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The Relationship In Experience Between Various Types of Affect

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The co-occurence in experience of various emotions was explored, with the focus on positive versus negative affect. In Study 1, 72 subjects read stories designed to produce varying levels of either positive or negative affect, and then rated their level of both types of affect. In Study 2, 42 participants rated their feelings during emotional times in everyday life for a period of 6 weeks. We found that emotions of the same hedonic valence (e.g., fear and anger) tend to co-occur. We also found that positive and negative affect do not occur together at high levels of intensity. These two facts about the relation of positive and negative affect are probably responsible for the bipolarity that is often found between them. These findings represent a challenge to those who postulate that there are unrelated discrete emotions and that the terms *positive affect* and *negative affect* do not describe meaningful clusters of emotions. We found that if one type of affect is of low intensity, the other type can be at any level from low to high. Therefore, a truly inverse and linear relation does not characterize positive and negative affect. This finding represents a challenge to most structural models of emotion. It appears that mutual exclusion only at high levels of intensity characterizes the relation between positive and negative affect.

We explore the relation between feeling particular emotions and experiencing other emotions. For example, if one feels joy, what is the likelihood of also feeling anger or fear? In recent years a great deal of discussion has focused on the structure of emotion (e.g., Daly, Lancee, & Polivy, 1983; Plutchik, 1980; Russell, 1978, 1979). In addition to the structure of momentary emotion, Diener and his colleagues (Diener, 1984; Diener, & Emmons, 1984; Diener, Emmons, & Sandvik, 1985; Diener, Larsen, Levine, & Emmons, 1985) have also examined the long-term structure of affect across persons. One necessary component in understanding the structure of affect is to examine how compatible the experience of varying emotions is. Are certain emotions compatible and others mutually exclusive? When the levels of an emotion change, do other emotions also change in intensity? For example, as negative affect increases, is there a necessary decrease in positive affect? When an emotion is felt, is the intensity related in a linear or nonlinear way to other emotions? Gaining knowledge of the interrelations of emotions as they are experienced will aid in understanding the structure of emotion, as well as the processes underlying affect. If particular emotions facilitate the experiencing of certain other emotions but inhibit yet other emotions, this will provide valuable insights into how the affect system functions.

In order to narrow the range of the questions asked, we focus on global positive and negative affect rather than on discrete emotions such as anger. There were several reasons why focusing on only global positive and negative affect was desirable. First, a two-dimensional system of emotion accounts for much of the variance in affect and has been most replicable (e.g., Russell, 1978, 1979; Schlosberg, 1954; Watson, Clark, & Tellegen, 1984; Watson & Tellegen, 1985; Zevon & Tellegen, 1982). The two dimensions are either positive–negative affect and arousal (e.g., Russell, 1978) or a similar system that appears to be a 45° rotation of the other system, with negative and positive affect as the two dimensions (see Watson & Tellegen, 1985). In contrast to the ubiquitous bipolar pleasant–unpleasant and arousal dimensions, factors of multiple discrete emotions (e.g., fear and joy) tend not to entirely replicate across investigators (e.g., Clyde, 1963; Ekman, Friesen, & Ellsworth, 1972; Izard, 1972; McNair & Lorr, 1964; Nowlis & Nowlis, 1956; Plutchik, 1980). Nor has there been agreement when dimensions in addition to positive–negative affect and arousal are proposed. A second reason for focusing on positive and negative affect is to simplify this initial analysis of the covariation in the experiencing of different emotions.

Zevon and Tellegen (1982) explored the interrelation of positive and negative affect through within-subject factor analyses. They found two independent factors, negative and positive affect, which replicated across virtually all subjects. Diener and Emmons (1984) also explored the experience of positive and negative affect within individuals. They found that positive and negative affect correlated highly inversely when the experience of affect was reported at particular moments. However, they found that when longer time intervals were examined, the experiencing of positive and negative affect tended to be uncorrelated across individuals. Diener, Emmons, and Sandvik (1985) reviewed the evidence for the existence of orthogonal negative and positive affect dimensions when long-term mood was considered. On the other hand, Russell (1978) found that positive and negative emotions were not independent, but were at opposite ends of a bipolar continuum. In this article we intend to extend the findings that in the earlier studies were based solely on correlational approaches. In particular, we first examine whether differences in the level of one type of affect are invariably accompanied by differing levels of intensity in the other type of affect. It is possible that positive and negative affect correlate only because they are incompatible at high levels of intensity. However, this would not necessarily mean that there was a close link between the two at other less

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intense levels. It might be that rather than show an inverse relation, as suggested by a negative correlation, or no correlation, as suggested by independent dimensions, positive and negative affect may be mutually exclusive; that is, positive affect may be experienced intensely only when negative affect is not present. However, it may be that the degree of positive affect can vary from low to high, as long as the level of negative affect is low. In addition, it may be that an increase or decrease in positive affect does not necessitate a change in negative affect as long as the latter is experienced at relatively low levels. Such a relation would appear as a simple moderate negative correlation unless one made a finer grained analysis of emotion reports. Thus the relation between positive and negative affect may be more complex and not completely captured by correlational or factor analytic approaches. A closely related issue is whether positive and negative affect are related in a truly linear way. The conclusions of Diener and Emmons (1984) and Zevon and Tellegen (1982) were based on an exploration of linear relations through Pearson's product–moment correlations. However, the idea of mutual exclusion suggests that a nonlinear relation may exist. Such a relation would produce an inverse correlation if it were analyzed via the Pearson statistic, although this correlation would hide an underlying curvilinear relation.

In summary, this article is a further exploration of the relation of the experience of positive and negative affect. In earlier studies researchers relied on correlational approaches. We examined whether there is a necessary inverse relation between positive and negative affect. If the two are mutually incompatible but not strictly inverse, it is necessary to use approaches beyond linear correlation to uncover this fact. The major question is whether levels of positive affect are invariably and linearly related to levels of negative affect. A mutual exclusion view suggests that this will not be the case. A related issue is whether there are patterns of co-occurrence for various emotions. If emotions are discrete and independent, they should not show specific patterns of co-occurrence, and categories such as "positive affect" and "negative affect" would have little scientific value. However, if certain emotions tend to be experienced together or are mutually exclusive, then categories or dimensions of emotions take on scientific import.

In order to explore the relations between various types of affect in depth, several approaches were used. In Study 1, an experimental manipulation was used to produce lower or higher levels of positive and of negative affect. Thus the pattern of correlations between the two could be explored both within and across conditions. If individuals' levels of affect correlated only when both positive and negative conditions were combined, not when the conditions were examined separately, it would suggest not that the two types of affect are invariably linked, but rather that they are only inversely correlated when strong levels of affect are considered because the two types of affect tend not to co-occur at intense levels. In addition, the means in each condition can also be considered determinants of whether a lower level of one type of affect necessitates a higher level of the other type of affect. In the second study, subjects reported their affect in everyday situations at times over a 6-week period when they felt "emotional." We explored the relation between negative and positive affect in these reports in several ways. Both linear and nonlinear correlations were computed. An analysis of the variance in one type of affect at each level of the other type of affect was also explored. In this way, we could determine whether the variability in each type of affect is greatest at low levels of the other type of affect. If so, this would suggest that there is not a simple inverse relation in the experience of positive and negative affect, but rather a more complex relation between the two.

In addition to the in-depth analysis of the relation between positive and negative affect just described, we also present in the second study a preliminary analysis of the relation between discrete emotions such as fear and anger. The major question was whether emotions of the same hedonic type tend to co-occur. If so, this would have clear implications for a comprehensive theory of emotions. If emotions of the same hedonic tone tend to co-occur, it would indicate that the underlying processes leading to these emotions in some way link them together.

Study 1

Method

Participants and procedures. Seventy-two college students served as subjects. These individuals were involved in a long-term study on daily mood, but were also requested to complete additional tasks. In this study each subject read two emotional stories, one negative and one positive. We manipulated intensity of mood with the "surprisingness" of the story ending, which has proved to be an acceptable method for manipulating degree of affective arousal (Iran-Nejad, 1983). After reading the stories, subjects completed an affect questionnaire.

There were two stories in both the good and bad conditions. The first story, adapted from Thurmond (1978), described an incident in which a woman was concerned about running out of gas late at night. After pulling into a service station, Marilyn is asked to come inside by the attendant. Because a maniac murderer is on the loose in the area, she is reluctant to go inside, but does so when he insists. In the negative condition, the gas station attendant strangles her. In the positive condition, it turns out that the attendant is really a good Samaritan intending to save her from a man whom he has spotted hiding on the back seat of her car. In the second story, adapted from Laymon (1975), the main character is awakened by footsteps outside his tent. He discovers that Sally is missing and does not respond to his calls. When he comes out of the tent, there is a man waiting with a gun in one hand and an ax in the other. In the negative condition, the camper is murdered. In the positive condition, the bad man is overpowered and arrested. Each subject read the good version of one of the stories and the bad version of the other story. Because each subject read both a good and a bad story, subjects were repeated across the positive–negative manipulation, but were nested within level of surprise; that is, each subject was in a particular condition for surprise in both the positive and negative conditions.

For each of the story conditions, there were three levels of surprisingness that were designed to manipulate cognitive arousal and therefore emotional intensity. The information given in the high surprise endings gave no indication of the story ending. For example, in the negative gas station story, the attendant was portrayed as a very nice fellow, so that his murder of the woman is unexpected. Similarly, in the positive condition of the camping story, Sally turns out to be the camper's dog who attacks the bad man. In each high surprise condition, the story ending is very unpredictable from the information contained in the story. In the medium surprise condition, hints are included throughout the story about the ending. In the low surprise condition, the ending of the story is obvious from information that is directly stated in the story.

Mood instrument. After reading each story, subjects completed a questionnaire. There was one question per page and these questions were systematically varied in order across subjects so as to eliminate order effects. Each question was rated on an 8-point scale anchored by *Not at*

*all*_____ (0) and *Extremely*_____ (7). We also included four irrelevant adjective questions (lonely, ambitious, toothache, and sweet taste) in order to see whether the manipulations affected them and to examine their relation with emotions. We included four questions to assess levels of positive and negative affect: pleasant, unpleasant, happy, and unhappy. For example, one question read "The conclusion of the story I just read made me experience:"; the response options ranged from 0 (*No* un*pleasantness at all*) to 7 (*Extreme* un*pleasantness*).

Results

Pearson correlations were computed between the affect adjectives in order to determine the relation of positive and negative affect across individuals. The correlations were computed for the 72 subjects across all conditions and also separately for the positive and negative conditions. These correlations are shown in Table 1. Several things are clear in this table. First, adjectives correlate much more strongly with those of the same hedonic type than with those of the opposite hedonic value. This occurs in all three sets of correlations. Second, across all conditions, positive and negative affect vary inversely at moderate levels. This indicates that when one considers conditions in which radically different levels of positive and negative affect are present, an inverse correlation will be found between the two. In other words, when one examines groups in which some persons are experiencing high-intensity positive affect and other persons are experiencing high-intensity negative affect, then across all individuals an inverse correlation between positive and negative affect will emerge. However, when one turns to the correlations within the positive and negative affect cells, one is examining the variations in affect among individuals who are experiencing varying degrees of positive affect in the positive condition and varying degrees of negative affect in the negative condition. In this case, the correlations between positive and negative affect drop to nonsignificant values close to zero. This indicates that differences in positive affect between individuals when they are happy are not necessarily related to corresponding differences in negative affect. The same pattern is true when negative affect predominates. These individual difference correlations support the conclusion that differences in positive affect are not always related to differences in negative affect. In other words, there is not a necessary inverse relation between the two. However, if one considers a broad spectrum of moments in which at times negative affect is strong and at times positive affect is strong, an inverse correlation between the two will be found.

One definitely cannot attribute the low correlation between positive and negative affect to restriction of range or to floor effects. If the nondominant affect was restricted in range or had reached a floor, it could not possibly correlate at moderate to high levels with adjectives of the same type (rs = .65 and .44). These correlations indicate that sizable relations are still possible with the variance that exists for the nondominant affect. In addition, as the means in Table 2 show, the mood adjectives had a long way to move before encountering the floor effect that is clearly evident for "Toothache."

The results revealed that in some cases the stories were not effective in producing differences in affect. In order to assess how average differences across individuals of one type of affect relate to differences in the other type of affect, it was necessary to compare stories that differed significantly in level of affect produced.

Table 1
Correlations of Mood Adjectives

Mood adjectives	Happy	Pleasant	Unhappy
All conditions			
Happy			
Pleasant	.77		
Unhappy	−.38	−.33	
Unpleasant	−.45	−.39	.80
Positive condition only			
Happy			
Pleasant	.77		
Unhappy	.07	.07	
Unpleasant	−.08	−.08	.65
Negative condition only			
Happy			
Pleasant	.44		
Unhappy	−.05	−.09	
Unpleasant	−.15	−.11	.74

Note. For $rs(70)$ of .20 and greater, $p < .05$; for $rs(70)$ of .28 or greater, $p < .01$.

Therefore, the low- and medium-surprise stories were combined because they produced very similar levels of affect for both stories. In addition, only one positive story (about the gas station) and one negative story (about the camper) were retained because the other two stories showed no mean differences for either positive or negative affect between any of the levels of surprise. Thus after deleting the ineffective manipulations, we had a 2 × 2 design (low/medium vs. high surprise and positive vs. negative ending). Dropping of the ineffective stories occurred without reference to the data that would shed light on the various questions under study.

The check on the surprisingness manipulation produced highly significant results, $F(1, 34) = 31.76$, $p < .001$, which did not interact with the positive versus negative story conditions. The means for the four cells are shown in Table 2. We computed preplanned orthogonal comparisons to compare the predictable and unpredictable cells within the positive and negative conditions (for all questions). The significance levels of these comparisons are indicated in the table by the letters *a* and *b*. The level of surprisingness was effective in manipulating level of affect in both positive and negative conditions.

The key findings in Table 2 are those for the mood adjectives. The positive stories differed significantly between the predictable and unpredictable cells in terms of *Happy* and *Pleasant*. However, not only did the unhappy and unpleasant ratings not differ significantly, but the means are ordered in the same direction as the positive adjectives. In the negative condition, there is the same type of pattern, although the significance levels for *Unhappy* and *Unpleasant* were of only borderline value. Once again, the opposite adjectives (*Happy* and *Pleasant*) were almost identical and, in addition, went in the same direction as the negative adjectives. What these results clearly show is that positive and negative affect can be felt at varying levels without necessarily influencing the value of the opposite type of affect. For example, greater positive affect in the unpredictable positive condition was clearly not accompanied by lesser negative affect. If a person has high affect of one type, this affect can decrease without the other type of affects' necessarily increasing.

Table 2
Mean Ratings of Stories

Questions	Story type: Positive, Predictable	Positive, Unpredictable	Negative, Predictable	Negative, Unpredictable
Surprise	2.29[b]	6.08[b]	2.88[b]	5.83[b]
Irrelevant adjectives				
Lonely	1.92	1.58	2.38	2.42
Ambitious	2.46	2.67	1.46	2.00
Toothache	0.00	0.17	0.13	0.17
Sweet taste	0.54	0.67	0.54	0.33
Mood adjectives				
Happy	2.67[b]	5.42[b]	0.71	0.83
Unhappy	1.42	1.67	3.25[a]	4.58[a]
Pleasant	3.21[b]	5.33[b]	1.08	1.17
Unpleasant	2.00	2.25	3.96[a]	5.33[a]

Note. $N = 24$ for predictable conditions and 12 for the unpredictable conditions.
[a] Predictable and unpredictable conditions differ at $p < .10$.
[b] Predictable and unpredictable conditions differ at $p < .01$.

The predictability manipulations did not influence the irrelevant adjectives. However, there were main effect differences between the positive and negative conditions for *Lonely,* $F(1, 34) = 6.51$, $p \leq .05$, and for *Ambitious,* $F(1, 34) = 7.23$, $p \leq .05$. Thus these adjectives were influenced by the mood manipulations. *Ambitious* and *Lonely* had seemed on an a priori basis to be irrelevant to the stories. However, the fact that the affect manipulations influenced them suggests a general "spreading" of negative or positive affect to other emotions of the same hedonic type. In other words, increased negative affect tends to increase other specific negative emotions and positive affect tends to increase other specific positive emotions.

Discussion

There are several limitations of the first study. The stories may have produced only modest levels of affect. In addition, stories are somewhat artificial stimuli and not highly relevant to subjects' lives. Last, surprise is a nonstandard way to manipulate intensity of affect, and there could be unique properties of such a manipulation. To remedy these limitations and obtain more ecologically valid data, in Study 2 we collected emotion reports from subjects on a daily basis over a 6-week period. In addition to the ecological representativeness of such emotion reports (Epstein, 1982), in Study 2 we had the advantage of being able to examine the actual co-occurrence of emotions over a broad spectrum of intensity.

Study 2

Method

Participants. Forty-two University of Illinois undergraduates served as subjects. They were enrolled in a semester-long course on mood research and were required to complete daily mood forms and many personality questionnaires (see Diener & Emmons, 1984, for further details). Students who did not wish to be subjects had the alternative of serving as experimenters or assistants in other studies. There appeared to be a wide range of students participating. Some wanted to learn about research, some wanted to learn about themselves, and others entered the course because it did not involve tests and papers. The course was graded credit–no credit; 3 persons received no credits (for completing an insufficient number of assignments), and their data are not included here.

Procedures. For this study subjects were to complete a mood form each time they felt "emotional," but no more than one report per day in order to ensure that a new emotional reaction was being captured by each report. They were instructed to pick a time when they felt an emotion that for them was fairly strong. Most participants completed approximately one mood report per day, but some produced only one report every several days. We have found that college students experience more intense emotions on the average than do older persons (Diener, Sandvik, & Larsen, 1985), and therefore an emotion report almost every day is not unreasonable. Obviously some subjects set their threshold higher than others for the level of feeling that was strong enough to warrant a mood report. Nevertheless, subjects were instructed to complete a report about once a day for the time that would usually qualify as their most emotional time that day. Subjects could complete the report immediately or as late as bedtime of that night, but were encouraged to fill it out as soon as practicable. The emotion reports had to be turned in the day after they were completed.

Mood instrument. The emotion measure contained nine mood terms designed to enable us to measure positive and negative affect. Four were positive (*happy, joyful, pleased,* and *enjoyment/fun*) and five were negative (*depressed/blue, unhappy, frustrated, angry/hostile,* and *worried/anxious/fearful*). Each term was to be marked on a scale on which 0 = *Not at all* and 6 = *Extremely much.* The intermediate values on this 7-point scale were also anchored with labels such as *Very slight* and *Much.* The nine adjectives were chosen on the basis of both a previous factor analysis (Diener & Emmons, 1984) and an effort to include the most important specific emotions listed by most emotion theorists (e.g., anger, fear, joy, and sadness). Although in some analyses we considered the single mood adjectives, the majority were based on composites for positive and negative mood. The composite for positive mood was the sum of the four adjectives divided by 4, and the negative composite was computed in an analogous fashion.

Results

During the course of the 6-week study, participants generated 1,416 emotion reports, or an average of about 34 per subject (in 42 days). A frequency count of positive and negative affect felt by all subjects at these emotional times is shown in Table 3. Because the composite affect scores were averages that were based on a number of mood adjectives, we rounded the averages to the closest integer to achieve the values shown in Table 3. One obvious fact is that very high levels of emotion occurred less frequently than did lower and moderate levels of affect. Another observation is that positive and negative affect did not occur at high levels together. Virtually all of the lower right cells are devoid of entries. Similarly, the upper left cells have fewer entries because these would not as readily qualify as emotional times, and therefore no emotion reports would be completed for them. Those few times when reports were turned in with virtually no affect can be attributed to several compulsive students who felt obliged to complete a report every day.

A polynomial regression was computed in order to determine whether the distribution was completely linear or had a curvilinear component. Because our computer program could analyze

Table 3
Frequency Count of Combinations of Positive and Negative Affect at Emotional Times

Level of reported negative affect	Level of reported positive affect							Marginal totals
	0	1	2	3	4	5	6	
0	1	0	9	43	93	93	57	296
1	4	10	33	58	98	99	51	353
2	27	50	31	25	29	22	12	196
3	55	105	31	21	3	2	2	219
4	77	67	27	12	0	1	0	184
5	71	33	11	4	0	0	0	119
6	39	10	0	0	0	0	0	49
Marginal totals	274	275	142	163	223	217	122	1,416

a maximum of 500 observations at once, and in order to cross-validate the results, three separate regressions were calculated on the emotion times of the subjects randomly divided into three groups. The linear coefficients were high and significant in all three groups ($rs = -.64, -.71$, and $-.66$). However, there were also highly significant curvilinear components in each of the three groups, $F(1, 457) = 46.53$, $F(1, 484) = 25.33$, and $F(1, 466) = 29.93$, all $ps \leq .001$. The degrees of freedom vary because subjects had somewhat different numbers of emotion reports in the three groups. One might think that the curvilinear effect was due to combining data from different subjects. However, individual regression analyses on the data of individual subjects revealed that a statistically significant curvilinear effect existed in about one half of the subjects' data (despite much lower degrees of freedom).

It is interesting that data that we artificially created in a perfect L shape, with a right angle and with roughly the same marginal frequencies as appear in Table 3, yielded a linear correlation coefficient of $-.60$. Thus even data that have a perfect L shape will show a strong linear component when they are analyzed via Pearson's product–moment correlation. In other words, a high inverse Pearson correlation does not necessarily imply a truly linear inverse relation.

The average values of each type of affect at each level of the other type of affect are shown in Table 4. High average levels of positive affect occur only at very low levels of negative affect. Similarly, high average levels of negative affect occur only at low levels of positive affect. However, once a certain level of affect is reached, the other type of affect does not change dramatically.

A second approach to the question of average values is also shown in Table 4. If one looks at those times when one type of affect predominated over the other type, and ignores times when the two were equal, one can compute the average level of each type of affect at each level of the other type of affect. In other words, when a person is predominantly happy, how does negative affect vary as his or her positive affect increases? Similarly, when a person is predominantly unhappy, how does his or her positive affect vary as a function of the level of negative affect? In Table 4 these values are labeled *Average subordinate values* and are shown for each level of the dominant affect. Values are not shown at the 0 and 1 levels of the dominant affect because it is impossible to have any of the opposite type of affect if the predominant affect is at these low levels. These subordinate values are interesting in that they are very low and rather uniform across all levels of the dominant affect. This suggests, for example, that when a person is predominantly happy at a particular time, he or she will experience a very low level of negative affect. More importantly, the level of negative affect does not decrease dramatically as he or she becomes happier. Once a person is predominantly happy, he or she tends to experience low levels of negative affect across all levels of positive affect. When a predominantly happy person experiences lower levels of positive affect, he or she does not have to experience any specific level of negative affect. The same pattern is evident when negative affect predominates.

As informative as the average values just presented may be, the variance in the data is also important. The standard deviations of each type of affect at each level of the other type of affect were therefore computed. This analysis will reveal whether one type of affect is more dispersed or variable at certain levels of the other type of affect. The standard deviations for negative affect were computed for each level of positive affect from 0 through 6 and were, in order, 1.27, 1.13, 1.39, 1.33, 0.73, 0.72, and 0.72. Similarly, the standard deviations for positive affect at each level of negative affect were 1.08, 1.35, 1.81, 0.93, 0.80, and 0.40. What is clear is that the standard deviations for one emotion are much lower at high levels of the other emotion; that is, there is a large amount of variability in an emotion at low and moderate levels of the opposite valenced affect, but very low variability of an emotion when the opposite valenced affect is high.

Although these analyses were all conducted on global positive and global negative affect, one can also examine specific discrete emotions. The correlations between specific emotions across all 1,416 emotion times are shown in Table 5. Several things are apparent. First, emotions of the same valence tend to show high correlations with each other. This means, for example, that when

Table 4
Average Values of One Type of Affect at Each Level of the Other Type of Affect

Value	Average	Average subordinate value
Positive affect	Negative affect	
0	4.09	—
1	3.39	—
2	2.47	.79
3	1.46	.86
4	0.74	.74
5	0.71	.71
6	0.66	.66
Negative affect	Positive affect	
0	4.48	—
1	4.09	—
2	2.47	.65
3	1.21	.87
4	0.88	.86
5	0.56	.56
6	0.20	.20

Table 5
Correlations Between Specific Affect Adjectives

Specific emotions	1	2	3	4	5	6	7	8
1. Happy								
2. Joyful	.85							
3. Pleased	.88	.83						
4. Fun/Enjoyment	.80	.79	.77					
5. Depressed/blue	−.66	−.55	−.60	−.55				
6. Unhappy	−.78	−.67	−.73	−.65	.81			
7. Frustrated	−.72	−.66	−.70	−.63	.66	.77		
8. Angry/hostile	−.64	−.52	−.59	−.51	.51	.68	.69	
9. Worried/anxious	−.45	−.40	−.44	−.39	.48	.51	.58	.38

people feel frustrated, they are also likely to feel anxious and angry. These correlations between discrete emotions indicate that, as suggested by Russell (1978), an overall structure for emotions exists, even though there may be distinct emotions. Another obvious pattern in Table 5 is that emotions of opposite valence tend not to occur together. However, these inverse correlations are not quite as strong in absolute magnitude as the correlations between emotions of the same valence (average values were .59 and .69, respectively). This suggests once again that although opposite-valenced emotions tend to be incompatible, their relation is not completely inverse.

Discussion

In Study 2 an inverse view receives some support in light of the strong inverse correlations found between both global and specific negative and positive emotions. However, the existence of a truly linear inverse relation is doubtful because of the significant curvilinear pattern and also the averages shown in Table 4. If the pattern were actually linear and inverse, average affect would decline in a uniform way without the precipitous drop that is evident in Table 4. In addition, the values of the subordinate affect would not be as uniform as they are across levels of the predominant affect. If the relation between negative and positive affect were inverse and liner, one would also expect the standard deviations either to be uniform or to be larger in the middle categories and smaller on the ends. However, the clearest pattern is one of small standard deviations at the upper ends of the other type of affect. There is some tendency for smaller standard deviations to occur also at lower levels of affect, but this pattern seems to be due mainly to the fact that subjects only infrequently completed mood reports with very little of either type of affect. The averages presented in Table 4 tend to be compatible with a mutual exclusion view, as long as mutual exclusivity does not imply an absolute zero level of the nondominant emotion. It is clear from Table 3 that a strong form of mutual exclusion is not supported because it appears that intermediate levels of negative affect can be felt simultaneously with moderate levels of positive affect. Thus there is not complete mutual exclusivity between the two types of affect except at strong levels of intensity. Above the level of *Moderate* (a 3 on our scale), positive and negative affect virtually never occurred together.

General Discussion

In these studies we relied not simply on the scaling of emotion words, but rather on an analysis of self-reported emotions as they were experienced. Several clear patterns emerged from the data:

1. People do not simultaneously experience both positive and negative affect at intense levels.

2. If one type of affect is at low levels, the other type of affect can be at any level of intensity from low to high. Similarly, when the predominant affect changes in intensity, the other type reflects no more change than is evident in irrelevant adjectives. In other words, the levels of positive and negative affect that one experiences are not tightly linked. However, a moderate inverse correlation between the two will emerge if a broad spectrum of times is considered because the occasional intense positive or negative affect is incompatible with high levels of the other type of affect. This reasoning is confirmed by the pattern of results found by Diener and Emmons (1984). They reported a correlation of −.57 between positive and negative affect when mood reports were completed at random times, but a very strong correlation of −.85 when the ratings were completed during times of strong emotion. Nevertheless, near independence of average levels of positive and negative affect will occur when individuals are compared over time because affect occurs at relatively nonintense levels most of the time. Thus positive and negative affect can occur rather independently over time because low levels of one type of emotion are compatible with any level of the other type of emotion. In other words, average levels of positive and negative affect can be independent across persons because most affect occurs at nonintense levels.

3. Emotions of similar hedonic valence tend to co-occur. For example, when a negative emotion is present, it is likely that other negative emotions will also be experienced. The co-occurrence of emotions of the same hedonic tone is stronger than the inverse relation between emotions of opposite hedonic tone. This has interesting implications for theories of emotion. If various discrete emotions co-occur, this suggests that they must fit into some larger more all-encompassing structure. It also suggests that certain underlying processes must be common to a number of emotions. Theories denying that there are structured interrelations among emotions and those denying that there are categories such as "negative emotion" must explain why some emotions tend to be experienced together and some do not. Watson and Clark (1984) postulated the existence of a broad "negative affectivity" factor that rests implicitly on the assumption that unpleasant emotions tend to co-occur within the same persons. What the link is between emotions of the same hedonic tone should be explored in future research.

4. Positive or negative affect were experienced at virtually all times that were classified by participants as "emotional." This suggests that positive and negative affect are essential elements of emotion. In other words, it appears that one necessary component of emotion is that it be a pleasant or unpleasant experience.

5. Subjects did report times at which they felt moderate amounts of positive and negative affect together. These times require more study in order to know whether subjects actually have both feelings together or switch rapidly back and forth between the two; that is, can people actually experience positive and negative affect at the same instant? If they can, why does this not occur at intense levels of emotion?

These five conclusions are important for several reasons. First, patterns found in factor analytic and other approaches to uncovering the "structure" of emotion perhaps arise because of these conclusions. For example, the incompatibility of higher levels of negative and positive affect may be responsible for the bipolar positive–negative factor that is found so often. Second, these conclusions suggest research directions in addition to those aimed at uncovering the structure of emotion; that is, each of these conclusions represents a phenomenon of interest in its own right and should be explored further. Why is it that emotions of the same valence tend to co-occur? Why do strong negative and positive emotions not co-occur? In determining the structure of emotion, our findings suggest several important considerations. The curvilinearity that we uncovered should be taken into account in structural models. The intensity of emotions that are examined should be carefully considered because different patterns can emerge at various levels of intensity. A simple inverse linear view of positive and negative affect must be rejected, despite sizable inverse Pearson correlations. Indeed, if only strong levels of emotion are considered, a highly inverse linear relation will be found. Nevertheless, when varying levels of intensity are closely examined, it becomes apparent that a true inverse relation between positive and negative affect does not exist. It is clear that one hedonic tone can be at varying levels without affecting low levels of the opposite hedonic tone. Furthermore, it appears that discrete emotions can "spread" so that different emotions of the same quality often co-occur. One can explain this by postulating that there are interconnections between these discrete emotions so that they are not completely independent of one another. The connection that couples emotions of similar hedonic tone could be mediated by the limbic system, by autonomic arousal, or by the cognitive processes that lead to emotions of a certain type. In terms of cognitive processes, it might be that situations that lead to a certain set of cognitive labels are also amenable to other cognitive labels that eventuate in emotions of the same hedonic tone. The correlations for specific emotions found here support the idea that specific emotions definitely have relations with one another in terms of co-occurrence. Therefore, the discrete emotions cannot be considered as totally independent of one another and can be fit into a larger structure as suggested by Russell (1979) and others.

One can analyze what various relations between positive and negative affect tell us about the underlying affect system. If they were completely independent, this would suggest that two separate affect systems are involved and that the activity of one type of affect system is independent of the activity of the other. If the two types of affect vary inversely, this would imply that there are two separate systems but that they are related by direct inhibition paths. This means that the degree of activation in one system is proportionally related to the degree of inhibition in the other system. Last, a mutual exclusion relation might suggest that there are not totally separate positive and negative affect systems localized in the brain, such that when one is active the other remains structurally intact. Rather, the experiences of positive and negative affect arise as a result of the functional interaction among a large number of distributed neuronal microsystems, much in the same fashion that a large number of suitably color-coded light bulbs might generate two different patterns of light (see Iran-Nejad, 1980; Iran-Nejad, Clore, & Vondruska, in press; Iran-Nejad & Ortony, in press). Certain neuronal systems may be connected to certain types of affect, but the experience of emotion may arise only from the interaction of a number of microsystems, some of which are common to all types of affect. Mutual exclusion occurs to the extent that the experience of one type of affect requires the engagement of the same set of microsystems that must also be engaged if the experience of the other type of affect is to occur. In other words, there are common microsystems or elements that are necessary for both positive and negative affect. Whether positive or negative affect emerges depends on which of the other sets of microsystems are also engaged and dominant at the time. In this sense, positive and negative affect are mutually exclusive in the same way that a smile and a frown are mutually exlusive—that is, to the extent that some of the same muscles and the lips must be engaged in both. It is conceivable that a person can make a smiling frown or a frowning smile only when the frown or smile are not making full or intense use of the muscles involved. In the same fashion, at low levels of intensity, one might be able to switch back and forth from pleasure to displeasure imagery, but as the intensity of one type of affect increases, so does its degree of mutual exclusivity with the other. This occurs because the common elements needed for an emotion are increasingly committed to the dominant emotion as intensity increases, and the nondominant emotion cannot occur without these elements.

There are several limitations to our studies. We relied solely on self-report data, and it would be valuable to examine other types of data in the same way. Do positive and negative facial expressions, for example, yield findings that are parallel to those that we found? In addition, our findings could be extended by the use of experimental designs in which more powerful mood manipulations are used.

The data on the relations between discrete emotions are interesting, but preliminary. We used only correlational analyses, although we found for the other types of data that these were inadequate to completely understand the relations involved. However, we thought that a more thorough analysis should await future studies. First, the discrete emotions in Study 2 were measured via only a single mood adjective and therefore may be unreliable. Second, several of these emotions occurred somewhat less frequently at intense levels than global affect, so that a detailed analysis would be based on very small numbers of cases. In addition, no manipulations were carried out in order to alter levels of specific discrete emotions. Last, it would be desirable to include a larger sample of emotions in such an indepth analysis. A thorough examination of the relation between the experience of var-

ious specific emotions would be a valuable direction for future research.

A deep rift between those who argue for discrete emotions and those who postulate an overall structure of emotions has divided the field of emotion. Our findings present a challenge to both sides. In terms of emotional structure, our findings indicate that simple and linear relations as suggested by most dimensional systems do not fully capture the interrelations among emotions. On the other hand, there do appear to be systematic relations between emotions that are not explored in most theories that postulate the existence of independent discrete emotions. It will be more important in the long run to uncover why emotions show certain patterned interrelations than it will be to simply describe the structure of emotions.

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