversion-extraversion and reactivity to withdrawal cues. However, the manipulation of arousal with caffeine may erase the increased sensitivity of introverts to withdrawal cues, thereby eliminating the association between introversion-extraversion and reactivity to withdrawal cues among individuals who have ingested caffeine.

As has been pointed out by other researchers (e.g., Venables, 1984), arousal is not a unitary phenomenon. Thus, although caffeine can be said to affect arousal, and the results of this study suggest that arousal is relevant for understanding personality, emotion, and the relation between the two, a thorough understanding of these phenomena will not be possible without examining which specific roles are played by which specific facets of arousal. Caffeine affects a number of different neurotransmitter systems including both dopamine and norepinephrine, and thereby affects nervous system functioning in a variety of different ways. The results of this study suggest that at least some of the aspects of nervous system functioning

that are related to personality and emotion are affected by caffeine. Unfortunately, the results of this study cannot elucidate which of the aspects of nervous system functioning that are affected by caffeine are related to personality and emotion. In order to determine which specific neurophysiological factors affect, and possibly underlie, the association between personality and emotional reactivity, it will be valuable for future research to measure and manipulate specific brain systems and neurotransmitters. We believe it will be particularly valuable to examine and manipulate brain systems that have been posited to be associated with the dimensions described earlier, such as approach-withdrawal.

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