5 Personality and the Structure of Affective Responses

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A common observation about people in emotional situations is the great variability of their reactions. For example, faced with rude service in a restaurant, one person may get extremely upset, brooding about the episode for hours, another might get momentarily furious, whereas a third might just be slightly irritated for a minute or two. Even if these people construe the situation in essentially similar terms, the magnitude and the duration of their reactions can vary significantly. Moreover, the structure of their reactions seems to transcend any particular situation. Thus, if the restaurant incident had occurred to our friend, we could make an "educated guess" as to his probable reaction. In other words, it appears that the structure of individuals' responses to emotion-inducing events is to some extent a consistent and coherent feature of personality.

The obvious questions arising from these everyday observations have led to the investigation of the relationship between personality and affect, or more specifically between personality and emotional responses. It is our contention that the examination of discrete emotional episodes can enrich our understanding of both personality and emotions. In particular, we believe that the comparison of positive and negative emotional responses may shed some light on emotional mechanisms per se, as well as on individual differences in affective reactions. However, before examining these claims in more detail, it will be helpful to review briefly relevant aspects of personality theory and emotion theory, as well as some of the more recent research on the relation between personality and affect.

A consistent conclusion from the growing body of literature on the structure of personality is the identification of five main dimensions (Digman, 1990).

Although the five dimensions have been given different labels by different researchers, the bulk of literature refers to extraversion (or surgency), agreeableness, conscientiousness, neuroticism, and culture or openness to experience (Costa & McCrae, 1985). One can order individuals along the introversion–extraversion dimension, where individuals scoring high on this dimension (i.e., extraverts) tend to experience positive emotions, to behave in a more dominant and active way, and to be socially active. On standard personality questionnaires, extraverts are more likely than introverts to endorse items such as "I love going to lively parties." Agreeableness refers to cooperation, trust, and altruism, as exhibited by the endorsement of items having to do with such humane activities as nurturing, caring, and providing emotional support. Conscientiousness encompasses organization, dependability, achievement motivation, and prudence. Individuals scoring high on the emotional stability–neuroticism dimension (i.e., neurotics) tend to experience negative emotions, especially anxiety, and are predisposed towards emotional instability. For example, neurotics are more likely than emotionally stable individuals to report worrying about things that they should have done or said, to be troubled by aches and pains, and to endorse items such as "Sometimes I feel miserable for no good reason." The culture, or openness dimension is seen as a broad dimension of intellect and refinement, aesthetic sensitivity, curiosity, the need for variety of experience, flexibility of thought, and so on.

In spite of the general agreement regarding the "what" of these five dimensions (i.e., their descriptive content), there is frequently a sense of discontent about their ability to provide a causal account with respect to the "how and why" of behavior (Revelle, 1987). Some of the most intriguing attempts to provide a causal theory of individual differences were made by H. J. Eysenck (1967, 1981, 1991) and Gray (1972, 1981). These attempts usually concentrated on a subset of the "Big Five," namely, extraversion and neuroticism for Eysenck, and anxiety and impulsivity for Gray. These two dimensions, albeit somewhat differently conceptualized, form what some researchers consider the "Big Two" primary personality dimensions (Wiggins, 1968). The primacy of these dimensions refers to their consistent and interpretable pattern of relationships with measures of cognitive, behavioral, and affective responses. Of particular interest in the current context are the findings of Tellegen (1985), who related these dimensions to one of the typical categories of affective states, namely mood. In what follows, we attempt to broaden the relationship between the "Big Two" personality dimensions (specifically, extraversion and neuroticism) and another category of affective phenomena, namely, emotions.

Emotions can be analyzed from many different perspectives: neurological, physiological, phenomenological, cognitive, and sociological, to name some of the more prominent ones. One of the common denominators of all these approaches is the attempt to find a classification scheme for emotions. Attempts to

differentiate amongst discrete emotions have been based on cognitive appraisal patterns (e.g., Arnold, 1960; Lazarus, 1991; Lazarus & Folkman, 1984; Ortony, Clore, & Collins, 1988; Roseman, 1984; Smith & Ellsworth, 1985), action tendencies (Frijda, 1986; Frijda, Kuipers, & Terschure, 1989), facial expressions (e.g., Ekman, 1984; Ekman & Friesen, 1975; Izard, 1977), as well as physiological responses (e.g., Ekman, Levenson, & Friesen, 1983).

However, the bulk of this and other emotion research has dealt primarily with *qualitative* distinctions (such as differentiating between various affective states), and has paid little attention to *quantitative* dimensions of emotional experience. Yet in the real world, people tend to describe their emotional experiences as "intense," "prolonged," and "deep," which are quantitative rather than qualitative descriptions. The failure of current emotion research to seriously consider quantitative aspects of emotions might be viewed as one of a number of simplifying assumptions made to facilitate research. A related assumption is the view of an emotion as a unimodal burst of activity of relatively brief duration. In fact, however, research conducted by Frijda and his colleagues (Frijda, Mesquita, Sonnemans, & van Goozen, 1991; Frijda, Ortony, Sonnemans, & Clore, 1992) indicates that more than half of the emotions studied lasted over an hour. This suggests that it may be unwise to restrict oneself to a single measure of emotion intensity over a narrow time interval, because emotions take place in time, and the quality of the overall emotional experience is related not only to its initial magnitude, but also to its temporal characteristics. Thus, we think it useful to think of the overall impact of an emotion not only in terms of its magnitude (which we shall sometimes refer to as *peak intensity*) but also in terms of its temporal aspects.

Another tacit assumption in most emotion research is that discrete emotions occur in isolation. In fact, emotional reactions frequently involve more than one discrete emotion. While describing an argument with a close friend, one of our participants reported getting angry, feeling hurt, and becoming increasingly upset over the possibility of losing the friend's affection and support. Another reported having a whole gamut of emotions regarding her sorority rush, ranging from extreme anxiety to elation intermingled with feelings of guilt. In view of such data it seems unlikely that one can capture the richness and complexity of an emotional episode by simply classifying it as "anger," "joy," or whatever.

We should perhaps think of an emotional experience as being like a piece of music: It has a certain structure, tempo, and duration. Several concurrent emotions, like instruments, can be involved, each playing its own melodic line. Musicologists go beyond the key, the tempo, and the leading instrument to study themes and variations as well as the interplay among the instruments in the piece. Similarly, psychologists should not restrict themselves to studying only the type and magnitude of emotional reactions, but should also consider their constituents, their duration, and their overall structure.

EMOTIONS: A BASIS FOR PERSONALITY?

Recent years have witnessed a growing interest in the relations among emotions, personality, and mood (e.g., Costa & McCrae, 1980; Larsen & Diener, 1987; Meyer & Shack 1989; Thayer, 1989). Several goals may be served by this endeavor. First, as we have already mentioned, the incorporation of considerations relating to emotional experience might lead to improved theories of personality. When viewed from the perspective of emotion theory, a theory of personality acquires many desirable characteristics, such as a link to the temporal ebb and flow of human actions, appraisals, and cognitions (Larsen, 1988; Larsen & Ketelaar, 1991). Moreover, because emotions have a long evolutionary history, they might provide an evolutionary basis for the structure of personality and the development of individual differences. Linking personality dimensions to emotional experience could provide a much needed theoretical "anchor," endowing personality models with more than just descriptive flavor (Revelle, 1987). This approach can be viewed as continuing the line of research initiated by Gray and Eysenck, aiming to explain basic personality dimensions in terms of primitive physiological, affective, and cognitive mechanisms.

Second, defining personality in affective terms has both theoretical and methodological advantages. On the theoretical side, recent research indicates that the structure of personality can be meaningfully related to the structure of mood (Meyer & Shack, 1989; Watson & Clark, 1984). In particular, this research indicates that personality dimensions of extraversion and neuroticism can be related to mood dimensions of positive affectivity and negative affectivity, respectively. Other research (e.g., Diener & Iran-Nejad, 1986; Diener, Larsen, Levine, & Emmons, 1985) has attempted to link personality to the characteristic intensity with which individuals respond to emotion-inducing events. These studies have consistently uncovered wide individual differences in emotional response as measured by the affect intensity measure (AIM, Larsen, Diener, & Emmons, 1986), a measure that assesses the characteristic overall intensity with which individuals typically experience their emotions. However, because both personality and emotional experiences are multidimensional constructs, it seems that a more informative relationship could be established if one could relate individual differences to more than one index of emotional experience. For example, in addition to looking at individual differences with regards to average or overall intensity, the relationship between personality and the temporal structure of emotional experience is likely to provide valuable theoretical insights.

On the methodological side, the link between personality and emotion research provides a new paradigm for the experimental study of personality, such as the one described in Larsen and Ketelaar (1991). In that study, a standard mood induction technique was used to induce positive and negative affect. This manipulation was used to test the hypothesis that the efficacy of negative mood induction would be better predicted by neuroticism scores than by extraversion

scores, whereas the efficacy of positive mood induction would be better predicted by extraversion than by neuroticism scores. If additional relationships between affect and personality can be established, it might be possible to manipulate various parameters of emotion-inducing situations and to use the data so derived to draw conclusions regarding personality.

Third, the study of emotional episodes could provide a link between the "fixed" and the "fluid" (Larsen, 1988) approaches to personality. The former approach concentrates on uncovering consistencies of acts, with a view to determining the nature and number of basic personality tendencies, whereas the latter approach is concerned with understanding adjustment patterns. These approaches differ radically along the time dimension: whereas the "fixed" approach focuses on discrete behavioral acts, the "fluid" one pays attention to the unfolding of behavioral patterns over extended time periods (e.g., a life time). Because emotions can last from a few seconds to years, they provide a meaningful and manageable way of unifying these two approaches. In other words, emotional episodes, replete with actions, cognitive changes, and phenomenological experiences, provide a fertile ground for examining stable traits and tendencies (such as the magnitude of emotional responses) as well as the changes and adaptations that occur over time.

Finally, one might view research concerning individual differences in emotion responsivity as a way to deepen our understanding of emotion mechanisms. Just as the primary way of studying the nature of intelligence has been to study individual differences, attempting to uncover the common factors that underlie cognitive abilities, so too, the study of individual differences in emotional responses might help us to better understand some of the rudimentary mechanisms of emotions.

Personality and Emotion

Two lines of research predominate attempts to relate the personality and emotion domains: One links personality to differently valenced affective responses, whereas the other concentrates on individual differences in emotion intensity, regardless of hedonic value.

Personality and Valence. The basic theoretical premise in the work of Gray (1972, 1981, 1987) and of H. J. Eysenck and colleagues (1967, 1981; H. J. Eysenck & M. W. Eysenck, 1985) is that personality dimensions are best understood as biologically based constructs. In addition to the biological fight-flight system, Gray has proposed two neurologically based motivational systems with differential sensitivity to cues of reward and punishment: the behavioral approach system, which is postulated to control behavior when signals of reward are encountered, and the behavioral inhibition system, which is postulated to control behavior when signals of punishment or nonreward are encountered. Whether

these systems can be conceptualized as directly causing (M. Eysenck, 1987; Fowles, 1987; Newman, 1987; Tellegen, 1985), or as only indirectly related to (Emmons & Diener, 1986) different personality dimensions, and how these systems relate to the dimensions of extraversion and neuroticism (or some other personality dimensions) remain open research questions. However, whatever these relations might be, there is considerable evidence from the biological perspective for the existence of *two systems,* each sensitive to differently valenced stimuli.

In addition to biologically based models, mood research (e.g., Thayer, 1989) has provided additional support for the existence (and relative independence) of two affective systems. Mood studies have indicated that personality dimensions correlate differentially with affect dimensions. Specifically, neuroticism tends to correlate with negative affectivity, that is, the predisposition to experience relatively excessive negative affect, but does not correlate with positive affectivity (Costa & McCrae, 1980; Meyer & Shack, 1989; Thayer, 1989). In contrast, extraversion tends to correlate with positive affectivity, but not with negative affectivity. These correspondences have been extensively validated using various measurement scales, time scales, and report types (Mayer & Gaschke, 1988; Meyer & Shack, 1989; Tellegen, 1985; Watson & Clark, 1991; Watson & Tellegen, 1985; Zevon & Tellegen, 1982).

As a part of an effort to understand the working of the two affective systems, Watson and Clark (1984) sought to specify the nature of negative affectivity, which they define as the "sensitivity to minor failures, frustrations, and irritations of daily life, as evidenced by the likelihood, magnitude and duration of . . . reactions." (p. 466). However, whereas the likelihood and the magnitude of emotional response have been heavily investigated, the temporal aspects have not. Furthermore, although all three aspects are easily separable from a conceptual viewpoint, existing research provides little in the way of constraining the set of possible interrelations between them and personality dimensions. More general hypotheses (e.g., postulating independent responsivity characteristics to each) need to be examined before all three can be tied together to form a unified notion of "sensitivity." Furthermore, one may ask whether the structure of positive affectivity mirrors that of negative affectivity, or is it the case that positive and negative affectivity relate differentially to the likelihood, magnitude, and duration parameters?

Personality and Intensity. That people differ in terms of the intensity with which they experience various emotions is an undeniable truth confirmed by everyday experience. In line with this intuition, Diener, Larsen, and their colleagues conducted extensive research regarding individual differences in emotion intensity (e.g., Diener, Larsen, Levine, & Emmons, 1985; Diener & Larsen, 1987). The main findings of their studies are that differences in affect intensity are highly stable over time and consistent across situations with different hedonic

values; that is, people who tend to have extreme reactions to positive events, tend to exhibit extreme reaction to negative events as well. Their research also suggests that the construct of affect intensity is related in a meaningful way to a variety of indices—physiological, behavioral, and cognitive. For instance, individuals scoring high on the affect intensity measure (AIM, Larsen, Diener, & Emmons, 1986) tend to be less physiologically aroused. On the other hand, behaviorally, they tend to be more sociable, more impulsive, and more extraverted. Finally, from the cognitive viewpoint, these individuals tend to interpret their emotional experiences in a more personally relevant way, to overgeneralize the consequences of both positive and negative events, and to selectively focus their attention on emotion-inducing events (Larsen, Diener, & Cropanzano, 1986).

Larsen and Diener (1987) attempted to explain such findings in terms of the modulation-of-arousal theory. This theory postulates a common optimal level of arousal for all individuals. However, individuals differ in their base level of arousal, and attempt to modulate their level of arousal at any particular time so as to keep that level close to the optimal level. According to this theory, affect intensity, extraversion, and sensation-seeking (i.e., attempting to increase sensory stimulation levels) originate from individual differences in the base level of arousal and exemplify various adjustment mechanisms designed to modulate the arousal level. Underaroused individuals might attempt to modulate arousal in different ways: Sensation-seeking activities raise the arousal level by providing intense sensory experiences (Zuckerman, 1979, 1987), whereas extravert activities increase arousal through social stimulation (M. Eysenck, 1987). On this view, emotional responsivity can be viewed as a manifestation of an (unconscious) heuristic designed to compensate for a low level of base arousal.

Hedonic Value: One Dimension or Two? Different lines of research agree in suggesting that a two-dimensional space adequately describes the structure of affect. However, there is much disagreement as to what the coordinates of this space are (Meyer & Shack, 1989). The mood literature (e.g., Costa & McCrae, 1980; Zevon & Tellegen, 1982) and biologically based models (e.g., Gray, 1987) suggest differential and partially independent systems of positive and negative affect, implying a need for two *unipolar* dimensions, one positive and one negative, as an adequate way to describe affective space. However, such a representation appears to be inconsistent with the emotion literature, in which theorists tend to assume one *bipolar* dimension of pleasantness–unpleasantness and another, orthogonal dimension of arousal (e.g., Russell, 1979, 1980). In addition, the view offered by Diener, Larsen and their colleagues (Diener et al., 1985) seems to suggest that they too embrace a view of emotional affectivity in which positive and negative affect form a single continuum. In short, the problem is the following: On the one hand, the two dimensions of affect, positive and negative, appear to vary independently, and to correlate differentially with vari-

ous personality dimensions; on the other hand, positive and negative affect have been found to correlate within individuals, consistent with a bipolar dimension of affect intensity.

Diener, Larsen, and their colleagues (e.g., Diener et al., 1985; Larsen & Diener, 1987) attempted to resolve this controversy by proposing two alternative dimensions of affect—intensity and frequency. In their view, intensity is the degree to which emotions are experienced regardless of valence, whereas frequency is the amount of time during which individuals experience *predominantly* positive or *predominantly* negative emotions (Diener et al., 1985). Thus, the dimension of intensity is independent of (and separable from) the dimension of frequency. Guided by this conceptualization, Diener et al. (1985) used a single measure of intensity in their investigation of subjective well-being: They assessed (over a period of several weeks) the degree to which respondents reported feeling various emotions (e.g., "happy," "pleased," "angry," "depressed"). Then, the frequency with which an individual experienced positive affect was measured by the number of units of time (e.g., days) for which he or she experienced predominantly positive or predominantly negative emotions. A day was designated as "predominantly positive" if the mean positive intensity score exceeded the mean negative intensity score. Intensity was computed as the mean strength with which individuals experienced their *dominant* affect.

In our view, this approach is still biased toward a bipolar view. The definition of frequency used by Diener, Larsen, and their colleagues, relying as it does on their notion of "predominant affect," involves an implicit assumption of bipolarity. Moreover, this kind of approach might overestimate the consistency with which people evaluate emotion intensity as they move from making judgments about one type of emotion to making judgments about another. This is because the approach assumes that emotion intensity is a unitary construct rather than one involving multiple, relatively independent components. However, Frijda and colleagues (Frijda et al., 1991; Frijda et al., 1992) identified dimensions such as peak intensity, duration and rumination, amount of felt arousal, strength of cognitive change, and strength of felt action readiness as being relatively independent dimensions of affect intensity. To the extent that emotion intensity is indeed a complex construct involving independent or partially independent components such as these, one should be cautious in assuming that participants use a stable criterion in making intensity judgments. Given that such judgments might implicate a multitude of somatic, behavioral, and cognitive features, a respondent in an experiment is likely to focus on the most salient feature of the particular emotional experience being judged—perhaps the strength of the initial reaction, or an unusually strong tendency to act, or (given time for it to occur) an abnormally long rumination time. It seems quite plausible that in evaluating the intensity, for example, of sadness, people will tend to focus primarily on duration, whereas when making the same judgment for anger they will focus mostly on peak intensity. Thus, a rating of 4 on some 7-point "intensity" scale might as

easily represent a 3-hour long sadness episode, as a 5-minute anger episode. We suspect that this problem is likely to be exacerbated with respect to judgments of intensity of emotions differing in valence. For these reasons we are skeptical about the validity of Diener et al.'s (1985) construct of "dominant affect." So far, researchers have been rather vague about which aspect of emotion intensity they are using as their measure, although most appear to use peak intensity almost by default. It seems to us that when studies necessitate asking participants to indicate the intensity of their emotions, it is preferable to be quite explicit as to which feature or features of emotion intensity they should focus on.

Having discussed the relationship between personality and emotion intensity on the one hand, and the multidimensionality of intensity on the other, a natural question is whether there exist meaningful relationships between the duration dimension of intensity and personality. Perhaps individual differences in emotional responses are related not only to differential susceptibility or vulnerability to positive and negative events, but also to the duration and the degree of recurrence and elaboration of various experiences. In a recent article, Larsen and Ketelaar (1991) sought to specify the concept of "sensitivity," which until now has been only loosely defined. They asked "whether the obtained effects [of differential hedonic capacity] are due to stimulus sensitivity or the response magnitude side of the stimulus–response equation" (p. 139). We think there is yet another possibility; hedonic capacity may be due to the length of the impact, or the rate of decay of the affective experience. By considering the duration of emotions, we might be able to examine and refine the nature of differential sensitivity of neurotics and extraverts to positively and negatively evaluated events.

AN EMPIRICAL INVESTIGATION OF THE PERSONALITY-EMOTION CONNECTION

In an attempt to explore some of the issues we have discussed, especially the relation between the temporal structure of emotional experience and different personality dimensions, we conducted a simple study to examine two main hypotheses. First, we hypothesized that the independence of positive and negative affect could be demonstrated not only in the structure of mood (e.g., Tellegen, 1985; Watson & Clark, 1984), but also in the temporal pattern of emotional responses. Second, we examined the possibility that personality characteristics would predict the temporal structure of emotional response. In particular, following the models of Watson and Clark (1984), and Gray (1972, 1981, 1987), we attempted to determine whether negative affectivity (linked to neuroticism) as well as positive affectivity (linked to extraversion and impulsivity) can be characterized as the susceptibility to intense and *protracted* reactions to events inducing negative and positive emotions, respectively. We predicted that neurotics would

report greater magnitudes and longer durations for negative, but not for positive emotions, and that extraverts would report greater magnitudes and longer durations for positive, but not for negative emotions.

Participants in the study were undergraduate students who completed the Eysenck Personality Inventory (EPI, Eysenck & Eysenck, 1964) several weeks before the study, providing neuroticism, impulsivity, sociability, and extraversion scores.[1] During the study proper, the participants completed a 70-item emotion questionnaire. Each item consisted of a short description of an event that a college undergraduate might experience. Event descriptions were designed to vary widely in their emotional significance from being extremely significant to slightly significant on both positive and negative dimensions. Importantly, some events had the potential to elicit both positive and negative responses simultaneously, representing instances of mixed emotions. In addition, some of the questionnaire items were classified according to the type of emotion they were likely to elicit. Sample events in the questionnaire included, "You are late to an interview with a prospective summer job employer," "You got back the wallet you forgot in a restaurant," "You bought something you could not afford," and "Your boyfriend/girlfriend tells you that you should stop seeing each other."

The introductory paragraphs of the questionnaire made clear that each event described might elicit either positive, negative, or mixed (i.e., both positive and negative) emotions. Each event description was followed by a response sheet on which respondents were instructed to indicate the peak intensity and the time-course parameters of their imagined reaction on one or both hedonic dimensions as appropriate (i.e., the person might indicate that he or she experienced some positive reaction *but also* some negative reaction after, say, buying an expensive item).

Several 8-point scales were selected to represent different facets of the temporal structure of emotional responses (Frijda et al., 1992). They included: (a) *peak-intensity,* the magnitude of the emotional reaction at its highest, ranging from *you would not be moved by the event* to *extremely pleased/displeased by the event;* (b) *rise-time,* the amount of time between the onset of the emotion and its peak. Response categories were: *Immediately, Few seconds, About a minute, Few minutes, 10–15 minutes, About an hour, Few hours, About a day;* (c) *duration,* the length of time between the peak of the emotional reaction and the return to baseline activity. Responses categories were: *About a minute, A few minutes, 10–15 minutes, About an hour, Few hours, About a day, Few days, About a week;* and, (d) *rumination,* the length of time that thoughts about the emotion-inducing event and/or its consequences would spontaneously arise after having once subsided. Responses were indicated on a scales with anchors: *Same*

[1]The extraversion scale of the EPI (Eysenck & Eysenck, 1964) has two subcomponents: impulsivity and sociability, that have been shown to have different effects on a variety of cognitive tasks (Revelle, Humphreys, Simon, & Gilliland, 1980).

as above (i.e., one forgets about the event as soon as the immediate emotional reaction subsides), *Same day, Next day, About a week, About a month, Few months, About a year, Few years.*

The three temporal scales (rise-time, duration, and rumination) were designed to allow a transformation of the temporal anchors into an equal-interval logarithmic time scale. An attempt was made to keep the labels cognitively salient ("A few hours," "About a day," etc.). These temporal scales, when considered as one continuum, form a seconds-based logarithmic scale. So for example, "Immediately" refers to 2^2 seconds, "Few minutes" refers to 2^8 seconds, "10–15 minutes" is roughly 2^{10} seconds, "About a day" refers to approximately 2^{16} seconds, and so on.

Temporal Structure of Emotional Responses

The data revealed that in general the temporal structure of an emotional response[2] involves a swift rise-time, taking less than half a minute in about 80% of the cases, followed by a relatively slow decay. After an emotional response reaches its peak, it can take hours, or even days for a person experiencing an extremely intense negative emotion to get back to his or her "normal" state again. Respondents judged that approximately 50% of the emotion episodes described would last more than an hour. Moreover, thoughts concerning the emotional episode were expected to continue to spontaneously come to mind for a couple of days. The median rumination period associated with the events described in our questionnaire was approximately 11 hours.

Some interesting relationships emerged between magnitude and temporal aspects of emotional experiences. First, it seems that peak intensity and the rise-time of emotions are related by an "inverted-U" function. Mild emotions (i.e., those with low peak intensities) tend to elicit an immediate reaction. As peak intensity increases, it takes longer to reach an emotional peak. However, at high levels of peak intensity rise-time is again shorter. One explanation of this relationship exploits the interplay between cognitive complexity and the urgency with which the event appears to demand a response. Reactions to complex situations are likely to demand the evaluation of many possible consequences, perhaps slowing down the time to reach peak intensity to which these evaluations might be contributing. In contrast, situations inducing intense reactions are likely to be high on the urgency dimension, thus necessitating a more immediate response. So, it might be that situations inducing mild emotional responses, and thus not likely to be very complex or urgent, result in a relatively short rise-time. Situations inducing moderate emotional responses might have considerable com-

[2]In most of what follows we sometimes discuss our results as though participants were reporting their actual rather than their imagined reactions to the specified events. Although aware of the issues involved in this distinction, we shall postpone our discussion of it until later.

plexity and moderate urgency, resulting in more time to reach a full-blown emotional state. Finally, high peak-intensity situations might be so high on the urgency dimension, that they necessitate an immediate response, regardless of complexity.

Second, whereas peak intensity was consistently related to the temporal decay measures, the data suggest that given comparable levels of peak intensity, duration can vary dramatically. For example, our participants rated the positive emotion associated with having "someone you find attractive suggest you meet for coffee" as high as 5.7 (on a 0 to 7 scale), which was almost as high as the emotion experienced after "saving your neighbor's child from a car accident." However, the average estimated duration associated with the former was 20 minutes, whereas for the latter it was more than 5 hours. The same pattern emerged with respect to rumination indices—respondents reported that they would stop ruminating about the coffee suggestion after an average of two hours, whereas the car accident experience leads to rumination for about a week. These results indicate that, in general, the overall reaction to an emotion-inducing event cannot be determined from peak intensity alone. It may be that some events elicit mostly somatic and expressive reactions (which are probably most relevant to estimations of peak intensity), whereas for others the attentional resources are claimed by information processing components concerned with examining and reevaluating the current world representation, resulting in longer duration and rumination components.

Positive and Negative Emotions. The data reveal many differences between positive and negative emotions with respect to their temporal characteristics, the most salient of which is that the duration and the amount of rumination associated with negative events is greater than that associated with positive events. Whereas this fact alone may not be very surprising, the size of the effect is. People expect to ruminate about events inducing strong negative emotions about five times as long as they do about events inducing strong positive ones (44 days and 8 days, respectively). Similarly, the effects of negative events of low intensity seem to outlast their positive counterparts. Mild positive experiences tend to be relatively brief, with their immediate effects dissipating in about 20 minutes, and their long-term effects lasting about 5 hours. However, a mild negative experience (i.e., one of comparable peak intensity), a trivial vexation, is associated with a much longer response period—a typical instance lasting a little less than an hour (almost three times as long as a comparable positive one) with a rumination phase lasting as long as 12 hours. A schematic depiction of these results is presented in Fig. 5.1, which highlights the differential decay rates of positive and negative emotions while illustrating their comparability in terms of peak intensity and rise-time.

Another way to quantify the differences in temporal patterns associated with positive and negative emotions is to consider the rates of change in duration and

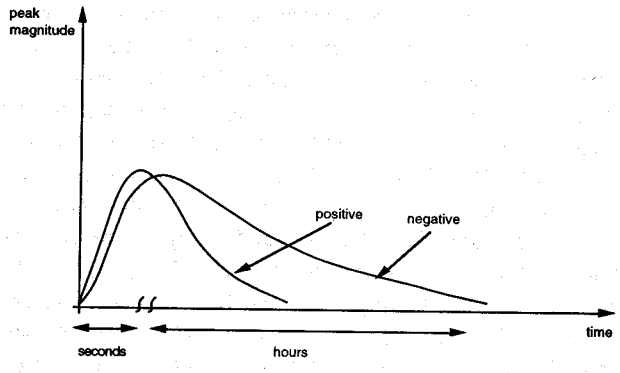

FIG. 5.1. Schematic representation of the duration of positive and negative emotions.

rumination. A one-unit increase in peak intensity was associated with an average increase in duration of approximately 40 minutes for positive emotions, but 110 minutes for negative emotions. A similar pattern of results was obtained with respect to rumination: The increase in rumination per unit of peak intensity was almost four times as large for negative as for positive emotions.

One might attempt to explain this difference by considering the typical consequences of events leading to positive and negative emotions. Negative emotions are often experienced when a goal is blocked. This means that events leading to negative emotions might necessitate the construction of new plans to attain the blocked goal, or the formation of a new goal to compensate for the lost one. Thus, negative emotions require cognitive resources to be allocated to the creation and elaboration of these plans. In contrast, positive emotions are usually experienced when a goal is achieved, so that plan revision and other demanding cognitive operations are less likely to be needed. For this reason alone, one might expect negative emotions to be more prolonged than positive ones (Taylor, 1991).

Mixed Emotions. Mixed emotions are instances in which both positive and negative affect are experienced. In our study, two thirds of the respondents expected to experience mixed emotions with respect to the possibility of speaking in public and after buying an item they could not afford, and nearly 40% expected to experience both positive emotions and negative emotions after being told that a friend had won a free ticket to Europe. In addition to eliciting expectations of mixed emotions, several items elicited differently valenced reactions in different individuals. For example, receiving a compliment from a stranger elicited expectations of only positive reactions from some participants, only negative reactions from others, and mixed reactions from the rest.

Our findings, as well as those of Diener and Iran-Nejad (1986), suggest that mixed emotions emerge primarily at mild or moderate levels of affect. So, for example, in our study, even such mild everyday experiences as receiving a compliment from a stranger, or having a friend win a vacation tended to elicit both positive and negative reactions. Nevertheless, the scarceness of reports of mixed emotions with high levels of intensity was somewhat surprising, especially given that discussions of mixed emotions (e.g., Zuckerman, 1987) often focus on intense experiences such as skiing and riding on roller coasters. In fact, mixed emotions *can* be experienced (and are reported) at relatively high levels of intensity if tapped at the time of occurrence. For example, reports of mixed emotions were collected at weddings (Revelle, 1991), presumably intensely emotional occasions. Other examples of such occasions include leaving home to go to college, graduations, selling of a house, and so on. One explanation for our failure to detect mixed emotions at high intensity levels might be that memory acts as a natural "dichotomizer," causing mixed emotions to be remembered as purely positive or purely negative. This possibility is consistent with the view that memory-mediated reports of emotional experiences are influenced by, and tend to conform to individuals' naive theories of the bipolarity of emotional experience. If this explanation is correct, we might expect more simultaneous occurrences of positive and negative emotions to emerge when experiential sampling, as opposed to memory-mediated techniques, is used.

One of the more intriguing questions in the literature on emotion and affect concerns the relation between positive and negative affect. As already discussed, the well-being literature (e.g., Diener & Emmons, 1984; Zevon & Tellegen, 1982), converging with the mood literature (e.g., Tellegen, 1985), indicates that the two dimensions of affect correlate differentially with various external variables such as personality dimensions. Moreover, recent research (e.g., Diener & Emmons, 1984; Diener & Iran-Nejad, 1986; Watson & Tellegen, 1985) has demonstrated that these dimensions tend to be independent with respect to average levels of positive and negative intensity, especially when assessed over long time periods. Our results provide support for the independence of positive and negative affect from two different perspectives: First, the nature of the relationship among various emotional indices depends on valence. Second, the existence of mixed emotions appears to be more easily accommodated by a view of positive and negative affect as being partially independent.

Distinct Emotions. Finally, there were stable differences across emotions in terms of their reported duration and rumination. The five emotions examined were joy, pride, anxiety, anger, and sadness.[3] The shortest reactions were those

[3]In fact, respondents did not specifically indicate which emotions they expected to experience in response to the different events described. The results we report are based on a preexperimental classification of the event descriptions into the emotions that we, the experimenters, thought they were most likely to elicit.

associated with pride and anger, which respondents rarely expected to last more than half an hour. Joy lasted significantly longer, with almost 60% of the cases lasting over an hour. The emotional state following an anxiety- or sadness-inducing event frequently spanned interruptions due to sleep (Frijda et al., 1991), with 30% of the occurrences lasting more than 18 hours, and the associated rumination lasting days or even weeks. The duration data for anger, sadness, and joy seem to be consistent with those reported in Scherer, Wallbott, and Summerfield (1986). However, in our grouping, the items focusing on negative prospects for the self were mostly pertinent to endangering self-esteem (perhaps best called anxiety), whereas the classification of Scherer et al. included items relevant mostly to physical danger (perhaps most appropriately called fear). This distinction seems to be crucial to the pattern of response: in Scherer et al.'s (1986) research, fear emerged as a relatively brief emotion, whereas in our study, anxiety emerged as a lingering emotion, persisting for hours and even days.

Individual Differences in Emotional Response

So far we have discussed the (partial) independence of positive and negative dimensions of affect, particularly with respect to duration. However, our data also suggest that this independence can be observed in individuals' responses to various life events. Specifically, neurotics seem to respond to emotion-inducing events in an amplified way regardless of the valence of the experience (in a way, "overreacting" to situations). They tend to report not only greater peak intensities, but also more prolonged duration and rumination periods. To give a concrete example, high neurotics (i.e., upper quartile) expected the duration of their affective reaction to "you realize that you've said the wrong thing in an important interview" to last about 18 hours, whereas low neurotics (i.e., lower quartile) expected it to last approximately 3 hours. A similar relationship was found for the associated rumination phase (about 4 days for high neurotics and less than 2 days for low neurotics). In addition, however, our duration data revealed that neurotics react even more strongly to *mild negative* as opposed to *mild positive* events. With respect to specific emotions, neurotics seem to react more strongly than stable individuals to anxiety- and anger-inducing situations.

In contrast, impulsivity and sociability tend to correlate with peak *positive* but not with peak *negative* intensity. Impulsives and respondents who rank high on the sociability dimension seem to be particularly sensitive to positive (in particular, moderate and mild) emotion-inducing events. With respect to specific emotions, impulsives tend to report greater peak intensities of reactions to joy-eliciting situations. In contrast to neuroticism, impulsivity tends to be particularly related to peak intensity, but not to the duration of the emotional response. For instance, individuals who are likely to endorse items such as "I like doing things in which I have to act quickly" (i.e., high impulsives) expect to react more strongly to events such as "you go to a fun party," expecting peak intensity to reach 6.3 (on a scale of 0 to 7), as compared to 5.2 for low impulsives (i.e., the

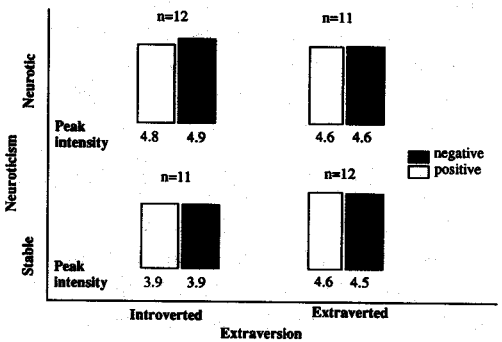

FIG. 5.2. Relations between personality type and peak emotion intensity.

lower quartile). However, no corresponding differences were observed with respect to the duration of positive experiences.

Another way of viewing the data is to consider them with respect to different personality "types" (Gray, 1987). Using a median split technique, we divided the respondents into high and low groups on both extraversion and neuroticism dimensions, artificially creating four personality "types." The data for positive and negative peak intensities for these groups are presented in Fig. 5.2.

Consistent with previous studies (e.g., Wallbott & Ellgring, 1986), participants low on both dimensions reported expecting to experience particularly low levels of peak intensity, whereas participants high on the neuroticism dimension and low on extraversion dimension expected to experience relatively high levels of peak intensity. A statistical analysis of these data revealed that although there were significant differences between respondents in terms of the magnitude of emotional reaction as a function of neuroticism and extraversion, there were no corresponding differences between positive and negative peak intensities within respondents.

Second, we examined the differences in the duration of positive and negative emotions between the same four groups (see Fig. 5.3).

Comparing Fig. 5.2 and Fig. 5.3 reveals that the differences between personality types are much more pronounced for duration than for peak intensity. The

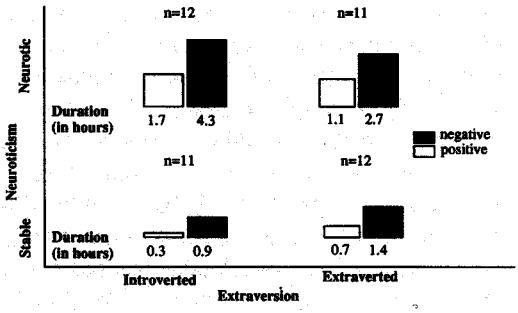

FIG. 5.3. Relationship between personality types and emotion duration.

duration data show that participants high on the neuroticism and low on the extraversion dimension tend to exhibit a "high" emotional profile, apparently "immersing" themselves in their affective experiences for long periods of time (particularly for negative emotions). Respondents low on both dimensions tend to exhibit a "low" emotional profile, devoting relatively little time to their emotional reactions. A statistical analysis of the data revealed significant between-respondent differences in terms of duration as a function of neuroticism, as well as significant within-respondent differences in responses to positive as opposed to negative emotion-eliciting events as a function of extraversion, and an interaction between neuroticism and extraversion. These results suggest that using duration as an index of emotional response enhances our ability to differentiate between various personality types. Our initial hypothesis regarding individual differences in emotional experience postulated that neuroticism is related to intense and protracted negative experiences, whereas extraversion is related to intense and protracted positive experiences. Our data reveal that this hypothesis was too simplistic. A more refined account, postulating differential relationships of neuroticism and extraversion to different indices of emotional response is needed.

It might be objected that the relations between personality dimensions and aspects of emotional experience are not impressive in terms of the magnitude of the observed effects. Indeed, Wallbott and Ellgring (1986) reported a similar pattern of relationships between personality dimensions and affective reactions that they regarded as uninteresting. For example, they found a significant correlation between neuroticism and peak intensity of fear, and between neuroticism and duration of fear ($r = .30$ and $r = .28$ respectively), and a significant correlation between extraversion and the peak intensity of joy ($r = .21$). However, they concluded that individual differences are not very important for the study of emotions, saying, "The personality characteristics discussed above do not seem to be very important predictors of emotional experiences" (p. 209). On the other hand, we think that knowing that somebody is highly neurotic would enable us to predict, for example, that he or she is likely to have a relatively protracted response to a negative emotion-inducing situation. Furthermore, from the perspective of emotion theory, individual differences in intensity and duration might be indicative of different processes underlying similar emotional responses. For example, it is possible that one process is driven by physiological reactivity whereas the other is driven by cognitive activity. Thus, tracing the cause of protracted (or brief) emotional episodes to either physiological or cognitive differences (or, more likely, a combination of the two) might elucidate the structure, as well as the process of emotional responses.

So far, we have concluded that positive and negative events differ in the temporal aspects of the emotional responses they evoke, as well as in their relationships with different personality characteristics. Moreover, we have discussed some possible reasons for differences in duration of positive versus negative emotions and speculated about the imbalance of the consequences of positive and negative events. We now want to consider the possibility that the causes of differences in duration of individuals' responses to emotion-inducing situations might be linked to a variety of physiological and cognitive factors.

DURATION OF EMOTIONS: COGNITIVE AND PHYSIOLOGICAL FACTORS

Some theories of depression and neuroticism (e.g., Martin, 1985; Nolen-Hoeksema, Morrow, & Fredrickson, 1993; Teasdale, 1988) argue for a cognitive interpretation of the prolonged experience of negative emotions. For example, Teasdale suggests that it is the nature of cognitive processes and representations that determines whether a person's initial depression will be transient or prolonged. Our findings are consistent with this hypothesis, particularly when one takes into account the reciprocal relationship of affect and cognition. Thus, neuroticism is not only associated with a predisposition to experience negative emotions, but also with a predisposition for (relatively) excessive rumination about the events that lead to them. These ruminations have obvious mood and

memory consequences (Blaney, 1986), increasing the availability of negatively valenced information, which in turn influences the interpretation of future events, creating an affective-cognitive vicious cycle. We think that our results may help to elucidate the persistence and recurrence of depression episodes associated with individuals who rank high on the neuroticism dimension (Nolen-Hoeksema, 1987; Nolen-Hoeksema et al., 1993; Teasdale, 1988; Weissman, Prusoff, & Klerman, 1978). The duration of the negative affect following an emotion-eliciting event has direct implications for the expectations, experience, and recall of these episodes. With respect to expectations, neurotics might be especially apprehensive about negative experiences because their memories of, and estimates of the consequences of such experiences are more intimidating: They encode these experiences as being prolonged and expect even a mild negative experience to demand considerable cognitive resources. They might also tend to develop ruminative response characteristics (similar to the ones described by Nolen-Hoeksema, et al., 1993) because the protracted duration of the emotional response provides more opportunities for noticing and subsequently focusing on one's emotional state. With respect to experience, the longer the period during which a person is influenced by physiological and cognitive processes activated by the emotion, the higher the probability that this experience will be subjectively perceived as important and meaningful. Finally, with regards to recall, longer events are presumably more likely to be recalled than shorter ones. For all these reasons, it seems plausible to suppose that individual differences in perceived affective duration might play a causal role in individuals' differential susceptibility to depression persistence.

Viewed from a physiological perspective, it is also plausible that cognitive mechanisms of rumination and recall are set in motion by simple differences in biologically determined parameters. Thus, one could postulate the existence of biologically determined decay rates of affective responses (with decay rates of negative responses being typically slower than those of positive ones), which determine the length of impact of an emotional experience. For example, a slow decay rate for negative emotions might be responsible for neurotics' prolonged preoccupation with the inducing event and its implications for the self, whereas impulsives' emotional "forgetfulness" might be associated with a rapid decay rate. Thus conceived, affective decay rate could be likened to the physiological characteristic of base-level arousal (Eysenck, 1967). Like arousal, affective decay rates might affect a variety of cognitive and emotional processes, influencing a wide range of behaviors. On a more global note, it might be that personality traits could be conceived of as rates of change of affective responses (Revelle, 1989), with the associated behaviors being the result of particular decay rates.

However, it is unlikely that individual differences in responses to emotion-inducing events can be attributed to cognitive factors alone or to physiological factors alone. A more accurate account would almost certainly have to consider both. A better understanding of the relative roles of physiological and cognitive