

Concept of Emotion Viewed From a Prototype Perspective

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SUMMARY

Many have sought but no one has found a commonly acceptable definition for the concept of emotion. Repeated failure raises the question whether a definition is possible, at least a definition in the classical sense of individually necessary and jointly sufficient attributes. A series of seven studies explored an alternative possibility that the concept of emotion is better understood from a prototype perspective than from a classical perspective. Specifically it is argued that membership in the concept of emotion is a matter of degree rather than all-or-none (that the concept has an internal structure) and that no sharp boundary separates members from nonmembers (that the concept has fuzzy boundaries).

As hypothesized, the concept of emotion has an internal structure: happiness, love, anger, fear, awe, respect, envy, and other types of emotion can be reliably ordered from better to poorer examples of emotion. In turn, an emotion's goodness of example (prototypicality) ranking was found to predict how readily it comes to mind when one is asked to list emotions, how likely it is to be labeled as an emotion when one is asked what sort of thing it is, how readily it can be substituted for the word *emotion* in sentences without their sounding unnatural, and the degree to which it resembles other emotion categories in terms of shared features.

In response to an argument made by Armstrong, Gleitman and Gleitman (1983), the evidence for internal structure is acknowledged not to imply fuzzy boundaries. Thus, it was further shown that the concept of emotion, and several other of Rosch's prototypically organized concepts, lacks sharp boundaries and thus can be empirically distinguished from classically defined concepts: Peripheral members of classical concepts but not of fuzzy concepts are nonetheless unequivocal members of the concept.

Finally, implications of a prototype view for the psychology of emotion are discussed. Issues raised include extension of the prototype analysis to anger, fear, and other types of emotion; scientific versus everyday folk concepts; and emotion concepts versus emotion events.

Everyone knows what an emotion is, until asked to give a definition. Then, it seems, no one knows. Most may agree that anger, fear, sadness, and excitement are among the emotions. But is pain, hunger, alienation, courage, loneliness, religious awe, startle, or lust? Are emotions mental, physiological, or behavioral events? Are some emotions more "basic" than others, and if so, which ones? Is it legitimate to speak of emotions in infants, cats, birds, insects? We have yet to reach agreement on answers to such questions, or more important, to agree on how such questions could be settled. In this article, we hope to add to the understanding of issues such as these by ex-

amining, not emotional experiences, but the concept of emotion.

Attempts to define emotion can be traced back at least as far as Plato and Aristotle. The nature of emotion (or passion, as it was then called) was debated by philosophers, including Thomas Aquinas, Descartes, Hobbes, Hume, Spinoza, and Kant, followed by the psychologists, including Wundt, James, McDougall, and Watson. Wundt (1912/1924) and Titchener (1910) thought that emotion is a mental event. Watson (1919) said that emotion is behavior, and Wenger (1950) said that emotion is a type of physiological activity, specifically activity innervated by the autonomic nervous

system. Virtually the same debate can be seen today when Solomon (1977) argued that emotion is a type of judgment (and hence a mental event) and Tomkins (1980) argued that emotions (or affects as they are now sometimes called) are "sets of muscular and glandular responses. . . . In short, I propose that affect is primarily facial behavior" (p. 142).

Many psychologists doubt that emotion can be defined in strictly mental, strictly behavioral, or strictly physiological terms. Each definition can be met with counterexamples. Most acknowledge cases of emotion with no clear physiological or behavioral signs, and most acknowledge that the same physiological or behavioral events occur at times when we would not want to say that emotion is occurring, as in exercise or acting. Against the view that emotion is a mental feeling, there is Averill's (1980) argument:

It is perfectly meaningful to say of a person that he is envious, even though that person might sincerely and vehemently deny the fact. Such a statement would not be meaningful, however, if concepts such as envy referred specifically to feelings. (p. 137)

An alternative form of definition has been to include behavioral, physiological, and mental events as components within a single definition of emotion. Thus, for Izard (1972), "emotion is a complex process that has neurophysiological, motor-expressive, and phenomenological aspects" (p. 51). Unfortunately, the same statement could be made about mo-

tives or attitudes or cognition. Indeed, this type of definition is so broad that it is difficult to imagine what in psychology would not be an emotion, so defined.

Psychologists with less patience for philosophical argument often turn to operational definitions of emotion, such as galvanic skin response (GSR), avoidance behavior, facial expression, or verbal self-report. Still, their justification for doing so rests on some idea of what emotion is. (Otherwise, why pick one operational definition over any other?) Most psychologists are unwilling to say that GSR or any other (one or more) of these specific measures is emotion. After all, to do so would be to solve the issues under discussion here by fiat, which among other things, is a nonempirical solution. Therefore, most wonder (or at least acknowledge it is legitimate to wonder) whether GSR and the rest are valid measures of emotion. But the question of validity can only be answered, in principle, by first knowing what emotion is. Operational definitions are thus generally now taken to postpone rather than to solve the problem.

In attempting to define concepts, not just within psychology but within philosophy, anthropology, linguistics, and other disciplines, people tend to assume what can be called the classical view of concepts. The classical view, which can also be traced at least as far back as Aristotle, is that concepts can be precisely defined by one or more individually necessary and jointly sufficient (criterial) features. Concepts are thus pictured as mental pigeon holes with precise boundaries. This approach has some major success stories: Classical definitions can be stated for such important (but nonpsychological) concepts as even number and odd number, square and triangle, and grandmother and cousin.

William James was the first writer we know of to point out that some concepts cannot be so defined. James (1902/1929) began his book *The Varieties of Religious Experience* with an attempt at a precise definition of "religious experiences" but was compelled to conclude the following:

Do what we will with our defining, the truth must at last be confronted that we are dealing with a field of experience that cannot be sharply drawn. The pretension, under such conditions, to be rigorously "scientific" or "exact" in our terms would only stamp us as lacking in understanding

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of our task. Things are more or less divine, states of mind are more or less religious, reactions are more or less total, but the boundaries are always misty, and it is everywhere a question of amount and degree. (p. 38).

Wittgenstein (1953) used the concept of game to illustrate a related idea. There is no one feature that is shared by all games and that could therefore serve as a defining feature for the concept of game. Rather, any game will share some features in common with most other games. Thus, one game resembles other games in much the same way that one member of a family resembles the others. Following Wittgenstein, writers in various disciplines have identified natural language concepts that appear to lack defining features and whose boundaries, rather than clearly defined as had previously been assumed, are "fuzzy" (Hersh & Caramazza, 1976; Labov, 1973; Lakoff, 1973; Zadeh, 1965).

Within psychology, Eleanor Rosch has been mainly responsible for rekindling an interest in the nature of concepts through her articulation of prototype theory as an alternative to the classical view (Rosch, 1973a, 1973b, 1974, 1975a, 1975b, 1975c, 1977, 1978). Rosch argued that many everyday concepts such as fruit, vehicle, and tool lack defining attributes. Such concepts are organized around their clearest examples, which are referred to as *prototypes*. Other instances vary in their degree of family resemblance to the prototypes, with prototypes shading gradually into nonprototypes and nonprototypes shading gradually into nonmembers. More prototypical members share more attributes in common with each other; less prototypical members have fewer attributes in common with each other and have a greater number of attributes in common with members of adjacent concepts. For example, some fruits, such as apples and oranges, are clear, prototypical instances of the concept fruit. Other fruits can be ordered from better to poorer examples. Hence, there is an internal structure to the concept of fruit. Cherries are good examples, but coconuts and figs are mediocre examples; olives may not belong at all. One concept, such as fruit, blends indistinguishably into neighboring concepts, such as vegetables.

Many such natural concepts can also be ordered in a hierarchical structure, which is just to say that some concepts are included

within others. For example, the set *fruit, apple, MacIntosh apple* illustrates a hierarchy with superordinate, middle, and subordinate levels.

Neisser (1979) further elaborated the implications of Rosch's theory. He restricted his analysis to the concept of intelligence, but the implications of what he said might be very broad indeed. Neisser argued that "intelligent person" is a prototypically organized concept. The prototypical intelligent person is a hypothetical ideal, which no one person can match—"even Aristotle would have flubbed a few scale items" (p. 225). Actual persons resemble the prototype to varying degrees, and more important, along varying dimensions. Thus, two equally intelligent persons could be quite different in their actual mental skills. One intelligent person might be extremely good at abstract concepts and intellectual puzzles but might be poor at organizing specific tasks and at producing practical results. Another, equally intelligent person might have these attributes in reverse. If intelligence does not refer to a single ability or to a single mental process, no single ability or single mental process can serve as an adequate definition of intelligence. Intelligence is not something that a person has; it is the degree to which that person resembles a hypothetical entity. And "resemblance is an external fact and not an internal essence" (Neisser, 1979, p. 223).

Some of the major concepts in psychology, including the self, personality disposition, and mental illness, have similarly been reconceptualized in light of Rosch's theory (Buss & Craik, 1980, 1983; Cantor & Mischel, 1977, 1979; Cantor, Smith, French, & Mezzich, 1980; Horowitz, Wright, Lowenstein, & Parad, 1981; Rogers, Kuiper, & Kirker, 1977; Wiggins, 1980). We are perhaps brought closest to an analysis of the concept of emotion through the work by Cantor and her associates (1980) on psychiatric diagnostic categories. Some of the well-known criticisms long leveled at the psychiatric diagnostic system are reminiscent of the problems encountered with emotion concepts. For example, the diagnostic categories lack precise definition. Few patients fit clearly into one and only one category, with the result that diagnosis is not especially reliable. Some patients appear to be prototypical examples of certain categories, but other patients are rather poor examples. From the

classical view of concepts, psychiatric diagnosis appears to be messy, and diagnostic categories appear to be anomalies. The problems that clinicians have sought to overcome strongly suggested that their diagnostic system would be better understood through Rosch's theory of concepts. From a prototype view, the fuzzy boundaries of the diagnostic categories are not anomalous but are orderly and understandable features of natural categories. Empirical analysis of diagnostic judgments supported hypotheses derived from this line of thinking.

Several authors have noticed features of the concept of emotion that would suggest that it, too, may be prototypically organized and may lack sharp boundaries. Leeper (1948) observed that some emotions are prototypical examples of the concept of emotion, and Duffy (1934, 1941) observed that no sharp boundary separates emotional from nonemotional states. Averill (1980) observed the following:

The concept of emotion is like a net woven from many different strands (connotations), none of which is essential to the integrity of the whole. Moreover, the concept of emotion is a very broad net which when cast upon the psychological waters, captures diverse phenomena. (p. 18)

Indeed, at this point, the reader should have little difficulty beginning to apply Rosch's theory to the concept of emotion. One might imagine a hierarchy with the concept of emotion at the topmost, or superordinate, level. At the middle level might appear such familiar types of emotion as anger, fear, love, happiness, sadness, and the like. Besides these prototypical members, there would also be less prototypical emotions such as pride, envy, courage, and lust. Each middle-level category might be further subdivided at a subordinate level: anger subdivided into wrath, annoyance, rage, fury, and indignation; fear subdivided into apprehension, panic, dread, and alarm; love subdivided into filial love, romantic love; and so on.

Rosch did not spell out specific hypotheses so much as offer a general approach that must be specified through empirical means in any particular domain. In this article, we report a series of seven studies designed to explore the feasibility of viewing the concept of emotion as prototypically organized and as lacking sharp boundaries. Emotion was the most superordinate concept of interest to us, and we asked subjects in Study 1 to produce categories

at the next lower level in the hierarchy. Not surprisingly, these turned out to be categories such as anger, fear, love, and so forth.

We then followed Rosch's footsteps in an attempt to chart the internal structure of the concept of emotion. In Studies 2 and 3, we examined two additional responses Rosch found associated with internal structure: the probability of naming the middle-level categories with the superordinate name and direct ratings of prototypicality. Study 4 concerned a prediction about the consequences of internal structure, specifically, the prediction that prototypical emotions serve better than nonprototypical emotions as substitutes for the word *emotion* in naturally occurring sentences. Study 5 took a closer look at the relation between internal structure and fuzzy borders. This study was in response to an argument made by Armstrong, Gleitman, and Gleitman (1983) that internal structure does not imply fuzzy boundaries. We attempted to demonstrate that the borders of the concept of emotion (plus several of the concepts studied by Rosch) are fuzzy rather than sharply defined. In Studies 6 and 7, we explored one hypothesis, that of family resemblance, concerning the principles that might govern the formation of internal structure of the concept of emotion. Altogether, these studies yielded seven separate ways of mapping the internal structure of the concept of emotion, seven ways, that is, of ordering middle-level emotion categories according to prototypicality. Rather than compare these different ways with one another as they appear, comparison is postponed until a final section where the convergence of all seven is assessed.

In these studies, subjects were all undergraduates of the University of British Columbia, Vancouver, Canada, who volunteered their participation.

Study 1: Free Listing of Exemplars

We presented subjects with the concept of emotion and asked them to list its members. This served to generate the next lower level in the hierarchy of emotion categories. Twenty of these exemplars were selected as *target emotions* to be used in the other studies. How readily such middle-level categories come to mind is one measure of prototypicality.

Method

Subjects ($N = 200$) read the following instructions and were given 1 min to provide their responses:

This study is part of a larger project on the sorts of things people have in mind when they hear and use words. On this questionnaire we are interested in the kinds of things that might belong to general categories. We will give you the category and you will give us the items. For example, if given the category "SEAFOOD," you might respond with such items as clams, oysters, lobster tails, shrimp salad, pickled herring, and so on.

Now please list as many items of the category "EMOTION" as come readily to mind. Stop after about a minute or 20 items.

Results and Discussion

In tallying responses, we ignored syntactical form (e.g., *happy* and *happiness* were treated as the same response), yet attempted to be as conservative in this as possible (e.g., *fear* and *frightened* were treated as separate responses). The rationale for collapsing across syntactical form was that in no instance did a subject list different forms as though they were separate emotions. This left 383 different items, of which 187 were mentioned by only 1 subject. The 196 nonidiosyncratic responses are listed in Table 1.

Exemplars of emotion varied widely in how readily they came to mind. At one extreme were the 187 listed by only 1 individual. At the other extreme were four categories, happiness, anger, sadness, and love, listed by more than half of the subjects. There was no clear break in frequency-of-listing scores between these extremes, no obvious boundary between available and unavailable categories. Rather, there was a gradual change from instances that come readily to mind to those that do not.

Twenty target emotion terms, listed in Table 2, were selected for further analysis in this study and in subsequent studies. These were the 10 terms with the highest frequency scores plus 10 more chosen to represent a broad range of degree of membership, provided they were mentioned by at least 4 subjects (2% of the sample). This set of 20 target emotion terms thus excludes rare and borderline cases of emotion.

At the time we gathered these data, we did not know that similar data had been collected by Hunt and Hodge (1971), who had asked subjects to list four exemplars for each of var-

ious categories, including emotion. To compare our results with theirs, we made a second tally of our data, counting only the first four responses. We also retallied Hunt and Hodge's results by collapsing across syntactical form as we had done. Given in Table 2 are frequency-of-listing (availability) scores for the 20 target terms (a) based on our original scoring from our data, (b) based on a tally of the first four responses in our data, and (c) based on our rescoring of results from Hunt and Hodge. In our data, the frequency scores based on all responses correlated .97 with those based on the first four responses. These two scores correlated .80 and .76, respectively, with the Hunt and Hodge frequency scores. The same three correlations computed with the rank orders were .98, .89, and .86, respectively. Thus, the frequency scores appear to be reliable across scoring methods, experimenters, and samples of subjects.

Of course, this degree of reliability was obtained for a sample of terms including the most available ones and extending over a considerable range of frequency-of-listing scores (2%–76%). To examine reliability within a lower and more restricted range, 30 items were selected from those with frequency scores between 1% and 20% and that were not among the 20 target emotions of Table 2. Across these 30 terms, frequency scores based on all responses correlated .75 with those based on the first 4 responses. These two scores correlated .47 and .40 with the Hunt and Hodge scores, respectively. The same three correlations computed with the rank orders were .68, .51, and .51, respectively.

Study 2: Generating the Superordinate Name

In the first study, subjects went "down" the emotion hierarchy. In Study 2 subjects were asked to go "up" the hierarchy. Rosch (1973a, 1973b) found that more prototypical members of a category are more likely to elicit the superordinate category name than are more peripheral members. Thus, this task provided another measure of internal structure. This study also gave us an opportunity to verify that the 20 target emotions are indeed considered emotions and to observe what other kinds of superordinate concepts might be given for the 20 target emotion terms.

Table 1
Free Listing of Exemplars of Emotion

Happiness (152)	Hurt (16)	Lust (8)	Dislike (5)	Stress (4)	Thinking (3)	Insecurity (2)
Anger (149)	Liking (16)	Tenderness (8)	Exuberance (5)	Thrilled (4)	Wonder (3)	Malicious (2)
Sadness (136)	Lonely (16)	Annoyed (7)	Panic (5)	Tranquility (4)	Admiration (2)	Meditating (2)
Love (124)	Sympathy (16)	Arousal (7)	Satisfaction (5)	Unhappy (4)	Alert (2)	Mixed (2)
Fear (96)	Compassion (14)	Cheerful (7)	Touching (5)	Violence (4)	Amazement (2)	Outgoingness (2)
Hate (89)	Ecstasy (14)	Disappointment (7)	Aggression (4)	Vulnerability (4)	Appreciation (2)	Protective (2)
Joy (82)	Envy (14)	Distress (7)	Amused (4)	Ambivalence (3)	Anguish (2)	Rapture (2)
Excitement (53)	Grief (14)	Frightened (7)	Apprehension (4)	Attraction (3)	Belonging (2)	Relaxed (2)
Anxiety (50)	Mad (14)	Hopelessness (7)	Awe (4)	Bliss (3)	Boisterous (2)	Repulsion (2)
Depression (42)	Sorrow (14)	Irritation (7)	Deep (4)	Confidence (3)	Closeness (2)	Responsibility (2)
Frustration (39)	Warmth (14)	Kindness (7)	Desire (4)	Conflict (3)	Communication (2)	Responsiveness (2)
Crying (36)	Nervous (13)	Longing (7)	Dismay (4)	Defeat (3)	Complacent (2)	Self-concept (2)
Feelings (35)	Pain (13)	Melancholy (7)	Enjoyment (4)	Dejection (3)	Contempt (2)	Self-esteem (2)
Jealousy (29)	Tense (13)	Pleased (7)	Enthusiasm (4)	Expectation (3)	Criticism (2)	Sentimental (2)
Disgust (27)	Moody (12)	Rage (7)	Exhilaration (4)	Expressive (3)	Cynical (2)	Softness (2)
Laughter (27)	Pride (12)	Relief (7)	Gay (4)	Giving (3)	Devotion (2)	State (2)
Elation (26)	Smiling (12)	Respect (7)	Hostility (4)	Helping (3)	Distrust (2)	Stubbornness (2)
Caring (24)	Trust (12)	Scared (7)	Humor (4)	Helplessness (3)	Disturbed (2)	Successful (2)
Guilt (22)	Passion (11)	Sensitive (7)	Loyalty (4)	High (3)	Dread (2)	Tiredness (2)
Embarrassment (20)	Tears (11)	Sex (6)	Miserable (4)	Humility (3)	Edgy (2)	Turbulent (2)
Contentment (19)	Pleasure (10)	Shyness (6)	Mournful (4)	Jubilation (3)	Expression (2)	Uncertainty (2)
Peace (19)	Calmness (9)	Sincerity (6)	Needs (4)	Negative (3)	Euphoria (2)	Uncontrollable (2)
Upset (19)	Glad (9)	Strong (6)	Pensive (4)	Passivity (3)	Frown (2)	Understanding (2)
Worry (19)	Affection (8)	Afraid (5)	Rejection (4)	Positive (3)	Gentleness (2)	Unstable (2)
Empathy (18)	Boredom (8)	Anticipation (5)	Remorse (4)	Quiet (3)	Hardness (2)	Uptight (2)
Confusion (17)	Delight (8)	Bitterness (5)	Serenity (4)	Reactions (3)	Heart (2)	Wanting (2)
Surprise (17)	Greed (8)	Concern (5)	Shame (4)	Resentment (3)	Hyperactive (2)	Weak (2)
Despair (16)	Hope (8)	Control (5)	Sharing (4)	Terror (3)	Impulse (2)	Withdrawn (2)

Note: The number in parentheses is the number of subjects, out of 200, who listed each item or some syntactic variant of it. Items listed by only 1 subject were omitted.

Table 2
 Percentage of Subjects Who Listed Each of 20 Categories of Emotion

Category	Study 1 ^a		Study 1 ^b		Hunt & Hodge (1971) ^c	
	Rank	%	Rank	%	Rank	%
Happiness	1	76.0	1	51.0	4	29.75
Anger	2	74.5	2	49.0	5	27.75
Sadness	3	68.0	3	42.5	6	22.75
Love	4	62.0	4	38.5	2	52.25
Fear	5	48.0	5	24.5	1	53.25
Hate	6	44.5	6	19.5	3	44.50
Joy	7	41.0	7	13.0	7	15.75
Excitement	8	26.5	8	6.5	10	5.00
Anxiety	9	25.0	10	3.5	9	7.00
Depression	10	21.0	9	4.0	8	7.50
Disgust	11	13.5	13	2.5	14	1.00
Guilt	12	11.0	11.5	3.0	13	1.25
Embarrassment	13	10.0	11.5	3.0	17	0.25
Worry	14	9.5	14	1.5	15.5	0.75
Envy	15	7.0	15.5	0.5	12	1.5
Pride	16	6.0	18.5	0	15.5	0.75
Calmness	17	4.5	18.5	0	11	2.0
Boredom	18	4.0	18.5	0	19	0
Respect	19	3.0	15.5	0.5	19	0
Awe	20	2.0	18.5	0	19	0

Note: Study 1, $N = 200$; Hunt & Hodge, $N = 400$.

^a All responses in 1 min. ^b First four responses. ^c Four responses.

Method

Subjects ($N = 118$) read the following instructions:

This study is part of a larger project on the sorts of things that people have in mind when they hear and use words. On this questionnaire, we are interested in the general categories to which things might belong. We will give you a word and you will give us the general category. For example, if given the word "truck," you might write in "vehicle" or "motor vehicle." For the word "polio," you might respond with "disease" or "illness."

The list below refers to things you can experience. For each of the items, your task is to provide the general category to which it belongs. You may use the same word as often as you wish. Don't worry about whether your answer is right or wrong. This is not really a test of knowledge, but a study of ordinary language. There are actually many possible answers. All we want is your opinion.

Four forms of a 20-item questionnaire were distributed. In one version, 7 of the 20 target emotions (Taken from Study 1, Table 2) were interspersed with 13 filler items such as *tingle*, *dizziness*, *stubbornness*, *moodiness*, *alertness*, or some other psychological concept. In the second version, a second set of 7 target emotions were interspersed among the filler items. In the third version, the remaining 6 target emotions were interspersed among 14 filler items. In the fourth version, all 20 target emotions were listed without filler items. The rationale for the last version was

that a subject receiving 20 emotion terms in a row would be reluctant to give *emotion* as the response to every one. Our purpose was to create an implicit bias against giving *emotion* and to discover what other superordinates would be generated. Each form of the questionnaire with filler items was given to 30 subjects; the questionnaire without filler items was given to 28 subjects.

Results and Discussion

The percentage of subjects giving *emotion* as the superordinate for each term is listed in Table 3. Although never from 100% of the subjects, every target emotion term generated *emotion* as its superordinate both on the questionnaires with filler items and (with the exception of *respect*) on the one without filler items. Some of the responses not included in this first count included the word *emotion* embedded in a phrase, such as the following: negative emotion, positive emotion, unpleasant emotion, spontaneous emotion, neutral emotion, unhappy emotion, happy emotion, and uncontrolled emotion. With the exception of the first two phrases listed, these occurred only among responses to the questionnaire without filler items. The percentage of subjects

giving either *emotion* or one of these phrases is also listed in Table 3.

Only two types of superordinate were common to more than two target words and did not include the word *emotion*. The words *feeling*, *negative feeling*, or *positive feeling* were given as the superordinate concept at least once for all 20 target emotions on questionnaires with and without filler items. The words *state*, *state of mind*, or *state of being* were given as the superordinate concept at least once for 17 of the 20 target emotions on the questionnaire without filler items and were given at least once for 15 of the 20 on the version with filler items. These responses raise a question: How is *emotion* different from other superordinate psychological concepts? Perhaps *emotion*, *feeling*, and *state* are synonyms. Perhaps *emotion*, *feeling*, and *state* are all terms on one level of a hierarchy, with considerable but not complete overlap in meaning. Alternatively, *emotion* may be a type of feeling or state. This would be so if, for example, feelings include

not only emotions but beliefs, desires, proprioceptive feedback, pains, and illnesses.

Study 3: Prototypicality Ratings

In this study, subjects directly rated how good an example of emotion each of the 20 target emotions is. Previous research showed that subjects can provide such direct ratings, and more important, that the ratings are reliable (McCloskey & Glucksberg, 1978; Rosch, 1973a, 1973b).

Method

Subjects ($N = 55$) read the following instructions, which were borrowed from Rosch (1973a, 1973b):

This study has to do with what we have in mind when we hear and use words. Let's consider the word "red." Close your eyes and imagine a true red. Now imagine an orangish-red. Imagine a purplish-red. Although you might still name the orange-red or the purple-red with the term "red," they are not as good examples of "red" (not as clear cases of what red refers to) as the clear, true red. Orange and purple are even poorer examples of "red," perhaps not even red at all.

Notice that to judge how good an example something is has nothing to do with how much you like the thing. You might prefer a purple-red or purple to a true red, but still recognize which is the better example of "red."

The word we are interested in is *emotion*. We are interested in which experiences or feelings are good or poor examples of "emotion." On the following page is a list of things that you can feel or experience—things like hunger, happiness, anger, and dizziness. We would like you to rate the extent to which each feeling on the list is a good or poor example of "emotion." Don't worry about why you think something is or isn't a good example—just give us your opinion.

Subjects rated each of the 20 target emotions on a scale of 1–6, ranging from *an extremely poor example* (1) to *an extremely good example* (6) of an emotion. Subjects were given as much time as they wished to complete the task. The terms were listed in the same random order for all subjects.

In order to assess the reliability of these ratings over time, a similar questionnaire was readministered to the same subjects 5 months later. At that time, the subjects ($N = 53$) also rated the prototypicality of the 30 additional terms examined in Study 1 that had been listed by 1% to 20% of subjects.

Results and Discussion

Mean prototypicality ratings at Times 1 and 2 for the 20 target emotion terms appear in Table 4. Test-retest reliability of these mean scores can be estimated by the correlation between the two columns: .97. To assess inter-

Table 3
Percentage of Subjects Giving Emotion as the Superordinate Category for 20 Target Emotion Terms

Category	Emotion as response		Emotion as part of response	
	Without	With	Without	With
Love	50.0	50.0	64.3	60.0
Sadness	35.7	60.0	53.6	66.7
Hate	35.7	50.0	46.4	50.0
Happiness	32.1	56.7	46.4	60.0
Joy	32.1	46.7	46.4	50.0
Anger	28.6	46.7	46.4	56.7
Depression	28.6	10.0	42.9	10.0
Envy	25.0	30.0	39.3	36.7
Disgust	25.0	36.7	35.7	40.0
Fear	25.0	33.3	39.3	46.7
Guilt	25.0	26.7	39.3	36.7
Pride	25.0	3.3	35.7	3.3
Worry	25.0	26.7	39.3	30.0
Anxiety	21.4	30.0	35.7	30.0
Excitement	21.4	30.0	32.1	40.0
Respect	21.4	0	32.1	3.3
Awe	17.9	10.0	28.6	10.0
Embarrassment	17.9	20.0	35.7	23.3
Boredom	10.7	3.3	25.0	3.3
Calmness	10.7	6.7	21.4	6.7

Note. Percentages are given separately for lists of terms without and with fillers.

Table 4
Prototypicality Ratings for 20 Target Emotions

Category	Time 1		Time 2	
	Rank	<i>M</i>	Rank	<i>M</i>
Love	1	5.46	2	5.27
Hate	2	5.26	3	5.04
Anger	3	5.15	1	5.36
Sadness	4	5.04	9	4.49
Happiness	5	5.00	8	4.51
Joy	6	4.89	5	4.93
Fear	7	4.78	4	5.00
Depression	8	4.73	6	4.58
Excitement	9	4.58	10	4.47
Guilt	10	4.55	7	4.55
Embarrassment	11	4.36	12	4.31
Anxiety	12	4.29	11	4.44
Envy	13	4.13	13	4.26
Worry	14	3.84	14	3.96
Disgust	15	3.71	15	3.89
Awe	16	3.46	17	3.24
Pride	17	3.33	16	3.51
Calmness	18	2.75	18	2.82
Boredom	19	2.71	19	2.76
Respect	20	2.49	20	2.51

Note. Ratings were made on a scale from *extremely poor example* (1) to *extremely good example* (6). At time 1, $N = 55$; at Time 2, 5 months later, $N = 53$. The correlation between mean ratings at Time 1 and Time 2 was .97.

rater reliability, an intraclass correlation coefficient was computed with data from the second testing (this coefficient is equivalent to the average of all possible split-half reliability coefficients). The results were .96 for all 50 terms and .95 for the 20 target terms, again indicating high reliability of the mean ratings.

Of course, individual prototypicality ratings were not as reliable. The mean correlation between two raters for the 20 terms was .38, indicating substantial variability from one subject to the next. The mean test-retest correlation for 1 rater across the 20 terms was .55, indicating substantial variability in individual ratings from one time to the next.

Initially it seemed possible that rating the extent to which love and anger are good examples of the general category of emotion would prove a meaningless task to subjects. They might question the credibility of the task, refuse to complete the ratings, or resort to some other judgment such as their preference for each emotion. It seemed possible that even if subjects performed the task, their responses would be highly idiosyncratic because of the

subjective nature of emotional experiences. What actually happened was that subjects found it meaningful to rate the extent to which an instance is a good example of an emotion. Moreover, subjects tended to agree with one another and tended to be consistent over time, although pooled ratings were required to achieve stable prototypicality scores.

Study 4: Substitutability

Consider the following sentence: "Twenty or so birds often perch on the telephone wires outside my window and twitter in the morning." For most readers, the sorts of birds that come to mind tend to be prototypical birds, such as robins or sparrows. In fact, substituting *robins* or *sparrows* in place of *birds* in the sentence leaves a completely natural sounding sentence. But, Rosch (1977) observed, substituting nonprototypical birds, such as *turkeys* or *ostriches*, produces a rather peculiar sounding sentence. Rosch (1977) showed that, in general, substituting prototypical members for a superordinate tends to produce a sentence that retains its naturalness, whereas substituting peripheral members may not do so. This result is consistent with the notion that more prototypical members are more representative of, or closer to the meaning of, the superordinate. If, on the other hand, the meaning of a superordinate concept consists of a list of defining attributes common to all category members, substitutability should be equivalent for all members.

We asked subjects to judge how peculiar or natural they found various sentences. In each sentence we had substituted one of the 20 target emotions for the word *emotion*. Half of the original sentences had been obtained by asking another group of subjects to write sentences with the word *emotion* in them. The other half were taken from four recently published introductory psychology textbooks.

Method

Subjects ($N = 400$) read the following instructions:

This questionnaire is part of a larger project on the sorts of things people have in mind when they hear and use words. In this study we are interested in how peculiar or how natural certain sentences sound. For example, the sentence "A bowl of apples makes a nice centerpiece for the table" probably sounds quite natural to most people. On the other hand, a sentence like "A bowl of

watermelons makes a nice centerpiece for the table” sounds rather peculiar. In this study we’re not interested in sentences about fruit. Rather, we are interested in how peculiar or natural sentences about emotions sound.

Below is a series of sentences—some make a lot of sense, others make some sense, and some may make no sense at all. Your task is to read each sentence to yourself and rate how natural or peculiar it sounds to you. Don’t spend time wondering if your answer is right or wrong. There are no right or wrong answers, so just base your response on your first impression from reading the sentence.

The subject then rated 20 sentences on a scale ranging from *very peculiar* (1) to *very natural* (6). The 20 sentences were drawn from a pool of 400 sentences formed from the 20 listed in Table 5 by substituting 20 target emotions in place of the word *emotion*. Sentences were drawn in such a way that each target emotion and each sentence frame appeared only once on the questionnaire for a given subject. The mean rating across 20 subjects defined the naturalness score for a given target emotion in a given sentence.

Results and Discussion

Subjects did indeed find some sentences more peculiar than others. Consider the fol-

lowing set (mean naturalness rating is given in parentheses):

- “Sometimes emotion is hard to control.”
- “Sometimes anger is hard to control.” (5.6)
- “Sometimes respect is hard to control.” (2.8)

As this example suggests, substitution of the more prototypical exemplars tended to produce the more natural sounding sentences. Evidence for this conclusion is shown in Table 5 in the form of correlations between naturalness scores obtained here and the prototypicality scores obtained in Study 3. (One coefficient was calculated for each sentence by correlating across the 20 target emotions.) The results were stronger for some sentences than for others, with a range of .27 to .76. Still, all correlations were in the expected direction, and all but 1 were reliably so.

To provide substitutability scores for the target emotions, naturalness scores for each were averaged across the 20 sentences. These scores are given in Table 6, and are compared

Table 5
Correlation Between Naturalness and Prototypicality

Sentence	Correlation
1. It is hard to be close to someone who shows no emotion.	.27
2. You shouldn’t let emotion get in the way of reasoning.	.43*
3. It is often hard to express the emotion that you really feel in an adequate manner.	.63**
4. He could not speak a word for he was so overcome with emotion.	.44*
5. The emotion of a person could be revealed on his/her face.	.54**
6. Some people tend to show more emotion than others in certain situations.	.48**
7. Sometimes emotion is hard to control.	.59**
8. We should be careful not to allow our emotion to control our actions completely.	.66**
9. Who knows better one’s emotion than those around you?	.32*
10. She expressed her emotion through crying.	.76**
11. A state of emotion is recognized by its holder as a departure from his or her normal state of composure; at the same time there are physical changes that can be detected objectively.	.48**
12. Emotion is a subjective experience. As such it is rich, varied, concrete, and personal—but very difficult to define or study.	.34*
13. We infer emotion in animals because of observable behavior that is analogous to what we believe to be emotion in human beings.	.41*
14. A person gripped by strong emotion can exert great energy over a longer period than is normal.	.46**
15. Emotion accompanies motivated behavior; the effect can be facilitating or interfering.	.42*
16. Emotion means an aroused or “stirred up” frame of mind.	.50**
17. Despite the undebatable importance of emotion in the life of humans, psychological research and theory frequently skirt detailed treatment of this subject.	.32*
18. In spite of the vividness of our personal knowledge of emotion, it is very difficult to give an objective definition to the term.	.71**
19. When sufficiently intense, emotion can seriously impair the processes that control organized behavior.	.64**
20. Emotion enables the individual to exert great energy for a brief period.	.46**

Note. The first 10 sentences were written by college undergraduates. The second 10 were taken from introductory psychology textbooks.

* $p < .05$; ** $p < .01$, one-tailed.

Table 6
Mean Substitutability Scores for 20
Target Emotions

Target	Score	Target	Score
Excitement	4.6	Pride	4.0
Fear	4.4	Embarrassment	4.0
Anger	4.3	Sadness	3.9
Anxiety	4.3	Envy	3.9
Joy	4.2	Depression	3.8
Love	4.1	Disgust	3.7
Hatred	4.1	Awe	3.6
Happiness	4.1	Boredom	3.3
Guilt	4.1	Respect	3.2
Worry	4.0	Calmness	3.0

Note. Scores shown are means across 20 sentences. The score for each sentence was a mean across 20 subjects on a rating scale from *very peculiar* (1) to *very natural* (6).

with other measures of internal structure later. By dividing the subject pool into two groups, the split-half reliability of these scores was estimated to be .98.

Some results with sentences taken from introductory psychology texts may be worth special mention. Some of the statements resulting from substitution sounded peculiar even when relatively prototypical exemplars replaced *emotion*. Here are several examples:

"When sufficiently intense, happiness can seriously impair the processes that control organized behavior." (3.5)

"Sadness accompanies motivated behavior; the effect can be facilitating or interfering." (2.4)

"A person gripped by strong depression can exert great energy over a longer period than is normal." (2.4)

"Sadness means an aroused or 'stirred up' frame of mind." (2.6)

If substitutability can be taken as an indication of the core meaning of a concept, it appears that the textbook writers may not mean by *emotion* what nonpsychologists mean. If so, their justification for using the word is unclear.

Study 5: Unclear Cases

Armstrong et al. (1983) pointed out, rightly, that the existence of internal structure does not contradict the classical view of concepts. Demonstrating that a concept has an internal structure doesn't mean that it lacks rigid boundaries or criterial features unless one also

demonstrates that all classically defined concepts lack internal structure. And the opposite appears to be the case: Armstrong et al. (1983) asked college students to rate the prototypicality (goodness of example) of the numbers 4, 8, 10, 18, 34, and 106 as exemplars of the concept of even number. Subjects reliably placed them in the order we have them in. Moreover, this order correlated with the amount of time it took to verify that each exemplar was an even number. Similar results were found for other classically definable concepts.

Internal structure and a classical definition are clearly not mutually exclusive properties. Armstrong et al. (1983) went further by suggesting that internal structure may have nothing to do with the conceptual core (sense or meaning) of a concept but may pertain only to an auxiliary identification function, that is, the process whereby we pick out instances of the concept in the real world. The conceptual core of *grandmother* would be something like *mother of a parent*, whereas the identification function would specify features useful in identifying grandmothers, features such as grey hair, twinkle in her eye, and dispensing chicken soup.

If internal structure is compatible with a classical definition, this seems to leave us without a means of distinguishing precisely defined concepts from fuzzy concepts. Thus, Armstrong et al.'s (1983) results challenge proponents of the prototype view to demonstrate a difference between the two. We reasoned that one difference would concern the existence of unclear cases. The metaphor of a rigid boundary means that a classical definition enables one to adjudicate membership unequivocally. All members of a classically defined concept possess the necessary and sufficient attributes; anything else is not a member. Internal structure ought not to matter, therefore, when adjudicating membership in classically defined concepts. Peripheral members are just as good as prototypical members. The metaphor of a fuzzy boundary means that, although some cases definitely are members and some other cases definitely are not members, there exist equivocal cases. Peripheral members are the ones most likely to be equivocal cases, with subjects failing to agree with one another on membership.

To test this idea, we followed a procedure used by McCloskey and Glucksberg (1978). Subjects were asked questions of the form: "Is an X a Y?" with X replaced by a central or peripheral member of Category Y. For Y we used Armstrong et al.'s four classically definable concepts and their four prototypically organized concepts plus, of course, the concept of emotion.

Method

Subjects (*N* = 133) received a questionnaire that began as follows:

In this study, we're concerned with what people have in mind by some ordinary, everyday words—words like *male, female, sport, vegetable, emotion, even number, odd number, and intelligence.*

Below is a series of questions. Some will be extremely (even ridiculously) easy to answer. Others will be more difficult. In either case, please just give us your opinion. Emphasize accuracy over speed.

The subject then received a list of 34 questions. Each list was drawn from a larger pool of 136. About half of the questions on each list were filler items, for most of

which the expected answer was no. (Examples: "Is 47 a female?" "Is a carrot a fruit?" "Is a tricycle a vegetable?" "Is science a sport?" "Is a secretary a female?") The other half of the questions were the ones of interest: X was replaced by either a peripheral or a central member of Category Y, and Y was replaced by one of four classically definable concepts, one of four prototypically organized concepts, or emotion. Members and concepts are listed in Tables 7 and 8. Division into central and peripheral exemplars was made by Armstrong et al. (1983) for their eight concepts; for emotion, division was based on the results of Study 3. Each question was answered by between 31 and 37 subjects.

Results and Discussion

The percentages of subjects answering no to questions involving concepts studied by Armstrong et al. (1983) are given in Table 7. Consider the six members of the concept of odd number. There was little controversy about the three central members: All but 1 subject agreed that 3 and 7 are odd numbers; all agreed that 11 is an odd number. There was also little controversy about the three peripheral members: All agreed that 91 and 501 are odd num-

Table 7
Percentage of Subjects Who Disagree That an Item is a Member of a Superordinate Category

Classically defined concepts				Prototypically defined concepts			
Central		Peripheral		Central		Peripheral	
Item	%	Item	%	Item	%	Item	%
Female				Fruit			
Mother	3	Policewoman	0	Apple	0	Coconut	10
Sister	3	Chairwoman	6	Orange	0	Fig	12
Housewife	3	Cowgirl	0	Cherry	3	Olive	29
Odd number				Vegetable			
3	3	91	0	Carrot	0	Pickle	16
7	3	447	3	Pea	6	Parsley	15
11	0	501	0	Celery	0	Pumpkin	10
Even number				Vehicle			
2	0	34	3	Car	3	Sled	6
4	0	106	0	Bus	0	Skis	53
8	0	806	0	Motorcycle	3	Elevator	16
Plane geometric figure				Sport			
Square	3	Trapezoid	24	Baseball	0	Archery	3
Rectangle	0	Ellipse	19	Soccer	0	Weightlifting	3
Triangle	3	Circle	13	Football	0	Hiking	10

Note. Subjects were asked to respond *yes* or *no* to a question of the form: "Is an X a Y?" with X replaced by a potential member of Category Y. Percentages shown represent *no* responses. Number of subjects varied from 31 to 37.

Table 8
Percentage of Subjects Who Disagree That an Item is an Emotion

Central		Peripheral	
Item	%	Item	%
Happiness	0	Disgust	6
Anger	0	Guilt	11
Sadness	0	Embarrassment	22
Love	6	Worry	11
Fear	3	Envy	16
Hate	0	Pride	26
Joy	6	Calmness	48
Excitement	8	Boredom	39
Anxiety	8	Respect	74
Depression	11	Awe	26
<i>M</i>	4	<i>M</i>	27

Note. Subjects were asked to respond *yes* or *no* to a question of the form: "Is X an emotion?" with X replaced by one of the 20 target emotions. Percentages shown represent *no* responses. Number of subjects varied from 31 to 37. Division of emotions into central and peripheral was based on the prototypicality ratings of Study 3.

bers; all but 1 agreed that 447 is an odd number. Similar results were obtained for the concepts of even number and female, namely, equally little controversy for central and peripheral members. For the concept of plane geometric figure, on the other hand, there was controversy about peripheral members—a completely unexpected finding. We subsequently had the opportunity to discuss these results with the subjects who provided these data. Asked why they would deny that trapezoid, ellipse, and circle are plane geometric figures, they replied that they weren't sure what the words *trapezoid*, *ellipse*, or *plane geometric figure* meant.

Rosch's prototypically organized concepts, fruit, vegetable, vehicle, and sport, all showed a consistent pattern: little or no controversy about central members but some, and in one case considerable, controversy about peripheral members. Skis appear to be a decidedly unclear case, with 47% of subjects believing they are and 53% of subjects believing they are not a member of the class of vehicles. The concept of sport fit this pattern, but the amount of disagreement about peripheral members was small. In a subsequent replication of some of these results, we asked subjects about jogging,

handwrestling, and walking. Five percent, 11%, and 30%, respectively, disagreed that these were sports.

The results for the 20 target emotions are given in Table 8. As with Rosch's prototypically organized concepts, there was more (and indeed considerable) controversy about peripheral members than there was about central members.

There is a possible explanation for the results of this study that is consistent with the classical view: Perhaps different subjects possess different classical definitions for the concepts alleged to be fuzzy. Although it seems to save the classical view, this possibility would not be ideal for that view because there would be no one definition for a concept. Moreover, we know of no evidence supporting this possibility. In fact, it is made less tenable by results from the McCloskey and Glucksberg (1978) study. Their subjects not only disagreed with each other over whether, say, bookends are furniture but also were inconsistent over time, with the same subject one time deciding *yes* and the other time deciding *no* for peripheral members.

Although our results with plane geometric figures renders any conclusion from this study debatable, there is a simple and plausible interpretation. Provided subjects know the meaning of the words involved, peripheral members of classically definable concepts are nonetheless members. They are members because subjects know, implicitly or explicitly, the defining features of the concept. Peripheral members of the concept of emotion and of the sorts of concepts studied by Rosch are more likely to be controversial, because subjects know no way of arriving at a definite answer.

These results thus suggest that for words subjects know the meaning of, adjudication of membership provides a clear distinction between concepts that are classically definable and those with fuzzy borders. Moreover, adjudication provides a distinction that pertains to the core (sense or meaning) of the concepts. Our results thus speak against the attempt to save the classical view by arguing that the core is classically defined and that fuzziness has to do with an auxiliary identification function. Adjudication has nothing to do with an iden-

tification function. To decide whether, say, pride is an instance of emotion is not to identify proud persons; rather, it is to perform the semantic task of deciding whether any instance of pride is, by definition, an instance of emotion.

The main conceptual result of this study is a distinction between internal structure (or prototypicality) and fuzziness of boundaries. Armstrong et al. (1983) showed that classically defined concepts may also have internal structure. It appears that they do not have fuzzy boundaries. If we distinguish fuzzy borders from internal structure, we can say that many (perhaps even all) concepts may have internal structure, but that fuzziness of boundaries and a classical definition are mutually exclusive.

Study 6: Family Resemblances, Phase 1

Why are some exemplars more prototypical than others? Rosch and Mervis (1975) argued that Wittgenstein's (1953) idea of family resemblance provides a possible answer to this question. Although there may be no one attribute shared by all, members of a concept are linked through a complex pattern of crisscrossing and overlapping attributes. The degree to which a member resembles this overall pattern is referred to as family resemblance. The basic hypothesis is that the higher the degree of family resemblance, the higher the prototypicality.

An exemplar may resemble the other members of the family, or category, on two counts. It can possess more of the attributes possessed by other members or the attributes it possesses can be more characteristic of, that is, shared by more members of, the category. An exemplar's family resemblance can therefore be estimated by a weighted count of shared attributes, with the weight taken as the number of members sharing that attribute.

In order to study family resemblance among emotions, we asked subjects to list attributes of the 20 target emotions. From the attribute lists, family resemblance scores were calculated as a sum of weighted attributes. The weight is the number of target emotions sharing this attribute. In turn, family resemblance scores were expected to be correlated with other measures of internal structure.

Method

Subjects ($N = 40$) read the following instructions:

This is a study to find out the characteristics and attributes that are common to psychological experiences. For example, if you were asked to list the characteristics of a person experiencing terror, you might write:

- possible danger occurs—may be real like a bear; may be imaginary like a ghost
- attention is focused on the threat
- heart beats quickly
- eyes open wider
- eyebrows lift
- palms and soles sweat
- thoughts race through the person's mind
- unpleasant sensations are experienced
- the person runs as fast as they can
- hands tremble
- relief is experienced after a few minutes

It might help to imagine you're explaining the meaning of the word *terror* to a foreigner or to someone who has never experienced it. So, include the obvious. Tell how it comes about and what happens after. But emphasize a description of how one feels and acts.

Try not just to free associate. If "terror" makes you think of elevators, don't write elevators. We're interested in what is *common* to instances of terror.

Subjects were asked to take 2 or 3 min to list the attributes for each of 10 emotions presented in random order. Which 10 of the 20 target emotions were presented varied from 1 subject to the next in such a way that each target emotion was presented to 20 subjects.

Results and Discussion

The total number of responses generated was 2,425. Creating family resemblance scores required some decision as to which of these responses represented the same attributes and which represented different attributes. The attempt was to be conservative, to count as the same attribute only those words or phrases identical or highly similar in meaning. Most decisions were based on identical responses, and the decision to count nonidentical responses as the same was based on a consensus of two judges who were graduate psychology students. An example of a grouping of nonidentical responses is "eyes open wider," "eyes widen," "eyes open," "eyes are wide," and "widened eyes." These phrases were all considered to be "eyes open wider." On the other hand, "pupil dilation," "eyes averted," "squinted, narrow eyes," and "bright, sparkling eyes" were each treated as separate attributes. This grouping procedure left the number of distinct attributes at 643.

Next, 316 attributes mentioned only once were eliminated, leaving 327 attributes that were mentioned on 2 or more occasions, either for different emotions or by different subjects for 1 emotion. Each of the 327 attributes was then weighted by the number of emotions for which it had been listed. For example, a weight of 16 was given to "heart-rate increases," because it was listed as an attribute for 16 of the 20 emotions. This was, in fact, the highest weight obtained. The next most common attributes and their weights were: "perspiration/sweat" (10), "obsessive concern with a situation" (10), "tears/crying" (9), and "eyes open wider" (9). Thus, with the exception of "heart-rate increases," there were no attributes in common to more than half of the 20 emotions studied. A weight of 1 was given to "doesn't care about appearance" because it was listed (by 2 or more subjects) for only 1 emotion (depression).

Finally, a family resemblance score (Phase 1 score) was calculated for each target emotion. This score is simply the sum of the weighted attribute scores of the attributes listed for that emotion. These scores are given in Table 9.

These family resemblance scores were calculated directly from attribute lists provided by the subjects. No attributes were added, and none were deleted. The procedure may have faithfully reflected the data, but it depended, perhaps excessively, on the ability of students to bring to mind and to articulate the properties of such elusive entities as love and happiness. In contrast to this sort of production measure, in Study 7, family resemblance scores were based on a recognition measure of each attribute.

Study 7: Family Resemblances, Phase 2

A second set of family resemblance scores was generated by asking subjects to rate how often a given attribute is associated with a given emotion. The attributes presented were derived from Study 6. The weight of an attribute was taken as its average degree of association across all 20 target emotions. A family resemblance score was then calculated for each target emotion as the average weighted attribute score.

Method

Subjects ($N = 210$) read the following instructions, with X replaced by 1 of the 20 target emotion terms or by the term *emotion*:

Table 9
Family Resemblance Scores for 20 Target
Emotion Categories

Category	Phase 1		Phase 2	
	Score	Rank	Score	Rank
Excitement	283	1	338.4	12
Fear	274	2	356.7	5
Worry	261	3	360.7	3
Anxiety	248	4	390.9	1
Anger	246	5	344.6	9
Depression	224	6	356.8	4
Joy	220	7	340.0	11
Guilt	217	8	341.1	10
Pride	211	9	288.0	19
Love	202	10	330.3	14
Happiness	200	11	314.0	16
Embarrassment	190	12	388.2	2
Hate	188	13	343.4	7
Disgust	183	14	328.2	15
Awe	164	15	338.8	8
Sadness	155	16	345.2	6
Respect	136	17	299.6	17
Envy	132	18	337.5	13
Boredom	112	19	292.9	18
Calmness	111	20	220.7	20

Note. The family resemblance score (Phase 2) for *emotion* was 388.4. Phase 1 and Phase 2 correlated .59 (.57 for rank order).

This is a study about our beliefs concerning important psychological states. This study is part of a larger project on the topic.

Please begin by considering one such state, namely, X. Remember several occasions in which you or someone you know has experienced X. Pause to consider the various forms it might take and some of the various events that might be associated with it.

On the remaining pages of this booklet is a long list of various events that could be involved in any psychological state. Some occur often, some rarely. Your task in this study will be to rate the extent to which each event goes with or is part of X.

Each attribute was rated on a 5-point scale labeled *never* (0), *rarely* (1), *sometimes* (2), *often* (3), and *always* (4). Each subject provided ratings for one term on 161 attributes. Altogether, each term was rated by 10 subjects. The 161 attributes had been derived from the 327 generated in Study 6. Attributes that would have been difficult for subjects to distinguish were combined. Any attribute containing a reference to another emotion was eliminated to avoid confounding family resemblance with similarity of emotions. Finally, some attributes were rewritten to make them easier to rate.

Results and Discussion

Phase 2 family resemblance scores were calculated by first summing the 10 judges' ratings for each attribute. The obtained range of scores

was identical to the possible range: 0–40. In order that attributes associated with more emotions would contribute more to family resemblance scores, an attribute weight was computed to provide something comparable to the attribute weights that had been used in Study 6. The weight for a given attribute was the mean of the judges' summed responses for that attribute across all 20 target emotions. The obtained range was 10.9–24.7. (To provide an estimate of the reliability of these weights, this analysis was repeated after randomly dividing the subjects into two groups. The resulting two sets of attribute weights intercorrelated .92 across the 161 attributes.) The highest attribute weight (24.7) was for "person is preoccupied." Next were "heart-rate increases," "eyes stare," "strong facial expression," "person has strong wants or desires," "person feels sensations in stomach," "person feels restless," "thoughts race through mind," and "muscles tense."

An attribute score was then calculated by multiplying the summed judges' rating by the attribute weight. Finally, these attribute scores were averaged across all 161 attributes for each target emotion and for *emotion*, resulting in the family resemblance scores given in Table 9. The obtained range was 288.0–390.9 for the 20 target emotions; the score for *emotion* was 388.4.

Convergence of Measures of Internal Structure

Six operations have been hypothesized to correlate with internal structure:

1. Frequency in a free-listing task.
2. Probability of emotion as the category name.
3. Direct ratings of prototypicality (goodness of example).
4. Substitutability for the word *emotion* in sentences.
5. Degree of consensus in adjudication of category membership.
6. Family resemblance scores.

Numbers 1, 2, and 3 were meant to chart internal structure as directly as possible; 4 and 5 were hypothesized consequences of internal structure; and 6 concerned the etiology of internal structure. Each task can be expected to produce somewhat different responses. For

example, fear and terror, or excitement and euphoria, are roughly synonymous except for differences in intensity. Although they may receive similar direct prototypicality ratings, the less intense and more frequently used word may nonetheless come more readily to mind.¹ It is, therefore, through a convergence of operations that internal structure is best demonstrated. Correlations among these six operations, calculated across the 20 target emotions, are shown in Table 10. All values were positive, most reliably so. In fact, all operations, save family resemblance, were highly intercorrelated (.57–.86 for raw scores; .62–.93 for rank orders). In addition, we have shown that the category membership of the 10 emotion categories with the highest prototypicality ratings is verified faster than that of less prototypical members (Fehr, Russell, & Ward, 1982). This convergence of measures of internal structure is good evidence for its validity.

The exception was family resemblance scores. The correlations between Phase 1 scores and other measures of internal structure were occasionally modest: between .34 and .85 (.28–.82 based on ranks). Phase 2 scores correlated only .59 (.57 based on ranks) with Phase 1 scores and between .22 and .67 (.28–.45 based on ranks) with other measures of internal structure. These modest correlations contrast with Rosch and Mervis's (1975) finding of substantial correlations (range = .84–.94) between family resemblance and measures of internal structure for natural object categories. Unlike the other indices of internal structure for emotion, family resemblance scores were based on the attributes of emotional states,

¹ Indeed, the readiness with which words come to mind may be thought to be more a function of how commonly they are encountered than a function of their prototypicality. It may be argued that frequency of encounter provides an alternative explanation for the alleged prototypicality effect obtained here. To explore this possibility, we examined the Kučera and Francis (1967) word frequency indices for the 20 target emotion words (or their syntactical variants). With standardized variables, the following regression equation expresses F , frequency of free listing (Study 1), as a function of prototypicality ratings (Study 3) and the Kučera and Francis norms: $F = .72$ (Prototypicality) + .26 (Kučera and Francis). The multiple correlation for this equation was .83 ($p < .01$), and only the prototypicality effect was significant at $\alpha = .05$.

Table 10
Correlations Among Measures of Internal Structure

Measure	1	2	3	4	5	6	7
1. Frequency of free listing ^a		.86	.80	.57	.63	.34	.22†
2. Emotion as superordinate ^b	.91		.85	.66	.78	.37	.38
3. Prototypicality rating ^c	.92	.88		.79	.86	.56	.58
4. Substitutability ^d	.73	.62	.69		.79	.85	.67
5. Consensus as emotion ^e	.93	.93	.87	.65		.60	.58
6. Family resemblance: Phase 1 ^f	.47	.28†	.42	.82	.41		.59
7. Family resemblance: Phase 2 ^g	.35	.28†	.43	.45	.42	.57	

Note. Correlations were calculated across 20 target emotions listed in Table 2. Correlations above the diagonal are based on raw scores; those below the diagonal are based on ranks.

† Not significant at alpha = .05, one-tailed, $N = 20$.

^a Item's frequency score based on all responses given in 1 min (Study 1). ^b Proportion of subjects including the word *emotion* in their response (Study 2). ^c Study 3. ^d Study 4. ^e Proportion of subjects agreeing item is an emotion (Study 5). ^f Study 6. ^g Study 7.

and the attributes of psychological states may be more difficult to articulate than the attributes of everyday objects. Perhaps neither of our measures of family resemblance was adequate (as suggested by their low intercorrelation) or perhaps internal structure of the concept of emotion depends, at least partially, on factors other than family resemblance. For example, peripheral emotion categories may not so much resemble the prototypical emotions less as they resemble prototypical non-emotions more.

General Discussion

Classical Approach Versus Prototype Approach

Do people act as if they understand the concept of emotion by means of a classical definition? So far, the necessary and sufficient features required for a classical definition have not been found. Philosophers and psychologists have not found them, and the subjects in our studies failed to list them. The features most frequently listed for our 20 target emotions were "heart-rate increases," "perspiration/sweat," "obsessive concern with situation," "tears/crying," and "eyes open wider." Do all emotions have all (or any one) of these features? Not according to the subjects of Studies 6 and 7. We don't even have to consider atypical emotions to provide counterexamples: clear cases of happiness and sadness exist with none of these features. Of course, these may

not be the right features, but the question of what are the right features remains.

A classical definition seems especially unlikely when we see disagreement about what is and what is not an emotion. If a person either explicitly or implicitly knows classical definitions for, say, the concepts of pride and emotion, there should be no ambiguity in deciding whether pride is an instance of emotion: The question would simply be whether the set of features defining pride included the set of features defining emotion. But people cannot agree whether pride is an emotion, and it therefore seems unlikely that they know the defining features. Note that the issue here is not the perceptual one of how we decide whether someone is experiencing pride. Rather, the issue is one of meaning: whether, by definition, instances of pride are also instances of emotion. It is this semantic issue that subjects in Study 5 did not know how to resolve.

Is it possible that a classical definition may be uncovered through scientific investigation of actual instances of emotion? That is, may we someday discover necessary and sufficient features in all emotions? Such a discovery would be an extraordinary coincidence. For it would mean that a set of events selected on the basis of one set of features (let us say resemblance to a family of prototypes) just happens to possess, unbeknown to those doing the selecting, another set of features that are common to all instances and that together are

unique to those instances. But there is a more important problem: It is unclear which events the scientists are to investigate, because we cannot agree which events are, and which are not, emotions.

Is the concept of emotion better thought of as prototypically organized? Because no research had previously been done on this question, our studies were highly exploratory. Still, the results could hardly have been more encouraging. Nearly all of the predictions derived from Rosch's theory worked well when extrapolated to the domain of emotion. We cannot say that Rosch's is the only theory consistent with our results. There are now various competing explanations for the sorts of findings we have presented here (see Brooks, 1978; Smith & Medin, 1981). We can say that the success of working within Rosch's framework contrasts with the frustration expressed by writers who have attempted to define emotion from a classical perspective of criterial features and that Rosch's theory has served to reveal properties of the concept of emotion previously overlooked.

Much of our evidence points to the psychological reality of what Rosch calls "internal structure." Although the classical view is not contradicted by the existence of internal structure, it does not account for internal structure. Furthermore, the search for a classical definition might have been motivated by the assumption that to understand a concept one has to know a classical definition for it. Internal structure serves to undermine the classical view by giving an account of how a person can use and can understand a concept without explicitly or implicitly possessing a classical definition for it. Indeed, from the standpoint of a psychologist, the greatest gain from our studies may be the information on how people understand and use the concept of emotion.

For example, internal structure in the concept of emotion may allow us to predict some aspects of how people reason about emotion. Rips (1975) showed that internal structure predicts inductive judgments: People are more willing to generalize from prototypical members of a category to nonprototypical members than vice versa. Told that robins (prototypical birds) have a new disease, subjects were willing to guess that ducks (nonprototypical birds)

would catch the disease. Yet, they were less willing to generalize to robins when told that ducks have the disease. Evidence from Study 4 is consistent with the prediction that reasoning is related to internal structure. Recall that people's statements about emotion appear to make more sense when applied to prototypical emotions than to peripheral ones and that this was true for statements made by psychologists as well as by nonpsychologists. Could psychologists' reasoning be related to internal structure? Suppose you are shown that pride and envy follow a certain psychological law. (The law could be anything—say, that these emotions depend on cognitive labeling of a social situation.) Would you be willing to generalize that law to other emotions? Would you be more willing if you had been shown that more prototypical emotions—say, anger and euphoria—follow that same psychological law?

The prototype approach suggests several additional hypotheses not addressed in the present set of studies. Until now, we've been concerned with the way in which some concepts (fear, love, pride, etc.) are members of another concept (emotion). There is another sense in which something can be a member of a concept, namely, the way in which actual occurrences are members. Our first hypothesis, then, is as follows: In much the same way as the concepts of fear, love, pride, and so on can be ordered according to their degree of membership in the concept of emotion, actual occurrences of fear, love, pride and so on can be ordered in their degree of membership in the concept of emotion. The very best cases of actual pride, respect, and calmness seem rather mediocre examples of emotion when compared with good cases of fear, anger, and love. This is not to say that all instances of anger are better examples of emotion than are all instances of pride. More likely, the prototypical instances of anger are better examples of emotion than are the prototypical instances of pride. Still, there may be cases of pride that are better than are some mild cases of anger. Compare a feeling of overwhelming pride with a minor feeling of annoyance.

Second, we hypothesize that what we are calling the middle level of emotion categories is the basic level. Basic is the category level that provides an optimal balance between sim-

plicity of the category system and the information value of each category. Basic level categories are hence the ones used most often, that appeared first historically and that appear first ontogenetically, and that are labeled by the shortest words (Rosch, Mervis, Gray, Johnson, & Boyes-Braem, 1976). A person uses similar motor actions when interacting with members of a basic level (but not a higher level) category; its category members have a similar visual appearance, and a mental image can reflect the entire category. The middle level of the emotion hierarchy appears to fit this bill. We have short names for many of the concepts at middle level: fear, anger, love, hate, and so forth. We seem to have similar responses to anyone experiencing, say, anger, but not to everyone experiencing an emotion. We seem to be able to visualize a facial expression of anger, or fear, or sadness, but not one of emotion.

Third, we hypothesize that middle-level emotion categories possess an internal structure and fuzzy boundaries. We believe that just as emotion is prototypically organized, fear, love, pride, envy, and the others are each prototypically organized. Consider the prototypical case of fear: A dangerous situation occurs suddenly. You are startled, and you scream. You try to focus all your attention on the danger, try to figure a way out, but you feel your heart pounding and your limbs trembling. Thoughts race through your mind. Your palms feel cold and wet. There are butterflies in your stomach. You turn and flee.

Although we often speak of fear as a thing, a more apt description may be a sequence of events. The sequence just narrated might never have actually occurred in just that way. But to know the meaning of the word *fear* is to know some such sequence. It is to know a *script* (Abelson, 1981) in which events unfold in a certain order. The script contains prototypical causes, beliefs, physiological reactions, feelings, facial expressions, actions, and consequences. The notion of script can thus be seen to extend to episodes the notion of prototype.

Thinking of concepts as scripts may help to clarify a problem at the heart of the prototype approach. The problem concerns resemblance as the criterion of membership and arises because everyone distinguishes real

things from toys, statues, portraits, or any other representation that they resemble (Armstrong et al., 1983). A toy tiger can resemble the prototypical tiger more than does a three-legged, tame, toothless, albino tiger, but one never doubts that the toy is a toy and the albino is a tiger. The concept of script gives the right sense to "resemblance to the prototype" because as a script the prototype includes the history of the object or event. For example, anger feigned on the stage may superficially resemble genuine anger, but the two are distinguishable on the basis of their history—how they come about and where they lead. A toy tiger may superficially resemble a genuine tiger, but the two are vastly different when viewed from a historical perspective. On the other hand, the three-legged albino shares enough tiger history to remain a tiger.

Finally, there is a potential misunderstanding that we would like to avoid. To say that the concept of fear is a script, or to say that the concept of emotion is organized around prototypes rather than being classically defined, is easily misunderstood. For example, we have not said that classical definitions cannot play a role in the study of emotions. We have not said that actual emotional states are inherently prototypical or nonprototypical. We have not said that a frightened person or a person in any specific emotional state is merely acting out a role according to a preconceived script. Rather, we want to say that actual events are said to be or not to be fear, anger, emotion, or whatever to the extent that they resemble certain ideal cases. In other words, the concern of our prototype analysis is with the nature of emotion concepts rather than with the events to which those concepts are applied. The properties of concepts must be distinguished from the properties of events. For example, it is only with respect to a specific concept that an event can be said to be prototypical or peripheral, and the same event can be a peripheral member of one concept and a prototypical member of another.

Psychology of Emotion

We began this article by raising questions that are of interest chiefly to psychologists. Yet, so far, we have said little about the concept of emotion as used in psychology. Part of the

explanation for this omission is that we have been examining a set of concepts, all of which are regularly employed by everyone. The concepts of emotion, anger, fear, love, pride, and the like are not technical concepts. Nevertheless, they play at least two important roles in the psychology of emotion.

For some topics in psychology, everyday emotion concepts are part of the phenomena to be investigated. One example would be the social psychological topic of the perception of emotion in others: the way one person categorizes and labels the emotion of another. Another example may be conscious experience of emotion, at least on Schachter's (1964) account, in which the experience of emotion is thought to be mediated by a person's conceptualization (categorizing and labeling) of his or her own state. Part of the psychologist's job in such cases is to understand emotion concepts as people use them in everyday life.

Emotion concepts also play quite another role in the psychology of emotion, a role in the assumptions psychologists make, the questions they ask, and the answers they offer. This is their role as scientific concepts in the study of actual states. It is a role that has too rarely been examined and about which a prototype analysis raises interesting questions.

To illustrate this role, let us consider what is perhaps the most basic question of all: What is the domain of events that must be explained by any psychological theory of emotion? Often the implicit assumption appears to be that the emotion theorist must explain whatever events are grouped together by the everyday concept of emotion. For example, Brady (1970) studied behavioral measures of emotion, which Plutchik (1980) criticized as not what "most people would call measures of emotion" (p. 92). Another example can be seen in the passage cited earlier in which Averill (1980) said the following:

It is perfectly meaningful to say of a person that he is envious, even though that person might sincerely and vehemently deny the fact. Such a statement would not be meaningful, however, if concepts such as envy referred specifically to feelings. (p. 137)

Averill was offering a counterexample to William James's theory of emotion in which emotion was taken to be a mental feeling. It is not clear how James would reply to Averill, but it is clear that Averill is assuming that any theory

of emotion must include envy within the class of events to be explained. A more recent example comes from an exchange published in *Behavioral and Brain Sciences*. Panksepp (1982) proposed a psychobiological theory of emotion based on four distinct neural systems, which he labeled *rage*, *fear*, *expectancy*, and *panic*. More than two dozen commentaries followed, many of them raising the issue of whether what Panksepp was explaining was really emotion. To cite just 2 from many possible examples: "Expectancy" is difficult for me to view as an emotion" (Lazarus, 1982, p. 439) and "There may be distinctive neural systems which in some sense lie at the base of certain emotional reactions. But these systems are not themselves emotions" (Solomon, 1977, p. 445). In his reply, Panksepp commented as follows: "The semantic controversies that routinely arise in the discussion of emotion have long hindered the progress of research in this area" (p. 449) and it "is unlikely that we can resolve disagreements concerning the meanings of terms such as *emotions* and *feelings*" (p. 453).

Of course, emotion cannot be studied without delimiting the domain to be studied—deciding which phenomena are and which are not in the domain. But the question can be raised whether the everyday concept of emotion defines that domain in the scientifically most useful way. Nor can that domain be studied without employing a set of descriptive concepts—deciding how to categorize or otherwise describe different emotions. The question can also be raised whether everyday middle-level categories of emotion are the best set of descriptors for scientific purposes. Many of the controversies in the psychology of emotion revolve around such issues, and we would like to suggest one possible explanation for why they remain controversies: Emotion theorists face a dilemma. As scientists, they have sought precisely defined descriptive and explanatory concepts and definite, clear-cut answers to their questions. At the same time, they have attempted to be, or their critics have demanded that they be, true to our everyday concept of what emotion is. Why this is a dilemma can be seen by returning to the questions raised at the outset of this article.

Is pain, hunger, alienation, courage, loneliness, religious awe, startle, or lust an emotion?

A yes or no answer for each item on this list would be desirable on scientific grounds, to know, for example, which events a theory of emotion must explain. Furthermore, from a classical perspective it is reasonable to expect yes or no answers. But either answer would misrepresent the idea of emotion as everyone regularly understands it.

Are emotions mental, physiological, or behavioral events? Our prototype analysis suggests that all events referred to by the folk concept of emotion may not share any one such feature. Most cases of emotion may involve a mental (or physiological or behavioral) component, but not all. If so, there would be no simple answer to the original question.

Are some emotions primary, basic, or fundamental, and if so, which ones? Until primary, basic, and fundamental are defined, this question is difficult to interpret. One possibility is that the idea of basic emotions stems from the existence of prototypical emotions. If so, no sharp boundary separates basic from non-basic emotions. Rather, emotions vary in degree of basicness/prototypicality. Again, there is no single answer to the original question.

Is it legitimate to speak of emotions in infants, cats, birds, or insects? The prototypical cases of many emotions, such as love, anger, pride, and envy, probably involve human adults in certain socially meaningful contexts. The activities and contexts of infants, cats, birds, and insects can resemble the activities and contexts of human adults. Still, the resemblance will never be complete, and the further we move from the prototypical case of the human adult, the less resemblance there is likely to be. But there will be no sharp dividing line. Closer examination may reveal more points of similarity (or dissimilarity) and in this way may indicate that the degree of resemblance is greater or smaller. No amount of examination, however, could reveal whether your cat is really in love, no more than whether grey is really black or white.

At some point in this discussion, the reader might have wanted to reply: The psychologist need not be bound by folk concepts of emotion but may alter or abandon them to create a set of technical concepts more useful for scientific purposes. Perhaps new, classically defined concepts can be formulated. Perhaps the fuzziness of everyday concepts can be eliminated

by certain well-placed arbitrary boundaries. This is correct. A prototype analysis is a descriptive, not a prescriptive, analysis. To say that a concept has fuzzy borders is not to advocate fuzziness. Any empirical account of a concept—whether based on prototype or any other theory—describes the current structure of the concept. This is true for Neisser's (1979) analysis of intelligence, Cantor et al.'s (1980) analysis of psychiatric diagnostic categories, and Buss and Craik's (1983) analysis of personality disposition, as well as the present analysis of emotion. We see no reason to suppose that current, everyday folk concepts are the best of all possible concepts. Evidence such as that we have reported here must not be taken as setting limits on the sorts of conceptualizations psychologists can construct in the future. Knowledge of folkways tells us how something is done, not how it can or should be done.

But one point must not be overlooked when considering the creation of new concepts: New concepts do not somehow define *emotion*, *anger* and the rest. New concepts² pick out a new class of events. So far, most psychologists have been reluctant to accept such proposals as Duffy's (1934, 1941) or Mandler's (1975) or Kagan's (1978) to abandon everyday concepts of emotion and to create new ones for scientific purposes. This may be because everyday concepts such as emotion and fear were assumed to be classically definable. Another reason may be that creation of new concepts would involve definition by fiat, a nonempirical approach to delimiting concepts. Still another reason may be a confusion between con-

² It is sometimes thought in discussions such as this that an important question is whether to use everyday words or to create new ones in scientific analyses. It is not. The important question is whether to use everyday concepts or to create new ones. Once this is answered, labeling should follow suit. After all, to label old concepts with new words is superfluous. And to label new concepts with old words is confusing: Doing so would not somehow make the new concepts easier to understand or more relevant than those same concepts labeled by new words. In fact, labeling new concepts with old words seems to invite the sorts of confusions we have seen in the exchanges between James, Brady, Panksepp, and their critics. If the meaning of a new concept is not clear, it is not made clearer by labeling it by an everyday word. Such labeling merely invites the reader to confuse the proposed new concept with the old concept.

cepts and reality or between emotion concepts as phenomena to be explained and as scientific explanatory tools. But the most important reason appears to be that new concepts will not, indeed can not, pick out the same events as picked out by old concepts. The questions emotion theorists find most interesting are phrased in everyday language. The domain of events to be explained is assumed to be just those events picked out by the everyday word *emotion*. A similar situation exists in the diagnosis of mental disorders or in the assessment of intelligence or personality. So there's the dilemma: The old concepts are not what scientific analysis seems to call for, but new, scientifically respectable concepts cannot be equivalent to the old ones and cannot answer the old questions.

How, then, might a prototype analysis be used in the psychology of emotion? Its use depends on which of two tasks the psychologist is performing. One task is to describe the way in which people conceptualize emotions (their own and those of others)—the lay implicit taxonomy of emotion. Here a prototype analysis promises to play a direct, valuable, and heuristic role. In this task, folk concepts cannot be abandoned or altered, for in this task these concepts are not among psychology's explanatory tools but are among the things to be explained. The other task is to ask and answer questions about the events referred to as emotions. Here we have a choice. We can continue to ask and answer questions by means of everyday concepts, to commandeer them for scientific purposes. In this case, a prototype analysis promises to help reveal properties of these concepts, thereby helping to avoid unwarranted assumptions and unanswerable questions. Alternatively, we can choose to develop new concepts. Here, a prototype analysis may or may not play a role—the theorist must choose whether to create concepts that are classically defined or fuzzy, that are internally organized or not, or perhaps, that have some other set of properties altogether.

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