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Structure of Emotions

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Interesting structures emerge in scaling analyses of emotions when stimuli are confined to terms that are relatively free of cognitive and behavioral connotations. Study 1 *focused on 99 such terms, rated on semantic differential scales. It revealed a bimodal distribution of emotions with regard to pleasantness, further distinctions in terms of activation, and a third dimension representing flight-fight.* Study 2 *obtained dissimilarity ratings for a representative subset of the terms; nonmetric multidimensional scaling replicated the dimensions in Study 1 with a clarified third dimension. None of the results conform strictly to a circumplex model of emotion. Instead the results suggest that emotions are hedonically polarized feelings. Activation appears to be the main discriminating factor in positive emotions, but activation and a sense of potency combine in discriminating negative emotions. These results encourage a dimensionally based cybernetic approach to emotion research.*

In the past two decades much has been published concerning the dimensional structure of emotions. Primarily the data-analytic techniques of factor analysis and multidimensional scaling have been applied to semantic differential ratings of mood (Averill 1975), self-report measures of emotion (Lorr and Shea 1979; Purcell 1982), and similarity ratings of emotions (Bush 1972; Russell 1980, 1983). As many as five to 11 factors have been proposed to explain the structure of emotions, but, as outlined by Watson and Tellegen (1985), a two-dimensional structure is currently the most widely advocated. Generally these two dimensions are defined as a pleasantness-unpleasantness dimension *(happy, glad* versus *sad, upset)* and an arousal dimension *(excited, tense* versus *relaxed, sleepy).* In recent work Russell (1980, 1983) has advocated a two-dimensional circumplex model of emotion terms; in this model very high or very low values on one dimension (e.g., arousal) necessarily are associated with middling values on the second dimension. Though two-dimensional representations are most common, the presence of a third dimension, such as potency or dominance, is not unusual (Averill 1975; Bush 1973); indeed Mehrabian (1980, p. 49) proposes that three dimensions are "necessary and sufficient to adequately define emotional states."

Like all data-analytic techniques. the results extracted from a factor analysis or a multidimensional scaling algorithm are affected by the data that are supplied for the analysis, Consequently the dimensional structure that is uncovered is linked directly to the domain of the stimuli chosen for analysis. Ortony and Clore (1981) reviewed the literature on emotion labels, and they suggested that the process used to select emotion words has not resulted in a domain of emotion words exclusively: lists of emotions sometimes include questionable terms like *sleepy, aroused, relaxed, droopy,* and *tired.* By questioning the inclusion of words defining traits, physical states, and cognitive states within the domain of emotion words, Ortony and Clore also question the validity of the resulting dimensional structures.

Ortony and Clore conducted a series of studies to determine the actual domain of pure emotion terms, relatively free of trait, physical, and cognitive implications (Clore, Ortony, and Foss 1987, Ortony and Clore, 1981; Ortony, Clore, and Foss 1987). Each of their studies employs judgments of the appropriateness of words as descriptors of emotion; the different studies vary the samples of judges and the linguistic frames for judgments. All studies reach similar conclusions concerning the domain of emotions: the list of adjectives dealing with internal, mental feeling states whose focus is solely on affect consists of only about one-quarter of the 500 words used previously.

An examination of the dimensional structure of several published studies (Bush 1973; Conte and Plutchik 1981; Russell 1980, 1983; Watson and Tellegen 1985), concentrating only on pure emotion words, resulted in two important findings. First, fewer than one-half of the words used in published emotion studies pass Ortony and Clore's tests for emotion terms. Second, in the two-dimensional solutions, a large gap opens in the structure when the physical state classifications are eliminated. A recent study (Shaver, Schwartz, Kirson, and O'Connor 1987), which used only words that passed a rating test of emotionality, also found the gap and concluded that the dimensionality of emotions is three rather than two. Consequently the past inclusion of terms that are not emotions may have masked the true structure of emotions.

This study examines the dimensional structure of the lexicon of pure emotion adjectives, particularly those which samples of lay judges rate as emotions in both the "feeling __" and the "being __" frames (Clore, Ortony, and Foss 1987). The resulting dimensions are unaffected by the inclusion of words that represent traits *(trustworthy, warmhearted),* physical states *(sleepy, droopy),* or cognitive conditions *(alert, confused).* The first study, which uses semantic differential ratings of a large set of emotion words, provides a discrimination of emotion terms and also defines the domain of emotions for sampling in the second study. The second study employs direct ratings of dissimilarity between selected emotions to uncover the multidimensional structure of the emotion lexicon.

Our results indicate that emotions have a structure which has not been recognized fully. It is not circumplex because of the gap between words naming pleasant and unpleasant emotions and because three dimensions of representation are required statistically and substantively. Moreover, the distribution of emotion terms in three dimensions is far from uniform because no named emotions define pleasant states of impotency.

STUDY 1

Questionnaire

One hundred and twelve words from Ortony and Clore's lexicon of affective descriptors were ordered randomly by sorting on middle letters. The words were printed eight to a page, generating a 14-page questionnaire. Each stimulus consisted of a framed emotion modifier—e.g., "being afraid feels"—followed by the following scales: GOOD, NICE versus BAD, AWFUL; BIG, POWERFUL versus LITTLE, POWERLESS; FAST, LIVELY, YOUNG versus SLOW, QUIET, OLD. Nine checking positions were provided on each scale row, labeled with the adverbs "infinitely," "extremely," "quite," and "slightly," with "neutral" at the middle. These three scales, based on cross-cultural work of Osgood, May, and Miron (1975), have been used by raters from various English-speaking populations to rate thousands of nouns, verbs, and adjectives; the properties of the scales have been studied extensively (Heise 1978, 1979; MacKinnon 1985; Smith-Lovin and Heise in press).

We created four different forms to balance order of presentation and to vary scale orientation systematically. Forms A and B began with "being mad feels" at the top of the first page; the pages in Forms C and D were in reverse order, with "being mad feels" at the top of the last page. Scales on odd-numbered pages of Forms A and C and on even-numbered pages of Forms B and D were arranged as follows where E, P, and A stand for the Evaluation, Potency, and Activity scales shown above and e, p, and a stand for the same scales with orientation reversed (e.g., GOOD, NICE on the right rather than on the left): pae, pEa, eaP, aEP, pAe, pEA, eAP, AEP. On the remaining pages these blocks were in reverse order: AEP for the top stimulus, eAP for the second stimulus, and so on.

Instructions for making ratings were presented orally and were printed on a page preceding the rating pages. We told subjects to skip words of which they had never heard and advised them that it was better to make no ratings than to make nonsense ratings. The initial page also asked them to check their gender, an age category, and whether they were from in state or elsewhere.

Participation in the survey was a required part of a sociology course and at the same time voluntary and anonymous. We achieved anonymity by asking the students to sign the face sheet on the questionnaire to obtain credit and then to return the face sheets and the questionnaires separately.

Subjects

We obtained usable questionnaires from 75 (of a total of 79) respondents: 55 percent female, 68 percent aged 21 or more, and 63 percent.

Eight respondents quit when the time was up and did not complete the last few pages of the questionnaire. The impact of the missing data is mollified, however, by the fact that pages were in reverse order for one-half of the questionnaires.

Preliminary Analyses

A number of emotion terms (e.g., *incensed, livid, despondent)* were not familiar to 13 or more raters. We dropped these along with the participles (e.g., *pining, yearning)* to obtain a final set of 99 emotion adjectives which had been rated by at least 28 males and at least 36 females.

Correlations of ratings by 78 respondents across all stimuli were Q-factored to determine whether respondents displayed systematic differences in the meaning of emotion terms. Ratings were coded on an assumed-interval metric for this analysis, and missing data were handled by pairwise deletions. A single component accounted for 42 percent of the total variance, while remaining components accounted for less

than three percent. Thus the general pattern of responses was similar across respondents. The Q-factoring, however, revealed that three respondents had low commonality with others; we dropped these three respondents in order to improve data quality, thereby reaching the final sample size of 75 respondents.

We conducted global chi-square tests for effects of stimulus ordering and scale orientation, as represented in the four different questionnaire forms. Neither of these factors contributed significantly to the distributions of responses. The conclusion that order of stimuli and scale orientation have no discernible effect on distributions of responses does not mean that precautions were unnecessary. Indeed, the four different forms in this study were mandated after a prior study without these precautions yielded uninterpretable data. Varying scale orientation prevents the development of response sets; varying order of stimuli is important if only to distribute the consequences of uncompleted questionnaires.

Results

Table I gives the median ratings of 99 emotions by males and females on Evaluation (E), Potency (P), and Activity (A).

Males and females differ in their ratings in a few cases. *Overwhelmed* is rated notably less good and more impotent by males than by females. Females rate *in-love* as livelier than do males, and females rate *bitter* as less potent. The range of female ratings is somewhat greater than the range of male ratings on all three scales (E: -3,5, 3.8 for females versus -3.1, 3.3 for males; P: -3.5, 3.4 versus -3.1, 3,0: A: -3.0, 3.4 versus -2.2, 3.0). Yet male and female ratings correlate highly—E: 0.99, P: 0.96, A: 0.96—and the general structure of the ratings is so similar that a single figure based on medians for the pooled data from both sexes shows the patterns for both genders.

Figure 1 shows the projection of emotions onto an Evaluation-Activity plane. Each emotion is represented on the scatterplot by the first letter of the emotion word (numbers indicate stacking at the same place). Potency is represented roughly by capital letters for emotions with ratings above zero on potency.

Figure 1 should reveal a circumplex formation according to past research. One departure from circularity—the oblong shape—could be artifactual: despite precautions for dealing with response biases, desirability still may have affected ratings and caused a positive correlation between Evaluation and Activity (see Fisher, Heise, Bohrnstedt, and Lucke 1985). Aside from this finding, however, a circumplex formation is absent in three ways.

First, a gap sweeps through the center of the diagram so that the formation has little appearance of a closed form of any kind. Only two emotions, *melancholy* and *anxious,* are positioned near the edges of the blank areas. Two other emotions, *overwhelmed* and *awe-struck,* nudge into the blank area, but they are near the middle of the diagram and detract from a circular appearance. The other 95 emotions fall on either side of a nearly vacant swath. The pattern indicates that emotions are defined for every gradation of activation, but practically no emotion terms are available for describing a hedonistically neutral affective state.

Second, hedonistic value and activation lack the functional relation with each other required by a circumplex model. A circumplex model requires that extremely high or extremely low activation is associated with middling evaluation, and that middling activation is associated with extremely high or extremely low evaluation. Our findings showed many exceptions, however, *Empty* and *depressed,* for example, are extremely unactivated and extremely bad feelings; *furious* and *outraged* are activated states in which one feels quite bad; *calm* and *at-ease* are good quiet feelings; *in-love* and *ecstatic* are good states of high activation.

Third, a circumplex model requires that all elements fall in a circle, with no meaningful variation around the line of the circle. Lack of any arc paralleling the Evaluation axis prevents testing the possibility of meaningful spread in activation. Feelings at the same level of activation, however, range somewhat in evaluation, even within bad feelings or within good feelings.

In addition, a circumplex model implies that all data can be represented in two dimensions, which means that the third measure of Potency should be irrelevant or redundant. Table 1 shows that Potency is not irrelevant in emotions: Potency ratings show significant variations.

The question of redundancy was addressed in two ways. First, Euclidian distances among all emotions in the three-dimensional EPA space were scaled nonmetrically in two dimensions. This step resulted in a statistically satisfactory solution (stress less than .03 for both males and females). The overall shape of the distribution is not changed in the nonmetric solution: it is like that in Figure 1. Fear terms like *petrified* and *terrified,* however, moved to middling activation and projected to the farthest extremes of badness, a formation that detracts from circumplexity.

We implemented a second analysis of the redundancy issue by regressing Potency ratings of emotions on the Evaluation and Activity ratings. The Potency ratings could be predicted well but not perfectly (R^2 of .85 for males and

Table 1. Median Evaluation, Potency, and Activity Ratings for 99 Emotion Labels

	Males			Females		
	E	P	A	E	P	A
afraid	-2.17	-2.17	-0.50	-2.79	-2.86	0.25
aggravated	-1.77	0.50	1.13	-2.04	-0.86	1.23
agitated	-1.67	-0.83	1.00	-2.27	-1.50	0.83
amused	2.36	1.08	1.81	2.72	1.58	2.31
angry	-1.44	1.43	1.75	-2.45	1.25	1.81
anguished	-1.85	-2.00	-1.33	-2.73	-2.32	-1.83
annoyed	-1.87	-0.22	0.31	-2.35	-1.31	1.00
anxious	0.44	0.56	2.36	-0.50	-0.61	1.95
apprehensive	-1.09	-1.00	0.11	-1.61	-1.56	-0.42
ashamed	-2.61	-2.80	-1.00	-3.19	-2.93	-1.50
at-ease	1.95	0.85	-0.18	2.70	1.88	-0.39
awe-struck	1.07	-0.75	0.75	1.33	0.42	1.22
bitter	-2.17	-0.21	-0.12	-3.00	-1.75	-0.43
blue	-1.92	-1.63	-1.67	-2.63	-2.19	-2.50
broken-hearted	-3.00	-2.77	-1.93	-3.47	-3.38	-2.56
calm	1.83	0.50	-0.60	2.80	1.45	-1.00
charmed	2.09	1.45	1.43	3.00	2.38	1.92
cheered	2.62	2.00	2.00	2.73	2.23	2.03
cheerless	-2.00	-1.56	-1.00	-2.45	-1.79	-1.47
contented	2.32	1.00	0.00	2.97	1.59	0.61
crushed	-3.00	-3.00	-2.10	-3.29	-3.15	-2.50
deflated	-1.88	-1.83	-1.40	-2.53	-2.77	-2.35
dejected	-2.03	-1.93	-1.13	-2.93	-2.92	-1.89
delighted	2.38	1.71	1.90	3.05	2.28	2.15
depressed	-2.92	-2.42	-2.17	-3.35	-3.08	-3.00
disappointed	-1.91	-1.58	-1.23	-2.35	-2.33	-1.80
discontented	-1.50	-1.25	-0.72	-1.86	-1.78	-0.42
disgusted	-2.03	-0.50	-0.07	-2.46	-0.44	0.22
displeased	-1.40	-0.73	-0.29	-1.64	-1.07	-0.31
dissatisfied	-1.87	-1.11	-0.57	-2.21	-1.75	-1.05
distressed	-2.33	-2.13	-1.69	-2.82	-2.68	-2.14
downhearted	-2.03	-1.45	-1.45	-2.43	-2.25	-1.92
ecstatic	3.03	2.68	3.04	3.44	3.03	3.24
elated	2.46	2.00	2.29	3.23	2.88	2.73
embarrassed	-2.25	-2.75	-0.50	-2.30	-2.50	-0.07
empty	-2.82	-2.62	-2.08	-3.24	-3.13	-3.00
envious	-1.91	-1.96	0.00	-2.54	-2.36	0.29
excited	2.33	1.95	2.67	3.14	2.81	3.08
fearful	- 1.27	-1.75	-0.44	-2.45	-2.64	-1.00
fed-up	-1.91	-0.50	0.83	-2.15	-1.83	1.39
flustered	-1.78	-1.71	-0.06	-1.70	-1.83	1.04
frightened	-2.22	-2.23	0.67	-2.92	-2.86	0.57
frustrated	-2.00	-1.95	-0.30	-2.62	-2.71	0.30
furious	-2.17	1.83	2.59	-2.81	1.38	2.46
glad	2.38	1.56	1. 75	2.85	2.50	2.12
grief-stricken	-3.06	-2.28	-1.75	-3.26	-3.12	-2.50
happy	3.03	2.19	2.50	3.31	2.86	3.08
heart-broken	-2.89	-2.85	-1.78	-3.47	-3.09	-2.64
heavy-hearted	-1.73	-1.00	-0.45	-2.64	-2.05	-1.88
homesick	-2.08	-2.11	-1.54	-2.73	-2.65	-2.05
horrified	-2.65	-2.50	0.28	-2.92	-2.14	-0.13
hurt	-2.75	-2.27	-1.29	-3.31	-3.07	-2.50
ill-at-ease	-2.07	-1.79	-1.07	-2.42	-2.20	-0.75
impatient	-1.54	-0.89	1.33	-1.78	-1.04	1.50
in love	3.32	2.90	1.67	3.81	3.35	3.37
irate	-1.79	1.13	1.93	-2.17	0.75	2.12
irked	-1.47	-0.65	0.85	-1.86	-0.71	0.97
irritated	-1.95	-0.95	0.75	-2.42	-0.91	1.39
jealous	-2.13	-1.65	0.27	-2.96	-2.55	0.25
joyful	2.78	1.95	2.35	3.09	2.43	2.50
joyless	-2.28	-1.83	-1.32	-2.77	-2.61	2.25
lonely	-3.00	-2.78	-2.33	-3.13	-3.08	-2.97

Table 1 *Continued*

	Males			Females		
	E	P	A	E	P	A
lonesome	-2.36	-2.64	-2.00	-3.15	-2.96	-2.63
lovesick	-1.69	-1.05	0.40	-l.58	-1.96	0.63
low	-2.10	-1.43	-1.28	-2.61	-2.69	-2.25
mad	-2.05	1.20	1.56	-2.66	0.70	1.75
melancholy	0.10	-0.25	-1.17	-0.69	-0.55	-1.56
miserable	-2.95	-2.61	-1.91	-3.25	-3.07	-2.36
mortified	-2.58	-2.21	-0.50	-3.21	-2.55	-1.86
moved	2.06	0.92	0.23	1.88	0.92	0.14
nervous	-1.32	-1.17	0.72	-1.95	-2.04	1.08
outraged	-2.56	1.75	2.15	-2.60	1.04	2.18
overjoyed	2.88	2.61	2.58	3.37	3.08	3.07
overwhelmed	-0.60	-1.43	0.88	1.00	0.00	1.58
passionate	2.80	2.17	2.07	3.33	2.75	2.92
petrified	-2.97	-3.07	0.00	-3.52	-3.47	1.22
pleased	2.83	2.25	1.50	3.00	2.54	1.91
proud	3.19	3.04	2.69	3.40	3.29	2.63
regretful	-1.31	-1.33	-0.80	-2.31	-2.18	-1.69
relieved	2.30	1.08	0.80	2.78	1.39	0.29
remorseful	-1.75	-1.56	-1.31	-2.08	-2.14	-1.75
resentful	-I 83	-0.88	0.50	- 2.33	-0.94	0.50
sad	-2.38	-1.94	-2.14	-3.06	-2.63	-2.78
satisfied	2.19	1.90	0.88	2.97	2.32	1.94
scared	-2.04	-1.79	0.64	-2.64	-2.84	0.13
self-pitying	-2.28	-2.20	-1.50	-3.10	-3.28	-1.95
shaken	-1.91	-1.85	-0.44	-2.22	-2.42	-0.88
shook-up	-1.75	-1.54	0.06	- 2.25	-2.44	0.40
sick-at-heart	-2.00	-1.93	-1.75	-2.79	-2.50	-2.00
sickened	-2.20	-2.00	-1.58	-2.82	-2.35	-2.00
sorrowful	-1.83	-1.33	-1.70	-2.73	-2.45	-2.35
sorry	-1.33	-1.44	-1.73	-2.10	-1.88	-1.86
terrified	-2.79	-3.04	0.00	-3.23	-3.40	1.19
thrilled	2.69	2.13	2.40	3.31	2.47	2.89
tormented	-2.40	-2.00	1.00	-3.30	-3.23	1.08
touched	2.18	1.60	0.44	2.46	1.04	0.19
uneasy	-1.36	-1.32	-0.28	-2.03	-2.17	-0.64
unhappy	-2.37	-2.00	-1.71	-2.94	-2.63	-2.10
upset	-2.09	-1.20	0.10	-2.69	-2.18	-1.06

.89 for females). Examination of residuals indicated that poor predictions were concentrated among anger emotions. A dummy variable coded 1.0 for *aggravated, angry, furious, irate, mad,* and *outraged,* and 0.0 otherwise, was added to the regressions, and this addition increased R^2 by .08 for males and .06 for females. Thus the potency ratings are redundant except in dealing with anger.

The multiple-regression equations are of interest:

$$P = -0.24 + 0.66\,E + 0.24\,A + 2.39\,D \text{ (males)}$$
$$P = -0.24 + 0.75\,E + 0.15\,A + 2.51\,D \text{ (females)}$$

where D is the dummy variable. The equations show that the ratings of potency correspond mostly to the evaluation of the feeling: good emotions are rated potent and bad emotions are rated impotent. Activity also is involved: active emotions receive slightly higher ratings of potency. Various forms of anger, however, receive much higher ratings of potency than one would expect from these general rules.

The meaning of these results, which can be confirmed by examination of Table 1 and Figure l, is that Potency is largely redundant in the ratings of emotional feelings except for differences between fear and anger. In the contrast between flight and fight, Potency is the distinguishing factor. Thus, even though the statistical contribution of a third dimension is small, the substantive contribution is major.

STUDY 2

Questionnaire

We chose 30 words in order to represent each area of the structure of emotion words found in Study 1. Selections were based on several criteria. Cluster analysis, using complete linkage, was applied to the Euclidian distances of

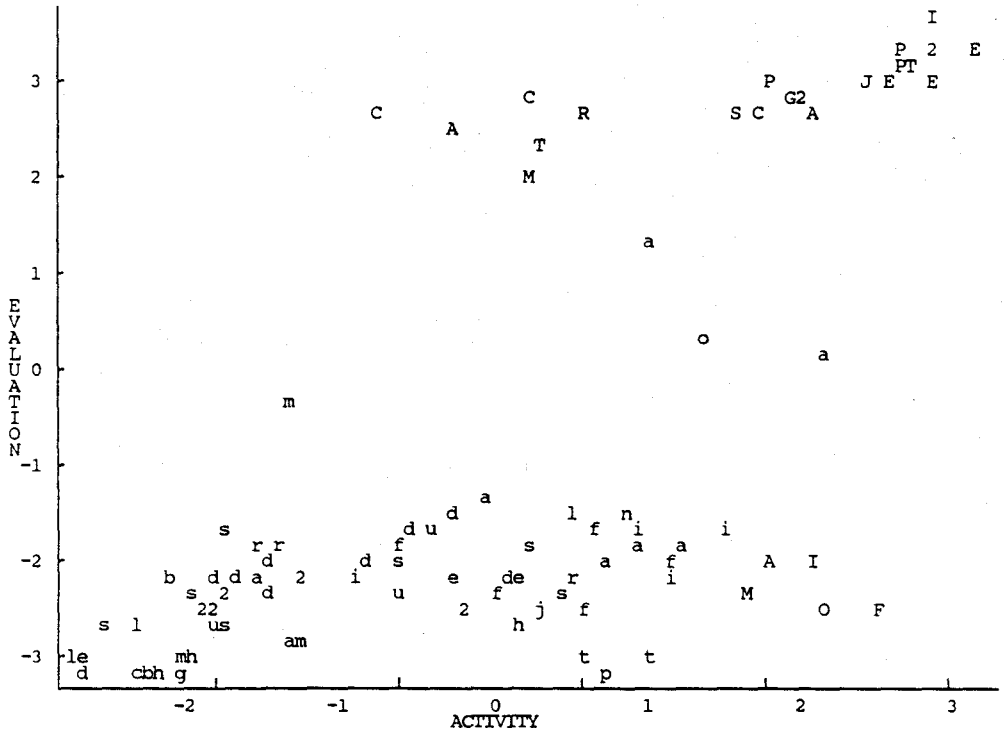

Figure 1. Distribution of emotion words with respect to median ratings on Evaluation and Activity for males and females combined. Position indicated by first letter of emotion word (numbers show stacking). Capital letters indicate emotions with Potency greater than zero.

the semantic differential data from Study 1. For both the male and the female data we identified 12 nonoverlapping clusters of emotion words with a reasonably high degree of agreement across gender in the composition of the clusters. We selected at least one item from each of the clusters (including single-item clusters), and two or more words from all but one of the multi-item clusters. Emotion words with low variance with the semantic differential ratings received a higher priority to improve stability of results (Zinnes and MacKay 1983), and words that had been used consistently in previous studies (e.g., Russell 1980) were preferred to allow for comparisons. The selection process resulted in over-representation of the "swath" words, located in the gap in Figure 1. We made these choices intentionally to gain more information concerning those words.

Next we paired the 30 selected words, forming 435 comparisons to be used for dissimilarity ratings. Because of the large number of pairs we constructed 10 distinct forms, each with 45 pairs of items. Words that represented extremes in pleasantness, activation, and potency, according to Study 1, appeared in the first three comparisons to allow for anchor points (Spector and Rivizzigno 1982). The calm-melancholy pair appeared in all forms as the last pair. Finally we reversed the order of items in all pairs, thereby creating another counterbalanced set of 10 forms for a total of 20 forms.

The emotions in each pair were rated as to their dissimilarity on a nine-point scale; zero indicated that the words were "not at all different" and eight indicated that the words were "totally different." Each pair of words was followed by a rating scale on the same line, and all were preceded by the sentences: "How different are the emotions below? Rate each pair." Subjects were instructed to skip pairs that contained an unfamiliar word.

Subjects

Three hundred ninety-four students from two introductory psychology classes and 80 students from a sociology class completed the questionnaires. All the students received extra credit for participation.

Preliminary Analyses

Ninety-nine percent of the pairs were rated by all subjects. Fourteen percent of the subjects did

not complete at least one item: the pairs most likely to be unrated included the words *irked, melancholy, awe-struck,* and *distressed.*

Median rather than mean dissimilarity values served as point estimators because preliminary observations of the data indicated skewing in the distributions of the interpoint distances. In comparing solutions that used both mean and median estimators, the multidimensional structure of the median data set was more consistent across subsets of the entire dataset. The mean and the median estimators, however, produced nearly identical structures.

We computed medians by pooling data from both orders of presentation—e.g., *happy-sad* and *sad-happy*—and we checked consistency by comparing estimates obtained separately from each order. The mean difference between the two estimates across all pairs was 0.63. *Happy, glad, at ease,* and *contented* had mean differences of 0.40 or less across all their pairings; *disappointed, furious,* and *depressed* had mean differences of 0.80 or above over all their pairings. Though the most pleasant emotions were judged more reliably than other emotions, the reliability of judgments involving other words was not much less.

Results

We used smallest-space analysis (Guttman 1968) to uncover the multidimensional structure of the direct dissimilarity-ratings data. Table 2 shows stress values of solutions using one to four dimensions for male subjects, female subjects, sexes combined, and sexes combined with the four swath words removed. The results indicate clearly that the addition of the third dimension improves the fit of the data across all the data sets, while the addition of a fourth dimension does not improve fit appreciably. Table 3 gives the coordinates for the three-dimensional solution with males and females combined.

The stability of the three-dimensional solution across the various solutions is very good. For the first dimension the correlation between male and female solutions is .99. the second-dimension correlation is .97, and the third-dimension correlation is .94. When the four swath words are removed, the structure of the solution is very similar to that of the full 30-word solution. The three-dimensional solution also was obtained for each of the three separate college classes that contributed data. Here, too, the stability of the structure is quite good; correlations between similar dimensions across classes range from .89 to .99, with a median correlation of .96. The consistency across all the independent solutions indicates that three dimensions are required to represent similarities among these 30 rigorously selected emotion words, and that the configuration of words in the three-dimensional space is reliable.

Table 2. Stress Values in Multidimensional Scaling by Dimensionality and Data Set

Number of Dimensions	Males	Females	All Data	Swath Out
1	.32	.32	.31	.29
2	.17	.17	.17	.17
3	.12	.11	.10	.10
4	.09	.09	.08	.08

Note: "Swath out" refers to solutions obtained without the terms *anxious, awestruck, melancholy,* and *over-whelmed.*

Table 3 Multidimensional Scaling Coordinates of 30 Emotion Words in Three Dimensions

	Dimension		
	1	2	3
afraid	-.36	-.89	-.19
angry	- 78	.30	.42
annoyed	-.72	.46	.22
anxious	.10	-.38	.88
at-ease	1.20	.46	-.44
awestruck	.47	-.55	.21
calm	.98	.50	- .67
contented	1.29	.31	- .23
depressed	- .48	.11	-.75
disappointed	- 42	.51	- .49
disgusted	- 62	.71	.17
displeased	-.67	.49	-.17
distressed	-.62	-.22	-.19
excited	.63	- 32	.79
frustrated	-.78	.20	.07
furious	-.75	.28	62
glad	1.31	- .05	.27
happy	1.30	.03	.38
irked	-.61	.45	.29
mad	-.73	.33	.39
melancholy	.60	35	-.76
miserable	-.67	.04	-.60
moved	.62	.07	.32
overwhelmed	.41	-.53	.39
petrified	- 39	-1.04	-.09
pleased	1.34	.05	.05
sad	- .26	.17	-.77
scared	-.29	-.91	-.01
terrified	- .46	- .95	-.07
upset	-.65	.02	-.03

Figures 2 and 3 show the three-dimensional structure obtained from pooled data for males and females in all three classes. Dimension 1 appears to be an evaluative dimension, with positive emotions such as *glad, pleased,* and *happy* at one end of the scale and negative emotions such as *angry, frustrated,* and *furious* at the opposite end. Dimension 3 appears to represent activity, with active emotions such as *excited, furious,* and *anxious* at one end of the scale and passive emotions such as *sad, melancholy,* and *depressed* at the other end. As

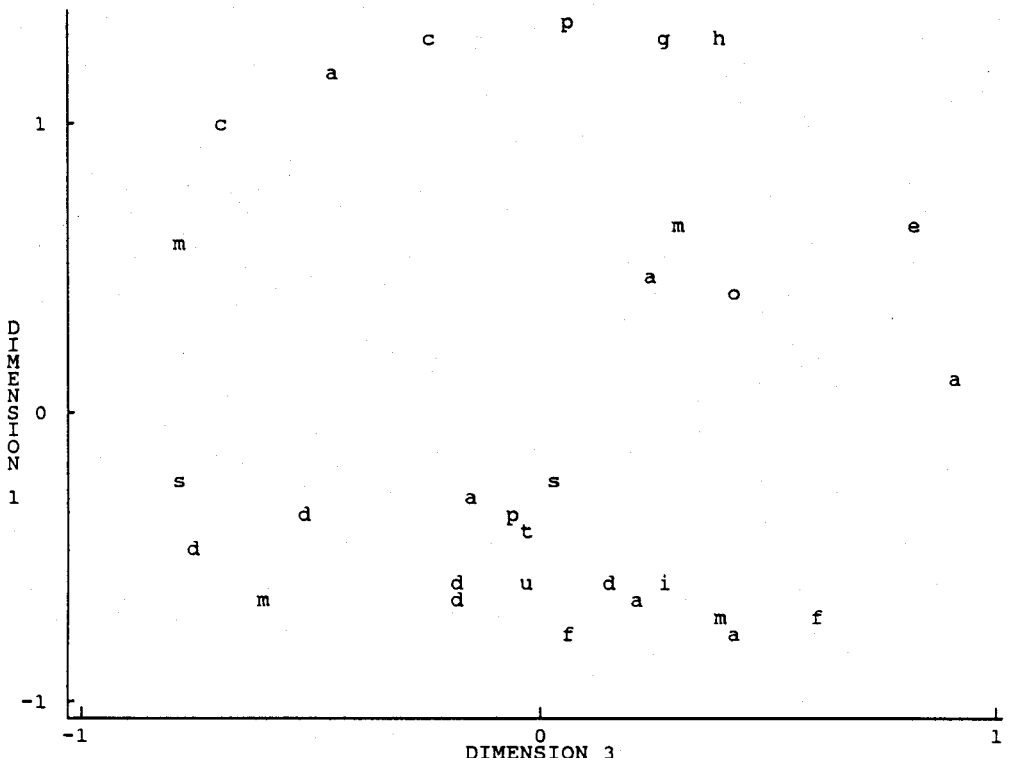

Figure 2. Results of multidimensional scaling—Dimension 1 ("evaluation") Dimension 3 ("activity"'). Plotted by first letters: afraid, angry, annoyed, anxious, at-ease, awe-struck, contented, depressed, disappointed, disgusted, displeased, distressed, excited, frustrated, furious, glad, happy, irked, mad, melancholy, miserable, moved, petrified, pleased, sad, scared, terrified, upset.

Figure 3 shows, most of the variation in Dimension 2 exists among unpleasant emotions; the main contrast lies between a cluster of fear words at the extreme left and words for anger and annoyance on the right, suggesting that this dimension has a potency interpretation.

The interpretability of the scaling dimensions in terms of evaluation, activity, and potency suggests that the coordinates of the scaling solution must correspond somewhat with the semantic differential ratings from Study 1. This possibility is substantiated: Dimension 1 coordinates correlate .94 with the semantic differential ratings for evaluation; Dimension 2 correlates .40 with ratings of potency; and Dimension 3 correlates .89 with ratings of activity. The scaling coordinates, however—on a rotation of principal axes—do not necessarily have optimal alignment with the EPA dimensions of Study 1. When scale coordinates and EPA ratings for the 30 words are combined into a canonical analysis, we see how high the correspondence can rise through simple rotation of axes. Three canonical components are significant, and the correlations between the scaling and the rating variates on the three orthogonal dimensions are .98, .91, and .76.

We conducted another canonical analysis in which we compared scaling coordinates with EPA ratings along with the squares and second-order products of EPA ratings; this analysis resulted in a three-dimensional solution with canonical correlations of .99, .94, and .91. Polynomial regression equations with only the most significant second-order terms convert ratings to values that correlate with the scaling coordinates .97 on Dimension 1 (evaluation), .84 on Dimension 2 (potency), and .94 on Dimension 3 (activation). When ratings for all words in Study 1 were transformed by these regression equations and when the results were plotted, the structure still was bimodal and noncircular in the evaluation-activation plane, but the oblong shape of Figure 1 was eliminated and values on the third potency dimension were spread out for negative emotions in a manner similar to the results from Study 2.

A circumplex model is not sufficient for defining the scaling structure in this sample of emotion terms. First, two dimensions, as necessitated by a circumplex model, are not

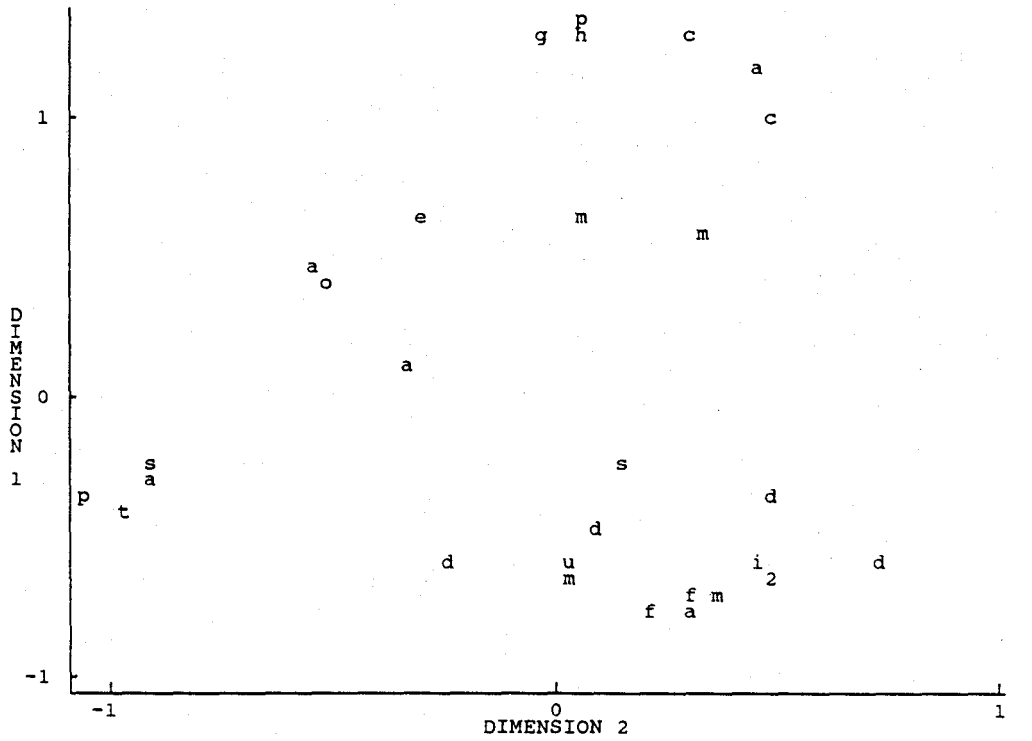

Figure 3. Results of multidimensional scaling—Dimension 1 ("evaluation") Dimension 2 ("potency"). Plotted by first letters: afraid, angry, annoyed, anxious, at-ease, awe-struck, contented, depressed, disappointed, disgusted, displeased, distressed, excited, frustrated, furious, glad, happy, irked, mad, melancholy, miserable, moved, petrified, pleased, sad, scared, terrified, upset.

sufficient for the best representation of the data. Second, Figure 2 reveals that sizable gaps exist in the middle of the evaluation dimension. Because the overrepresented "swath" words do not fill the spaces, these gaps may be areas where no words exist in the entire emotion lexicon. Third, the terms *awe-struck, moved,* and *overwhelmed* are projected into the middle of the traditional two-dimensional representation. These three terms are removed significantly from a circumplex arc.

At the same time, most of the positive emotions lie along an arc in Figure 2, and evaluations of emotions decline at the extremes of activation—calm and *melancholy* on the passive side and *excited* and *anxious* on the activated side—as required in a circumplex model. Negative emotions lie outside an arc, but their spread can be reduced by hand rotating the axes away from the principal-axes definitions while leaving the configuration of positive emotions largely intact. Moreover, the circular outline in Figure 2 is intrinsic in the dissimilarity ratings; it does not result only from nonmetric analysis of dissimilarity rankings. Scaling the data in three dimensions by using a linear function of distances onto dissimilarities yields a stress of .10. comparable to the stresses shown in Table 2 for solutions obtained with a monotonic function. The solution obtained with linear scaling looks essentially the same as Figures 2 and 3.

DISCUSSION

The emotion words chosen for Study 2 represent distributions discovered in Study 1. No logical consideration guarantees that scaling dissimilarities will yield the same patterns as are found through semantic differential ratings, unless the scales used to rate the emotions in Study 1 are meaningful in the emotion domain. The correspondence of dimensions obtained in the two studies demonstrates that emotion terms array themselves naturally in a three-dimensional space involving evaluation, activation, and a sense of potency. As noted in the introduction, other recent research also has reached this conclusion (e.g., Mehrabian 1980; Shaver, Schwartz, Kirson, and O'Connor 1987).

The scaling procedure in Study 2 is less presumptive than the rating procedure in Study 1; thus where discrepancies exist between the results,

Study 2 probably presents the truer picture of the overall structure of emotions. Our canonical and regression analyses incorporating squares and cross-products indicate that the semantic differential ratings can be transformed nonlinearly to a structure very similar to that produced by nonmetric scaling.

Differentiation of Emotions

Positive emotions are relatively simple in structure, differentiated by level of activation and by little else. Negative emotions are differentiated both by activation and by potency. Potency is crucial in the contrast between fear and anger—the emotions of flight and fight. The results of Study 2, however, as well as the data from Study 1 after conversion with the nonlinear transformation formulas, suggest that potency is involved more generally in differentiation of negative emotions (see Table 4). Unpleasant feelings with high activation yields anger when potency is high; less potency yields feelings of being flustered or nervous; impotency yields fear. At medium activation levels, potency is associated with feelings of disgust and bitterness; jealousy and envy develop with less potency; impotency yields shame and embarrassment. At low activation, higher levels of potency correspond to disappointment and regret: low levels of potency correspond to broken-hearted misery; unhappiness, sadness, and depression are arrayed between these extremes,

Emotion Voids

Positive emotions show little differentiation in terms of potency; all involve a sense of powerfulness. This result is not attributable to the characteristics of the particular methods used. This finding appears in both Study 1 and Study 2, and in another scaling study involving yet another method of data collection (Shaver, Schwartz, Kirson, and O.Connor 1987). Mehrabian (1980, p. 48) reported finding states of pleasure combined with submissiveness, but he included many nonemotions in his study (e.g., *lucky., protected, nauseated).* When restricted to the 35 words which are pure emotion labels, his semantic differential data graph in a manner quite similar to Figure 1; words referring to pleasurable submissiveness are absent.

The figures also show that few words are available for describing hedonically neutral emotions. Figure 2 shows a few such words: *calm, melancholy, excited, anxious.* Three additional *terms—overwhelmed, awe-struck, moved*—are judged as relatively neutral on both evaluation and activation, so different from the general patterns that they may not signify emotions at all. (Subjects might have rated these

Table 4. Distribution of Negative Emotions on Potency and Activity. Based on Conversion of Study 1 Data to Study 2 Coordinates

	Low Activation	Medium Activation	High Activation
High Potency	disappointed, sorrowful, regretful, downhearted, remorseful, blue, sorry	upset, discontented, cheerless, heavy-hearted, apprehensive, dissatisfied, resentful, displeased, bitter, disgusted	furious, fed-up, impatient, angry, agitated, outraged, irritated, irate, annoyed, irked, mad, aggravated
Medium Potency	distressed, deflated, homesick, joyless, sick-at-heart, unhappy, sickened, anguished, sad, low	envious, jealous, mortified, shaken, fearful, shook-up, ill-at-ease, lovesick, uneasy	flustered, nervous
Low Potency	broken-hearted, crushed, heart-broken, miserable, lonely, grief-stricken, self-pitying, empty, hurt, lonesome, depressed, dejected	scared, ashamed, embarrassed, afraid, frustrated, horrified	petrified, terrified, tormented, frightened

as cognitive states or even as descriptions of external conditions.) The sparsity of verbal labels for affective experiences that are neither pleasant nor unpleasant does not arise from selective sampling of stimuli. Our choice of emotion words is based on Clore, Ortony, and Foss's (1986) discriminant analyses of judgments by lay subjects, and the sample of words in Study 1 includes the vast majority of pure emotion adjectives available in English. Thus our results demonstrate empirically that most pure emotion words are hedonically nonneutral.

How are the voids to be interpreted? We do not believe that they mean that certain kinds of affective experience are impossible or indescribable. Rather, the voids result from common understandings of what "emotion" means. Unpleasant feelings and any sense of potent pleasure are understood readily as purely affective experiences; these are "emotions." Affective experience that is hedonically neutral, however, seems to require explanation, often in terms of bodily attributions, as in feeling "tired" or "horny." Pleasant feelings of impotence similarly require auxiliary accounting, often by implicating the environment, as in feeling "reverent" or "loved." Clore, Ortony, and Foss (1987) identified many words that have affective connotations mixed with behavioral or cognitive connotations; these are the words we must use to designate feelings outside the range of pure emotions, taking care that the behavioral and cognitive connotations fit the circumstances.

Russell's (1983) cross-linguistic studies of emotion circumplexes suggest that the structure of emotion terminology is the same in different languages. The issue of the voids, however, is not addressed directly in Russell's work, and new cross-cultural studies are essential to determine whether constraint of the emotion construct to certain kinds of affective experience is a sociocultural phenomenon or a universal psychological propensity.

The Circumplex Model

This study dealt with a broad range of pure emotion labels, and data generated from this rigorously screened corpus of stimuli lead to a view of subjective emotion that differs somewhat from the two-dimensional circumplex model which has been developing in the social psychological literature.

As required for a circumplex, emotion words differentiate nuances of feeling over the entire range of activation; in Study 2 it was found that extremes of activation are associated with limited pleasantness. Very few emotion terms, however, identify evaluatively neutral states, so the configuration of emotion terms is broken at the middle and consists at best of two arcs rather than a closed circle. Moreover, a clear third dimension arises with adequate representation of fear and anger terms. The third potency dimension adds nothing to the representation of positive emotions beyond what is provided through evaluation and activation distinctions; negative emotions, however, are differentiated by the degree of potency one feels as well as by hedonistic tone and activation.

Useful and interesting as the circumplex framework has been, further endorsement of this framework could have untoward consequences for emotion research. The circumplex framework encourages us to believe that people identify affectively neutral states as "emotions," though very few evaluatively neutral words are judged to be emotions. Moreover, the circumplex framework provides an inadequate basis for differentiating the abundance of negative feelings. Most alarming, the circumplex model provides a poor differentiation between anger and fear, offering no framework that accounts for the difference between the emotions of fight and flight. A three-dimensional model provides this differentiation and offers an immediate and sensible explanation of the difference: the emergence of fury as opposed to terror depends on one's sense of potency or dominance.

Dimensions and Emotional Processes

In their study of emotion knowledge, Shaver, Schwartz, Kirson, and O'Connor (1987) identified a dimensional structure in their data but essentially disregarded it, claiming that "the three abstract dimensions of emotion are emergent properties of emotion prototypes, not active elements in everyday processing of emotional information" (p. 1080). We contend the exact opposites: that the affective dimensions correspond to basic mental processes, as Mehrabian (1980) and others have argued, and that much of people's cognitive information concerning emotions is generated within the dimensional framework.

According to affect control theory (Heise 1979; Smith-Lovin and Heise 1988), people behave so as to confirm the sentiments associated with their situational identities: the customary levels of goodness, power, and activation for their roles. Emotions signal subjectively and interpersonally who people are and how well they are maintained by social interaction.

This theory achieves its power through a generative model that combines mathematical equations with dimensional data on identities, behaviors, and person modifiers. The mathematical representation of affective dynamics employs empirical impression-formation equations and other equations derived from these by applying the theory's cybernetic axioms. Data

bases are constructed from semantic differential ratings; (corpora currently are available representing middle-class cultures in the United States and in Canada and working-class culture in Belfast). Computer analyses are conducted as simulations of social interaction; they are so straightforward that the program is used for undergraduate assignments at several universities.

The generative approach of affect control theory to social knowledge corrects the worst flaw of prototype or scripting approaches: their crystallized and constrained capabilities allow nothing more to be taken out than was put in. As Shaver, Schwartz, Kirson, and O'Connor (1987, p. 1082) themselves note, "If we were to code every specific source of joy, sadness, anger, fear, and love in its own terms, we would have a nearly infinitive list of all life's experiences." Therefore the prototype approach to antecedents is limited to abstractions because "such a list would be impossible to compile." In contrast, the mathematical model of affect control theory has infinite domain, and concrete analyses of emotion can be conducted for any role relationship that is represented in the model's data base. Analyses may focus not only on how different circumstances produce different emotions in a relationship but also on how emotions associate with subsequent behaviors and with reidentifications of participants.

The affective dimensions and the psychological processes associated with those dimensions provide an extremely efficient way for people to assimilate knowledge about social life. After learning basic social categories, distributional constraints on categories, and sentiments associated with each category, people can generate automatically a wide range of social expectations. Only the core of social knowledge is learned piecemeal; the rest is assembled as needed in various circumstances. Thus the affective dimensions are central in the social psychological sense.

Affect control theory also provides us with a response to arguments about how the dimensions should be defined. We favor three dimensions of affective response not only because of the empirical evidence presented in this and other works (e.g., Osgood, May, and Miron 1975), but also because it is demonstrable that three dimensions are required to produce adequate simulations of social interaction. Although it is true that the three dimensions could be rotated to other orientations, we favor the EPA structure because impression-formation equations for these dimensions are known to be distinctive; each dimension serves as the basis for a different kind of psychological processing.

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