

Intensity and Frequency: Dimensions Underlying Positive and Negative Affect

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Research on emotions and several happiness scales suggest that positive and negative affect are strongly inversely correlated. However, work on subjective well-being indicates that over time, positive and negative affect are independent across persons. In order to reconcile this inconsistency, two dimensions are proposed for personal affective structure: the frequency of positive versus negative affect and the intensity of affect. Subjects in three studies completed daily and momentary reports on their moods. In support of the intensity dimension, the correlations between positive and negative intensity were strong and positive in all three studies. The intensities of specific emotions across persons were also highly correlated. Across the three studies the frequency and intensity of affect varied independently. Although average levels of positive and negative affect showed low correlations, this relation became strongly inverse when intensity was partialled out. Thus the intensity dimension helps explain the relative independence of positive and negative affect. In addition, emotional intensity is offered as a new personality dimension that manifests interesting characteristics.

Scientific interest in states of subjective well-being has increased substantially in recent years (for a comprehensive bibliography, see Diener & Griffin, 1984). Although psychologists have paid considerable attention to both single session surveys of global well-being and the structure of momentary affective states, fewer authors of empirical work have examined the structure of affect within persons over time. It is important to note the difference between research that focuses on momentary affect and research in which the longer-term structure of affect persons is examined. If one wants to understand the ongoing aspects of subjective well-being, affect must be sampled within the lives of people over a relatively long period of time.

In a seminal work, Wessman and Ricks (1966) examined the fluctuations of daily affect in a small group of students. They

concluded that persons differed in terms of their day-to-day affective states along two basic dimensions that were independent of each other: (a) the amount of positive as opposed to negative affect a person experienced, which they called *average hedonic level*, and (b) the amount of variability a person exhibited in his or her affect.

Bradburn (1969) made the next important contribution to this area. He collected data in several national samples and found that positive and negative affect, when measured separately, varied independently; that is, the amount of positive affect a person felt did not substantially correlate with the amount of negative affect they experienced. Note that Bradburn was not referring to an ability of people to experience positive and negative affect simultaneously in time. Rather, he was interested in investigating how people experienced both types of affect over time. Until Bradburn's discovery, most researchers had conceptualized affect as a single hedonic dimension in which positive and negative affect were defined and measured as bipolar opposites. The advantages of allowing positive and negative affect to vary independently have been demonstrated by various researchers (Cherlin & Reeder, 1975; Harding, 1982; Warr, 1978; Warr, Barter, & Brownbridge,

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1983). These investigators have shown that positive and negative affect, when measured separately, often correlate differently with other variables (e.g., personality measures).

The implications of Bradburn's (1969) work are important from a theoretical and methodological point of view. However, his conclusions have not gone unchallenged, the chief criticism being directed at the scales he used to measure positive and negative affect (Brenner, 1975; Kozma & Stones, 1980). For example, critics have argued that (a) the positive items contain a confounding element of arousal not found in the negative items, (b) ceiling effects for positive items in conjunction with floor effects for the negative items may attenuate the correlation between positive and negative affect, and (c) specific feelings receive the same weight as general ones and feelings experienced once are given the same weight as those experienced many times.

Although criticisms of Bradburn's (1969) work must be taken into account, other researchers have also found empirical support for the independence of positive and negative affect. Zevon and Tellegen (1982) factor analyzed mood reports of 23 subjects, collected over a 3-month period. They compared individual with group factor solutions and found a two-dimensional structure of positive and negative affect. They also concluded that these dimensions are unipolar, thus supporting Bradburn's findings. More recently, Diener and Emmons (1984) have replicated Bradburn's findings, using a diversity of measures and techniques. Diener and Emmons's results were based on an ecological sampling of daily affect and the use of broad affective terms. Although negative and positive emotions were inversely correlated for brief time periods, they found that when longer periods were considered, the two were independent across individuals. Thus one must take seriously the idea that the overall amounts of positive and negative affect a person experiences are unrelated to each other.

Although empirical evidence appears to indicate with increasing clarity that positive and negative affect vary relatively independently within persons, other contradictory considerations make this finding difficult to understand. Brenner (1975) reviewed a num-

ber of theoretical reasons why positive and negative affect should vary inversely. In addition, several researchers have constructed subjective well-being scales in which negative and positive affect show a strongly inverse relation (e.g., Kammann, Barter, Irwin, & Dixon, 1979). Warr et al. (1983) even found that when Bradburn's items are answered in terms of frequency of occurrence (e.g., "often" or "occasionally") rather than dichotomously, the two classes of affect become negatively correlated.

It seems that the more a person experiences pleasant emotions, the less time is available to experience negative ones. This straightforward intuitive reasoning is supported by the momentary emotion literature, in which the major dimension of overarching importance is invariably a bipolar pleasantness-unpleasantness dimension (Russell, 1980). Russell presented a good deal of evidence to demonstrate that positive and negative emotions correlate highly negatively. Even those emotion researchers who place momentary negative and positive moods on separate factors find that these two factors are not independent, but are highly inversely related. The work of Diener and Emmons (1984), as well as that of the emotion researchers, indicates strongly that the two types of affects are unlikely to occur within the same person at the same time. Therefore, the more time a person feels positive emotions, the less time he or she should feel negative emotions. The structure of emotions felt at a particular point in time is not the same as the structure of affect within persons over time. However, despite this difference one would still expect the two approaches to be compatible.

Thus the dilemma is the following: Bradburn (1969) and other researchers have found that negative and positive affect vary independently across persons. Yet the two poles of affect seem unlikely to occur at the same time. Therefore, it would seem as though the more frequently positive affect is experienced, the less frequently negative affect would be experienced. This is supported by subjective well-being scales worded in terms of frequency, which show a strong inverse relation between positive and negative affect. One might argue that a person could simply feel positive affect at certain times and negative

affect at other times. However, we know from the frequency scales such as that of Kammann et al. (1979) that the more often a person feels one type of affect, the less frequently he or she will feel the other type. Why, then, doesn't the inverse relation in terms of frequency produce an inverse correlation for average levels of positive and negative affect?

In an attempt to resolve this issue, we propose that it requires two underlying dimensions to understand how affect is experienced over time. The first dimension is frequency of positive affect, or the amount of time in which positive affect predominates over negative affect. The second is intensity, or the strength with which one experiences affect. One can calculate frequency easily by simply adding up separately the number of instances in which positive affect predominates over negative affect and those instances in which negative affect predominates over positive affect. Over the total number of observations, positive and negative affect vary inversely as suggested by both common sense and the emotion literature. This method of calculating frequency is also strongly supported by Diener and Emmons's (1984) finding that positive and negative emotions do not occur together at the same moment, especially when stronger emotions are experienced. But how can positive and negative affect vary independently if the two must vary inversely in terms of frequency? The answer we propose is that positive and negative affect covary together on an intensity dimension; that is, a person who experiences strong positive emotions may also be a person who feels strong negative emotions as well. In a recent study in which he assessed affect over time, Epstein (1983) had 30 college students report their emotions for 28 consecutive days. Averaging across 14 positive and 14 negative emotions, he found that there was a significant correlation of .58 between positive and negative emotional reactivity, or intensity. Although the focus of the study was not on the structure of affect, Epstein's incidental finding of the covariation of positive and negative intensity is of direct relevance to our study.

If the intensity and frequency dimensions are relatively independent across persons, a great deal of confusion can be resolved. Spe-

cifically, both a strong positive correlation between the intensity of positive and negative affect and a strong negative correlation between the frequency of positive and negative affect would tend to cancel each other out over time. In other words, the negative correlation of the two types of affect in terms of frequency is balanced by the positive correlation for intensity. The result is that overall means levels of the two types of affect will tend to be uncorrelated, because mean levels of affect result from the independent contributions of frequency and intensity.

In summary, we propose two basic dimensions that describe the structure of subjective well-being within person over time: (a) frequency of positive versus negative affect and (b) intensity of affect. In order to address this issue, we set up our study to examine several questions: (a) whether the intensity of positive and negative affect are related and to what degree, (b) to examine the relation between frequency of positive affect and intensity of affect, (c) to see whether average positive and negative affect become inversely related when the influence of intensity is removed, and (d) if the two hypothesized dimensions of affect do emerge, to examine their relation with other variables in order to determine if these dimensions are theoretically meaningful. An affective intensity dimension would be an interesting variable in its own right, independently of its ability to explain the positive-negative affect issue. Our proposal explains the confusion concerning past findings in two other ways. First, it explains why some researchers find independence of the two classes of affect and others do not. We propose that the former are assessing mean levels of affect, whereas the latter use scales with questions that are worded in terms of frequency. Second, our proposal explains why frequency can vary inversely, as suggested by many researchers, and yet mean levels of affect can still be independent of each other, as found by Diener and Emmons (1984).

Study 1

Method

The subjects were 11 male and 15 female undergraduates at the University of Illinois. They were enrolled in a semester-long independent study course and received a

grade of credit or no credit for their efforts. The course was publicized widely and there were few constraints on who could enroll. Subjects completed a mood form every day for a period of 10 weeks. Each evening before retiring, participants completed a form describing their emotions for that day. Distortions due to memory were minimized because subjects were required to turn in their forms on a daily basis. Individual students were allowed to make up any missed days at the end of the period. The procedure of sampling mood over a period of 10 weeks, as opposed to a single measurement of mood, allowed us to obtain a reliable measure of affect that was not highly contaminated by short-term factors (Epstein, 1979). In addition, sampling how people felt in everyday life allowed us to collect data that had ecological validity.

Mood form. The daily self-report measure consisted of 41 scales relevant to the subjective experience of affect. Twenty-three of the scales were monopolar and ranged from 0 (he or she felt that way *Not at all* during the course of the day) to 6 (he or she felt that way *Extremely much*). These mood descriptions represented both positive affect ("happy," "pleased," "joyful," and "enjoyment/fun") and negative affect ("unhappy," "depressed/blue," "frustrated," "angry/hostile," and "worried, anxious and fearful"). On the basis of factor analytic work, we summed four of these terms to provide a daily "positive affect" score, and we added five of the terms together to compute a daily "negative affect" score (see Diener & Emmons, 1984). Thus a person's total positive affect score could range from 0 to 24 and the negative affect score could vary from 0 to 30. However, we placed the two types of affect on the same scale by dividing each total by the number of terms involved in each total. We then used the daily positive and negative affect scores to calculate the frequency and intensity with which each subject experienced positive and negative affect on a daily basis over the course of the 10 weeks.

We calculated the frequency with which a subject experienced positive affect by adding up the instances when the daily positive affect score exceeded the daily negative affect score, and dividing this number by the total number of days sampled. Therefore, the "frequency" dimension refers here to the frequency of predominantly happy days. It is a percentage that can vary from 0 (most unhappy persons) to 100 (most happy persons). In other words, "frequency" does not refer to the frequency of days on which any level, no matter how small, of positive or negative affect is felt. Indeed, this type of frequency would be very high for most persons for both positive and negative affect because most people report at least a small amount of both types of affect on most days. The frequency estimate we used is based on the predominant emotion and thus ensures that more than a trivial amount of the emotion is reflected by the frequency estimate. We refer to this measure as *frequency* because it is based on a frequency count of happy days. However, the measure enables one to estimate duration or how much of the time someone is happy, not frequency in the sense of number of each individual occurrence of positive affect.

Intensity was the strength with which subjects experienced their dominant affect. We computed it by taking the mean positive affect for each subject on happy days—that is, those days on which positive affect exceeded

negative affect. Similarly, we calculated the intensity of negative affect by taking the mean negative affect score on unhappy days for each subject. The strength of the dominant mood serves as a good indicator of intensity because it does not depend directly on frequency. In other words, we can compute an index of how strongly individuals experience each type of affect regardless of how frequently their dominant mood is either positive or negative. Our measure of intensity refers to how strongly an emotion is felt when it is the dominant emotion. If an average value for an emotion were calculated over days, it would not be a pure measure of intensity because it would be confounded by how often the emotion was experienced. For example, an average value for negative affect would not reflect the intensity of negative affect when it was experienced because such an average would be highly influenced by the number of times when absolutely no negative affect was felt. We stress that intensity and frequency calculated by these methods are free to correlate very highly or not at all.

The daily mood report also contained 18 bipolar scales such as "Productive" and "Satisfied with my life." There were also a series of 23 bipolar terms such as "crabby-cheerful," "physically active-inactive," "feeling ill-feeling well," "unaroused-aroused," and "low self-esteem-high self-esteem." Many of the scales constituting the mood form were included for the purposes of a larger study on subjective well-being and are not presented in this report.

Artifact checks. When considering intensity scores it is important to examine the possibility that those scores only reflect differences in subjects' number use. To check for that possibility, we had subjects rate 57 positive affect words on the level of intensity implicit in their meaning. In this rating task any consistent tendency to use either high or low numbers had to be due to how people used the numbers of the scale and not to differences in their affective state because the same words served as stimuli for everyone. Because subjects were rating the words *per se* in terms of intensity, a tendency to use high numbers would indicate a tendency to use high numbers when responding to emotion words on the mood rating forms. The word ratings were used later to covary out any idiosyncratic effects that were due to how the subject used the numbers of the mood scales.

In a further effort to detect whether the intensity dimension was nonartificial, we had each participant write three descriptions of times when they felt very happy and three more about times when they felt very unhappy. Each event was to have taken place in the last 6 months. Subjects were required to take 30 min to complete each description and were asked to write in great detail. The stories were then randomly sorted and given to independent raters who were blind as to the story condition (happy vs. unhappy), subject, and experimental hypothesis. Two judges working independently rated each description on the same adjectives that constituted the positive and negative affect scales of the mood forms. We could then compute an estimate of intensity for each subject that was based on the judges' ratings of the stories. Because the stories were qualitative and were not based on the use of numbers by the subjects, a significant correlation between the judges' ratings of intensity for each subject and the subjects' own self-reported intensity on the daily mood forms would represent compelling support that subjects' self-reported

intensities reflected substantive differences in how they experienced affect. One can seek additional evidence for the validity of the intensity dimension by examining the magnitude of the correlation between the mean intensity of the subjects' three positive stories and the three negative stories as rated by the judges.

Results and Discussion

As predicted, the relation between positive intensity and negative intensity was strong and positive ($r = .70, p < .01$). In other words, the people who experienced intense positive emotions tended to be the same ones who experienced intense negative emotions. This strong positive correlation indicates that the intensity of one's positive emotions does not vary inversely with the intensity of one's negative emotions, as common sense might suggest. The sum of positive and negative intensity scores for each subject was used as their overall intensity score.

The correlation between the key variables is shown in Table 1. As might be expected, frequency and intensity tend to correlate substantially in most cases with mean positive and negative affect. This should be expected because the former two are components of the latter two. The intensity with which people experienced affect was relatively independent of frequency, the correlation between the two being nonsignificant. The correlation between mean positive and mean negative affect was also nonsignificant and positive. However, when intensity was partialled out of the correlation between mean positive and mean negative affect, the relation was inverse ($r = -.46, p < .05$). This indicates that when intensity is removed, mean positive and negative affect are no longer independent, but are inversely correlated. The strong reversal of the correlation from .24 to $-.46$ when intensity was partialled out indicates that affective intensity is a key reason that average levels of positive and negative affect are relatively independent.

To determine whether the intensity and frequency with which subjects experienced affect was a consistent or stable phenomenon, we calculated split-half reliability coefficients. Specifically, because daily mood reports were filled out for both the months of October and November, separate intensity and frequency scores for each month were computed for

Table 1
Correlations of Key Variables for Study 1

Variables	1	2	3	4
1. Mean positive affect	—			
2. Mean negative affect	.25	—		
3. Frequency	.77	-.24	—	
4. Intensity of affect	.90	.48	.24	—

each subject. The results indicated that both the frequency and intensity with which subjects experienced affect were relatively stable. The reliabilities were .72, .60, and .65 for positive intensity, negative intensity, and frequency, respectively. All correlations were significant beyond the .01 level.

The tendency to rate emotion words as intense (the mean rating for the 57 positive affect words) was partialled out of the correlation between positive and negative intensity. When this was done the correlation actually went up, from .70 to .74. This result indicates that a rating bias in the way in which subjects used numbers did not account for the way in which subjects rated emotion words on their daily mood forms.

Finally, the independent ratings of intensity for each subject that were based on judges' ratings of qualitative story data and the subjects' own self-reported intensity on the daily mood forms were correlated. The correlations were as follows: For positive intensity based on the story data with self-reported positive intensity, $r = .43, p < .05$; for negative intensity based on story data with self-reported negative intensity, $r = .54, p < .01$. Because the judges ratings were based on qualitative data and not on the use of numbers by the subjects, these correlations represent strong evidence that the variance between subjects on the intensity dimension in their self-reports reflect meaningful differences in how they experience affect. Additional support can be gleaned from the correlation between the positive intensity and negative intensity based on the data for each subject ($r = .42, p < .05$). The correlations based on the story data have to be interpreted in light of the low reliabilities of the judges ratings: For happy stories, $r = .55$, and for unhappy stories, $r = .37$. Also, the amount of variance in the judges' ratings of the subjects' stories was

small. Specifically, there were ceiling effects for the rating of happy stories and floor effects for the unhappy stories. Consequently, all intensity correlations based on the story data would probably be much higher if the judges ratings would have been more reliable and allowed for more variation between subjects.

Study 2

Study 1 confirmed our initial hypothesis and provided some evidence that the intensity dimension was not a self-report artifact. In Study 2 we wanted to replicate our findings with a larger sample. In addition, we wanted to sample peoples' affective experience for random moments. The moment ratings are even less dependent on memory and therefore the possibility of distortion in reporting should be further minimized.

Method

The sample consisted of 42 University of Illinois undergraduates (21 male and 21 female) recruited in the same manner as in Study 1. The main measurement instrument was the same mood form used in Study 1. In this study, however, participants rated their affective states within the context of different time frames. Specifically, subjects rated their mood (a) daily, summarizing the entire day, (b) at two random moments each day, and (c) when they felt a very strong emotion. The summary rating was a replication of the procedures used in Study 1. The moment ratings were filled out at two random intervals every day for 6 weeks. Each subject wore a watch with an alarm that would go off once early in the day and then again late in the afternoon or evening. The subject set his or her own alarm according to a randomized list of times that covered every 5-min waking period during the 6-week course of the study. In order to enhance spontaneity, the alarms were set hours in advance. Most subjects reported thinking about the alarm for 2 or 3 days, but thereafter it caught them unexpectedly. When the alarm went off, subjects were to focus on their feelings at that moment and complete a mood questionnaire immediately. They were also instructed to fill out a mood form whenever they felt a particularly strong emotion (positive or negative), but not more than once per day. These emotion forms were included because random moments were likely to miss these emotionally charged times. We computed scores for frequency and intensity on all mood forms for the different time perspectives, using the same formulas that were used for the daily mood forms in Study 1.

In this study we included two different measures to indicate how each subject used the number system of the scales. As in Study 1, these artifact checks were intended to assess response style bias. On one measure, subjects described in detail how they felt when they marked a 2

Table 2
Study 2: Intensity Correlations for Different Time Periods

Time period	Moment		Daily		Emotion	
	Pos	Neg	Pos	Neg	Pos	Neg
Moment						
Positive	—					
Negative	.88	—				
Daily						
Positive	.92	.77	—			
Negative	.71	.78	.70	—		
Emotion						
Positive	.79	.79	.73	.67	—	
Negative	.70	.80	.58	.61	.80	—

Note. $N = 42$. All coefficients are significant beyond $p < .01$. Pos = positive; Neg = negative.

and a 4 on both positive and negative affect. These four descriptions were then rated on a scale from -100 to 100 by two raters who showed high interrater agreement for both the positive and negative descriptions ($r_s = .90$ and $.92$, respectively). These ratings could then be partialled out of the intensity scores for subjects. In this way we could minimize the idiosyncratic ways in which the subjects interpreted the meaning of a number when rating their affective states. On the other artifact measure, subjects indicated where their happiness scale numbers from 0 through 6 would be on a line. The line was marked continuously with positive affect words that had been prescaled normatively for intensity and were placed at the appropriate position on the line. This provided subjects another opportunity to indicate the intensity of feeling they meant by their number responses. Thus we could check on the possibility that intensity ratings on the mood forms might be due to response style rather than affect per se.

Results and Discussion

Because mood reports were completed by subjects for three different contexts (days, random moments, and high emotion times), it was possible to compute the correlation between positive intensity and negative intensity as well as between frequency and summed intensity for each time period. The correlations between frequency and summed intensity were $-.11$, $.05$, and $.08$ for the moment, daily, and strong-emotion time periods, respectively. The correlation between positive intensity and negative intensity mirrored those of Study 1. The correlations for each time period are presented in Table 2. The correlation between mean positive and mean negative affect was $r = .13$, *ns*. When intensity

was partialled out, this relation became strongly inverse ($r = -.76, p < .01$). Intensity and frequency correlated with positive affect ($r_s = .83$ and $.52$, respectively) and with negative affect ($r_s = .59$ and $-.66$, respectively).

Interestingly, the correlations between positive intensity and negative intensity for the moment and emotional times were even stronger than those for the daily reports. This result is probably related to the extent that subjects had to rely on their memories when filling out the mood forms. Specifically, in the daily reports it is likely that more error due to memory bias was present in the data because subjects had to wait until the end of the day to complete the mood form. This was not the case for moment and emotion times as subjects were instructed to fill out a mood form immediately after their beeper signaled or immediately after they experienced a strong emotion. In addition, they were instructed to complete the mood forms so that they would reflect how they felt at that specific time.

Overall, this consistent pattern of results indicates that the intensity dimension plays an important role in how people subjectively experience affect when reviewing their entire day, considering their affective state at any given moment, and when they are interpreting the experience of a strong emotion. In other words, intensity is such a pervasive dimension in the organization of affective experience that there are some people who experience affect more intensely than do others no matter what the time period. Furthermore, people who experience positive emotions more intensely are also the same people who experience negative emotions more intensely.

To investigate the correlation between positive intensity and negative intensity from a different vantage point, we examined the intercorrelations for intensity between specific emotion words. Three positive affect words (*pleased, joyful, and enjoyment*) and three negative affect words (*angry, fearful, and depressed*) were used. The analysis involved examining the daily rating for all six emotion words for each subject each day. The score for the emotion word rated the highest each day was recorded. We calculated the intensity means for each emotion word by adding up the rating for each word, using the days on

which that word was rated higher than the other five emotion words. We then divided this sum by the number of days that that emotion word was endorsed as the predominate emotion of the day. In this way a separate mean intensity score was calculated for each of the six emotion words. The separate intensities for each of the six specific emotion words were intercorrelated across persons. The average correlation among the three positive emotions was $.42$, the average correlation among the three negative emotions was $.43$, and the average correlation between the three positive and three negative emotion words was $.41$. All correlations were significant beyond the $.01$ level, and none of these correlations differed from one another. These findings indicate that the tendency for some persons to experience affect more intensely than others is not simply limited to global measures of positive and negative affect, but also occurs at the level of more specific feelings.

We made an additional attempt in Study 2 to consider the degree to which the findings concerning intensity were biased by self-report artifacts. When the scores from the measures used to detect response styles were partialled out of the moment ratings, the correlation between positive and negative intensity remained virtually unchanged at $.88$. When the scores on the Marlowe-Crowne scale (Crowne & Marlowe, 1964) were partialled out in order to control for social desirability, the correlation between positive intensity and negative intensity increased slightly. In retrospect, this makes sense because those individuals who have a tendency to present themselves in a positive light would have strongly endorsed positive affect items and endorsed low levels on the negative affect scale. Consequently, a social desirability response set would have deflated the correlation between positive intensity and negative intensity.

In both Studies 1 and 2 the mean scores for the 18 bipolar self-rating scales included on the daily mood forms were correlated with frequency, positive intensity, and negative intensity. The relations that were significant across both studies are shown in Table 3. Scales that did not produce a significant pattern of correlations that replicated across

Table 3
Correlations Among Intensity, Frequency, and Daily Mood Variables

Daily mood scales	Frequency		Positive intensity		Negative intensity	
	Fall	Spring	Fall	Spring	Fall	Spring
Self-Esteem	.56	.55	.29	.00	.09	-.21
Inner Harmony	.75	.69	.32	.05	.04	-.14
Cheerful	.53	.68	.31	.13	.09	-.12
Self-Confident	.50	.67	.13	-.04	.09	.30
Aroused	.30	.12	.47	.34	.38	.26
Physically Active	.22	.11	.37	.41	.51	.30
Productive	.22	.09	.58	.40	.39	.30
Domineering	.37	.05	.56	.31	.45	.30
Caring	.40	.28	.31	.29	.08	.23
Satisfied With Day	.51	.59	.74	.42	.36	.22
Life Close to Ideal	.41	.43	.46	.38	.11	.22

Note. Fall $n = 26$, one-tailed $p < .05$, $r = .34$, $p < .01$, $r = .47$; two-tailed $p < .05$, $r = .40$, $p < .01$, $r = .51$. Spring $n = 42$, one-tailed $p < .05$, $r = .26$, $p < .01$, $r = .36$; two-tailed $p < .05$, $r = .30$, $p < .01$, $r = .39$.

both studies were Energetic, Well, Serious, Passive, Sociable, Lonely, and Melancholic.

Four self-rating scales relating to the psychological experience of global well-being (i.e., High Self-Esteem, Inner Harmony, Feeling Cheerful, and Feeling Self-Confident) covaried significantly with the frequency of positive affect but did not relate to either positive or negative intensity. In contrast, self-rating of high arousal, high levels of physical activity, high productivity, and a sense of domination in personal relationships were all significantly correlated with positive and negative intensity but were insignificantly related to frequency. This pattern of findings lends additional support to the hypothesis that frequency and intensity represent different dimensions of affective experience. Not only do they vary relatively independently of one another, but they also correlate meaningfully with other variables in different directions. In addition, the intensity of both positive and negative affect correlates in the same direction with the daily variables.

Another finding common to both studies was the pattern of correlations between both intensities and personality variables. A large battery of personality tests were administered to subjects in both studies. This battery included tests such as the Personality Research Form (PRF; Jackson, 1974), Rosenberg's Self-Esteem Scale (Rosenberg, 1965), and the Eysenck Personality Inventory (EPI; Eysenck & Eysenck, 1964). In Study 1, of the 57

personality scales completed by the subjects, 47 (82%) correlated with positive intensity and negative intensity in the same direction. Of the remaining correlations, all of them were close to zero. In Study 2, of 51 personality scales, 46 (90%) correlated with positive intensity and negative intensity in the same direction. These personality tests were given for the purposes of another study and do not have a relation with positive and negative intensity that was predicted beforehand. However, the fact that they correlated with positive intensity and negative intensity in the same direction in the overwhelming majority of cases strongly suggests that intensity is a unitary construct.

Study 3

The results of both Studies 1 and 2 are strong evidence regarding the nature of the relation between intensity and frequency, as well as the relation between positive intensity and negative intensity. However, because these results are based on similar samples of college students, it is important to determine whether the results could be replicated with older, more mature individuals, as well as with individuals who live in different environmental circumstances.

Method

Subjects were 34 adults living in the community. They ranged in age from 33 to 85, with a mean age of 65.

They were recruited through both a senior citizen center and a volunteer organization. The majority of participants were retired, though still active in the community. All were living independently and were in reasonably good health. Mood reports were completed daily for 30 consecutive days. The forms used were similar to those used in Studies 1 and 2, except that the print was enlarged in order to facilitate readability. The daily mood forms were returned weekly via self-addressed stamped envelopes provided to each subject. If any days were missed, they were made up at the end of the 30 days so that each subject completed an equal number of reports. For their participation, the senior citizen center and the volunteer organization received \$25 for each participant who completed the study. Again, scoring for positive and negative affect, we computed frequency and intensity of affect, using the same formulas used in Studies 1 and 2.

Results and Discussion

The results of Study 3 indicate that the findings from the first two studies do generalize to a different sample. The correlation between positive intensity and negative intensity was $.70$, $p < .01$, and the correlation between intensity and frequency was slightly positive, but not significant ($r = .25$). The correlation between mean positive and mean negative affect was $-.23$ in this sample. With intensity partialled out, this correlation became $-.86$, $p < .01$. Intensity correlated with positive affect ($r = .45$) and with negative affect ($r = .57$). Frequency correlated with positive affect ($r = .59$) and with negative affect ($r = -.79$). In addition to rating their affective experience, participants in Study 3 also rated their level of physical activity on a daily basis. The correlations between average physical activity level and the intensity and frequency scores for subjects mirrored similar findings from Studies 1 and 2. Specifically, mean level of physical activity was significantly related to both positive intensity ($r = .50$, $p < .01$) and negative intensity ($r = .37$, $p < .05$), but was unrelated to the frequency of positive affect ($r = -.08$).

General Discussion

In summary, our major findings were as follows:

1. The correlations between positive and negative affect intensities were strong and positive for all studies, with a value of $.70$ in the three sets of daily ratings and with higher values in the momentary and emotion ratings.

2. This relation was remarkably consistent across heterogeneous samples that differed in terms of both age and general life circumstances.

3. We found even stronger, positive relations between average positive and negative intensities when we analyzed the mood reports that were completed (a) at random moments and (b) just after particularly strong emotions had been experienced.

4. The intensities of separate specific emotions (e.g., joyful, depressed, angry) also covaried across persons.

5. The magnitude of the intensity correlations did not change when several potential self-report artifacts were partialled out. In addition, when subject-generated qualitative data was rated by independent judges, those subjects who described their positive emotions as intense tended to be the same individuals who described their negative emotions in more intense ways.

6. Both positive and negative affect intensities were found to be reliable over time. All of the foregoing suggest that emotional intensity is an important personality variable. However, the $.70$ correlations between positive and negative intensities indicate that only about one half of the variance in emotional intensity is accounted for by this underlying personality factor. There must be other unidentified factors that influence the intensity of either positive or negative affect.

7. Mean positive and negative affect correlated at very low levels in all three studies. However, when intensity was partialled out, the correlation between the two affects became strongly inverse in all studies. In the three daily studies, the correlations between positive and negative affect were $-.46$ (Study 1), $-.76$ (Study 2), and $-.86$ (Study 3) when intensity was partialled out. These values indicate that the personality dimension of affective intensity plays a large role in producing the typically low correlation across persons between positive and negative affect. Clearly, they are not independent when the influence of emotional intensity is taken out.

Overall, the data provide compelling evidence that intensity is a meaningful and reliable component of affective experience. Our second basic question concerned the relation between intensity and frequency. Here

we found, as predicted, statistical independence. Consequently, it appears that frequency and intensity represent separate processes that contribute independently to affective experience. Subsequent analyses (Diener, Larsen, & Emmons, 1983) suggest that intensity and frequency scores, when standardized, combine in an additive way to form mean levels of affect.

There are a number of reasons to believe that our intensity dimension is not a measurement artifact. Intensity did not correlate with the Marlowe-Crowne social desirability scale. We used a number of checks on artifacts and partialing these out from the intensity correlations did not diminish their magnitude. When subjects described their emotional experiences in paragraph form, an intensity dimension still emerged. Another reason to rule out acquiescence resides in the Affect Intensity Measure (AIM), which Larsen (1985) developed. This questionnaire measure contains 40 items, approximately one third of which are reverse keyed. Larsen found that respondents who answer the affirmatively phrased AIM items in the keyed direction also tend to respond to the reversed keyed items in the intense direction as well. In a more recent daily study, Larsen (1985) found that the AIM correlated .61 with average daily affect intensity. This finding also tends to rule out number use artifacts as an explanation of the intensity dimension because the AIM is answered in a true-false format.

It is important to understand that our intensity dimension is not a mathematical necessity based on the method by which the scores were computed. For example, if a person scores high on positive intensity, it is conceivable that when unhappy, he or she could score very low on negative affect (but lower or zero on positive affect). There are other arguments that suggest that our computational procedures do not artifactually create this intensity dimension. The story intensities, for example, were based on a straightforward single affect score for each story and still the intensity of the happy stories was positively correlated with the intensity of unhappy stories. Also, Larsen's (1985) Affect Intensity Measure is based on a straightforward single-score assessment of intensity. The more complex computational

procedures used in the daily studies were necessitated by the need to separate frequency from intensity, but the results were totally congruent with other methods of assessing intensity and show concurrent validity with external variables. Thus it appears that artifacts had little influence on the findings of this study.

A question can still be raised as to whether the intensity dimension merely reflects the way subjects describe their emotional states (whether with rating scales or with words), and not the way they actually experience them. If so, this cognitive way of labeling their emotions would be quite interesting in itself. However, data that we have more recently collected (including measures of physiological arousal, daily activities, and the way events are perceived) suggest that the intensity dimension represents a broadly pervasive style of affective life that has cognitive, physiological, and behavioral consequences.

The importance of the frequency and intensity dimensions has been demonstrated in other areas of psychology as well. In psychophysics, for example, the two basic physical dimensions of a stimulus are its frequency and intensity, and these dimensions combine to produce the psychological experience of perception. In personality psychology, according to Allport (1961), there are two defining characteristics of a trait response: frequency and intensity. In other words, how frequently and with what intensity does an individual exhibit behaviors presumed to be reflective of a given trait? Murray (1938) discusses the periodicity (frequency) and strength (intensity) of physiological and psychological needs. More recently, Ozer (1982) applied the dimensions of frequency and intensity to the scaling of behavioral response classes (e.g., how often and how much aggression is exhibited in a particular situation).

In some sense our dimensions are reminiscent of the ancient Greek Galen's four temperaments based on the four humors. In this scheme, a choleric person feels strongly or intensely, whereas the phlegmatic is relatively unemotional and therefore does not experience emotions intensely. The sanguine person is one who is frequently happy, whereas the melancholic frequently experiences negative affective states. However, unlike Galen, we

conceptualize frequency and intensity as continuous variables that tend to vary independently. Thus in our system a person could be, for example, both a choleric and a melancholic. In terms of experiencing happiness, those who are high in frequency of positive affect and high in intensity tend to feel exuberance and joy, whereas those high in frequency but low in intensity experience contentment and serenity. Those who are low on frequency and high in intensity often experience depression or other strong negative emotions. Low-frequency persons who are also low in intensity experience affect characterized by mild unhappiness. Thus, in terms of subjective well-being, the intensity dimension implies that low- and high-intensity persons typically experience happiness and unhappiness in very different ways.

Wessman and Ricks (1966) also proposed a two-dimensional model of affective experience. They defined their dimensions as the amount of positive affect as opposed to negative affect a person experiences, or average hedonic level, and the emotional variability a person exhibits day-to-day. Note that the constructs of variability and intensity are not synonymous. Variability is the standard deviation of mean affect measured on a single bipolar hedonic scale, and as a result necessarily combines frequency and intensity. On the other hand, intensity refers to the strength of a particular affective state, regardless of how frequently the state in question is experienced. Although Wessman and Ricks's (1966) measure of variability may have to some extent been contaminated with frequency, their descriptions of variable individuals sound as if they are describing individuals who would score high on our intensity dimension. Similarly, our frequency dimension is congruent with their description of happy persons. Thus we believe that in our work we borrow from Wessman and Ricks, but clarify the subjective well-being dimensions. Underwood and Froming (1980) also suggested affective dimensions of level and variability that are similar to frequency and intensity. Our intensity dimension may also appear similar to the trait of "emotionality" discussed by personality researchers (e.g., Buss & Plomin, 1975). However, it is unclear to what extent measures and concepts of "emotion-

ality" combine affective intensity with negative affect frequency. This is a topic for future research.

Our suggestion that intensity and frequency are the basic underlying dimensions of affect is congruent with the broad structure of emotions proposed by Russell (1980). However, whereas Russell's pleasant-unpleasant dimension appears to be one embodying the magnitude of positive versus negative momentary affect, the frequency dimension proposed here refers to the frequency of positive and negative affect when persons are assessed over time. Russell's arousal dimension may be congruent with our intensity dimension. Although it is encouraging that the two systems have similarities, the structure of affect experienced by persons over time does not necessarily have the same structure as momentary emotional states.

One significant contribution our research can make is to help clear up the controversy surrounding the relation of positive and negative affect. Specifically, one group of researchers finds that positive and negative affect are inversely related (Brenner, 1975; Kammann et al., 1979), whereas others report independence (Bradburn, 1969; Bryant & Veroff, 1982; Diener & Emmons, 1984; Zevon & Tellegen, 1982). Diener and Emmons's (1984) work represents an initial step forward in clarifying this confusion. What they did was to sample affect over varying periods of time (i.e., from moments to weeks). Their findings indicate that positive and negative affect are inversely correlated at particular moments in time, but that the correlation between the two decreased as the time interval increased. Thus when one considers a period of a few weeks or longer in a person's life, the amount of positive and negative affect one experiences is independent, even though experiencing the two emotions simultaneously is unlikely. These findings put some of the controversy into perspective.

When one examines longer time periods, however, it is still unclear why mean levels of positive and negative affect are independent. This is precisely the point at which the dimensions of frequency and intensity become critical. When one analyzes positive and negative affect scores in terms of frequency and intensity, the data become readily interpret-

able. Consider the idea that the more frequently one feels positive affect, the less frequently one feels negative affect. This proposition is consistent with Diener and Emmons's (1984) finding that people rarely experience strong negative and positive affect at the same time, and it implies that the two vary inversely in frequency. Consequently, if positive and negative affect are a combination of frequency and intensity, then they must covary in terms of intensity in order for mean levels to be independent. This is exactly what we find across all of the studies we conducted for this report. Because frequency and intensity appear to be uncorrelated, the resulting influence of the two, when persons are considered over time, is to make positive and negative affect independent.

We have presented evidence that frequency and intensity are important dimensions of affective structure. Frequency and intensity explain why some scales show that positive and negative affect are independent and some scales suggest that they are inversely related, depending on whether their wording taps mean levels or frequency. When mean levels of affect are correlated, with intensity partialled out, a strong inverse correlation emerges. This finding suggests that the intensity dimension is at least partly responsible for the low correlation between average positive and negative affect.

Should investigators measure positive and negative affect or intensity and frequency? Depending on the purposes of the investigator, both mean levels of affect and frequency and intensity could be of interest. Note that mean positive and negative affect are rotational variants of each other; that is, each can be derived from the other. If subjective well-being scales assess mean levels of affect over time, one will find independence, whereas if they measure frequency, positive and negative affect will vary inversely. This pattern has indeed held for all of the scales we have encountered, the majority of which appear to measure the frequency dimension only. If researchers want to assess emotional intensity, but do not want to use a longitudinal approach, then Larsen's (1985) Affect Intensity Measure is appropriate.

Although intensity may explain much of the independence between positive and neg-

ative affect, this does not mean that other factors may not operate as well. For example, Warr et al. (1983) showed that good environmental events correlate with positive affect and bad events with negative affect, even though the number of good and bad events do not correlate with each other. We have replicated these findings, which suggest that average positive and negative affect may be independent for reasons in addition to intensity. Although much of the independence between positive and negative affect can be accounted for by their covariation on the intensity dimension, certain factors may influence one or the other to a greater extent. The two do not covary perfectly in terms of intensity, and therefore certain influences probably affect either positive or negative intensity, but not both. This reasoning suggests that there may be some inherent independence between average positive and negative affect in the sense that a causal variable can influence one, but not the other. Thus there is justification for still measuring average positive and negative affect, as well as intensity and frequency. However, the covariation of positive and negative affect intensity undoubtedly explains a large portion of the statistical independence of mean levels of positive and negative affect.

Taking all the findings into consideration, the two dimensions of frequency and intensity appear to have heuristic value. In addition, they seem to be stable and theoretically meaningful. However, as of yet, we do not understand the underlying processes that mediate these variables. Preliminarily, we have some evidence that emotional intensity is simply related to how subjectively good or bad the events happening to the person are. We have also found that persons who experience more intense emotions show greater variations of emotion across various situational dimensions. Finally, we have found preliminary evidence for peripheral physiological differences between high- and low-intensity individuals. Researchers should try to tease apart the mechanisms underlying the intensity dimension. It appears also to have implications for theories of subjective well-being, for the psychopathology of affective disorders, and for personality assessment, all of which should be explored. Finally, some

may question the general utility of self-reports of affect or our daily reports in particular. However, there are many reasons to have confidence in at least moderate validity for such reports (see Diener, 1984, for a review). The measures show low correlations with social desirability, but theoretically meaningful correlations with other variables. Weinstein (1982) found that self-reported happiness was strongly related to an unobtrusive measure of smiling and laughing in an interview. Correlations between self-ratings and expert ratings of affect averaged an encouraging $r = .52$. Thus although some distortion or bias undoubtedly does enter these measures, they do seem to contain substantial amounts of valid variance.

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