

What's Basic About Basic Emotions?

Andrew Ortony
Northwestern University

Terence J. Turner
University of Kentucky

A widespread assumption in theories of emotion is that there exists a small set of basic emotions. From a biological perspective, this idea is manifested in the belief that there might be neurophysiological and anatomical substrates corresponding to the basic emotions. From a psychological perspective, basic emotions are often held to be the primitive building blocks of other, nonbasic emotions. The content of such claims is examined, and the results suggest that there is no coherent nontrivial notion of basic emotions as the elementary psychological primitives in terms of which other emotions can be explained. Thus, the view that there exist basic emotions out of which all other emotions are built, and in terms of which they can be explained, is questioned, raising the possibility that this position is an article of faith rather than an empirically or theoretically defensible basis for the conduct of emotion research. This suggests that perhaps the notion of basic emotions will not lead to significant progress in the field. An alternative approach to explaining the phenomena that appear to motivate the postulation of basic emotions is presented.

One of the most ubiquitous notions in the emotion literature is that some emotions have a special status. These privileged emotions are usually called *basic*, *primary*, or *fundamental* emotions. For several contemporary theorists, the idea that there exists a small set of basic emotions is central to their theories (e.g., Izard, 1977; Oatley & Johnson-Laird, 1987; Plutchik, 1962, 1980; Tomkins, 1962, 1963, 1984). Yet, although they and many others share the view that some emotions are basic, there is little agreement about how many emotions are basic, which emotions are basic, and why they are basic. Table 1 summarizes the proposals of a representative set of emotion theorists who hold (or held) some sort of basic-emotion position.

As the table shows, some emotion theorists have proposed as few as two basic emotions. For example, Mowrer (1960) proposed just pleasure and pain as the basic emotional states, the onset and offset of which are related to hope, fear, disappointment, and relief. Watson (1930) included only 1 of these, fear, in his 3 basic emotions of fear, love, and rage. More recently, Panksepp (1982) has proposed 4 basic emotions, expectancy, fear, rage, and panic; Kemper (1987) has proposed fear, anger, depression, and satisfaction; and Oatley and Johnson-Laird (1987) base their theory on the primacy of happiness, sadness, anxiety, anger, and disgust. At the other end of the scale, Frijda (1986) identified 18 basic emotions, including arrogance, humility, and indifference, as well as more commonplace examples, such as anger, fear, and sorrow; however, on other occasions (personal communication, September 8, 1986), he proposed only 6 basic emotions and in one article (Frijda, 1987) he

seemed to argue for only 2. Between these extremes are many theorists suggesting different numbers of emotions. Tomkins (1984), for instance, believed there are 9, and Izard (1977) suggested there are 10.

The divergence of opinion about the number of basic emotions is matched by the divergence of opinion about their identity. Some lists of basic emotions include terms that are included in no other list. For example, only Arnold (1960) included courage, Plutchik (1980) gave acceptance and anticipation, and McDougall (1926) suggested that subjection and "tender-emotion" are basic emotions. Whereas these are cases of basic emotions that appear to be unique to particular theorists, there are other candidates about which there is a little more, but by no means substantial, agreement. For example, contempt is believed to be a basic emotion only by Izard (1977) and Tomkins (1984; although recently Ekman & Friesen, 1986, have added it to their list of basic emotions), and the states of interest and surprise are both thought to be basic emotions only by Frijda (1986), Izard (1977), and Tomkins (1984).

What is one to make of all this? If there really are basic emotions, how can there be so much disagreement about them? One approach to answering this question might be to argue that whereas substantial disagreements exist, the extent of the differences is not really as great as our brief review suggests. If one were to take this approach, one would focus more on the agreement rather than on the disagreement among the researchers. One might point to the fact that nearly everybody who postulates basic emotions includes anger, happiness, sadness, and fear. One might also argue that not all of the variation in lists of basic emotions is real because the same emotion is often labeled differently by different researchers. Some theorists use the term *anger* and others the word *rage* while presumably referring to the same emotion; some speak of *fear* whereas others speak of *anxiety*; and the same pleasant emotion may be labeled *happiness* by one author, *joy* by another, and *elation* by yet another. One might argue for less obvious agreements as well. Although Panksepp (1982) is the only theorist who listed expectancy and

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Correspondence concerning this article should be addressed to Andrew Ortony, Institute for the Learning Sciences, Northwestern University, 1890 Maple Avenue, Evanston, Illinois 60201.

Table 1
A Selection of Lists of "Basic" Emotions

Reference	Fundamental emotion	Basis for inclusion
Arnold (1960)	Anger, aversion, courage, dejection, desire, despair, fear, hate, hope, love, sadness	Relation to action tendencies
Ekman, Friesen, & Ellsworth (1982)	Anger, disgust, fear, joy, sadness, surprise	Universal facial expressions
Frijda (personal communication, September 8, 1986)	Desire, happiness, interest, surprise, wonder, sorrow	Forms of action readiness
Gray (1982)	Rage and terror, anxiety, joy	Hardwired
Izard (1971)	Anger, contempt, disgust, distress, fear, guilt, interest, joy, shame, surprise	Hardwired
James (1884)	Fear, grief, love, rage	Bodily involvement
McDougall (1926)	Anger, disgust, elation, fear, subjection, tender-emotion, wonder	Relation to instincts
Mowrer (1960)	Pain, pleasure	Unlearned emotional states
Oatley & Johnson-Laird (1987)	Anger, disgust, anxiety, happiness, sadness	Do not require propositional content
Panksepp (1982)	Expectancy, fear, rage, panic	Hardwired
Plutchik (1980)	Acceptance, anger, anticipation, disgust, joy, fear, sadness, surprise	Relation to adaptive biological processes
Tomkins (1984)	Anger, interest, contempt, disgust, distress, fear, joy, shame, surprise	Density of neural firing
Watson (1930)	Fear, love, rage	Hardwired
Weiner & Graham (1984)	Happiness, sadness	Attribution independent

Note. Not all the theorists represented in this table are equally strong advocates of the idea of basic emotions. For some it is a crucial notion (e.g., Izard, 1977; Panksepp, 1982; Plutchik, 1980; Tomkins, 1984), whereas for others it is of peripheral interest only, and their discussions of basic emotions are hedged (e.g., Mowrer, 1960; Weiner & Graham, 1984).

Plutchik (1980) the only one who identified anticipation as a basic emotion, the way the authors used these terms suggests that perhaps they were both referring to desire, which is also listed as a basic emotion by Arnold (1960) and Frijda (1986). Similarly, Panksepp's *panic* might be relabeled as *distress*, which can be found in many people's lists.

Whereas such maneuvers reduce the disagreement, they do not and cannot eliminate it. Part of the problem lies in the difficulty of knowing what could count as evidence that different theorists are referring to the same emotion when they use different terms. A second problem is that for some theorists (e.g., Weiner & Graham, 1984), the (only) basic emotions are superordinate ones such as happiness and sadness, whereas for others, the basic emotions are more specific and lower in a hierarchical structure. Whether one thinks that basic emotions are the superordinate ones (perhaps out of which more specific ones are later differentiated) or that the more specific ones are basic is not just a matter of focus; they are quite different theoretical claims with quite different consequences. The problem of what different emotion words are used to refer to is not, of course, a problem that is unique to emotion theorists, or even to psychologists. It is a problem about the vagueness of language, especially with respect to terms that refer to psychological states. However, this fact, although perhaps constituting at least

a partial explanation of the confusion, does not mitigate it. If anything, it adds to the confusion because it suggests that there is a general problem about how to talk about the objects one wishes to study. Although we think there are ways of talking about emotions that can finesse the problem of what ordinary-language emotion words refer to (e.g., Ortony, Clore, & Collins, 1988), we do not see such proposals as providing a satisfactory resolution to the question of which emotions are the basic ones. Thus, we think the landscape of basic emotions is close to being as disorderly as Table 1 implies.

Why Postulate Basic Emotions?

In attempting to evaluate claims about basic emotions, the first question that needs to be addressed concerns the theoretical role of the notion of basic emotions. Why do theorists propose them? What would be the consequences of success or failure in the quest for a set of basic emotions? We should perhaps mention at the outset that whereas a belief in the existence of a small set of basic emotions is held, if not explicitly, at least implicitly, by many influential emotion theorists, it is certainly not held by all and is explicitly rejected by some (e.g., G. Mandler, 1984).

Perhaps the most common reason for proposing basic emo-

tions is to provide an explanation of some routine observations about emotions. These observations include the fact that some emotions appear to exist in all cultures and in some higher animals as well, that some emotions appear to be universally associated with and recognizable by characteristic facial expressions, and that some emotions appear to serve identifiable biological functions related to the survival needs of the individual and of the species.

Two main approaches to proposals about basic emotions, and one subsidiary one, can readily be distinguished. The subsidiary approach deals not so much with basic emotions as with basic emotion concepts (e.g., Fehr & Russell, 1984; Shaver, Schwartz, Kirson, & O'Connor, 1987). The two main approaches, which we discuss in greater detail, correspond roughly to two different conceptions of basic emotions—a conception of them as biologically primitive and a conception of them as psychologically primitive, that is, as the irreducible constituents of other emotions. The perspective corresponding to the biological primitives view appears to rest on the belief that the central issues concerning the problem of emotions can be dealt with by understanding their evolutionary origin and significance and that this can best be achieved by discovering and examining the biological underpinnings of emotions. Thus, the main theoretical purpose served by the biological view of basic emotions is to contribute to an understanding of the functional significance of emotions for individual organisms and their species. The idea is that the biologically based basic emotions are more likely to be found in more human cultures and in more species, whereas other emotions are more likely to vary across cultures and to be species specific. From this position, it is but a short step to a search for emotion-specific neurophysiological and anatomical substrates that can be found in all mammals and perhaps even in some related vertebrates.

The second main approach to basic emotions, the psychological primitives view, often starts from the position that there is a limitless number of emotions (e.g., Kemper, 1987). The idea that there might be some small, basic set out of which all others are built then offers the prospect of rendering the domain tractable. Once such a set is identified, the research agenda becomes clear: First, one can investigate the basic emotions themselves, and second, one can attempt to use the basic emotions as primitives in the study of other, nonbasic emotions by developing some kind of combinatorial model.

Not surprisingly, these two conceptions of basic emotions are not entirely independent of one another. If one views basic emotions as biologically primitive, it is easy to suppose that they are also psychologically primitive, and thus that they are capable of bearing a large part of the explanatory burden for the whole range of emotions. Similarly, for those starting from the view of basic emotions as psychological primitives, it would come as no surprise to discover that they had a biological basis.

The issues upon which we focus concern the empirical “cash value” of the concept of basic emotions. We are interested in what it means for a theory of emotion to postulate the existence of basic emotions—in what the empirical content of such a claim is. The distinction between the biological and psychological view is only of secondary interest. We view it as a kind of heuristic for analyzing the problem, rather than as an issue in itself.

Were the quest for basic emotions to succeed, there would be at least two important consequences. First, perhaps less speculative accounts of the functions of emotions could be proposed. Second, as already suggested, some theorists believe that a small but nontrivial set of basic emotions (i.e., more than two) would enable the entire domain to be explained in terms of them. A question that we postpone until the end of this article is whether failure to discover a set of basic emotions would mean that no progress can be made on these questions.

Are Proposed Basic Emotions All Emotions?

There are many reasons for the lack of agreement that seems to surround the notion of basic emotions. The first we discuss is a consequence of the fact that theorists do not always agree about what emotions are. The result is that some theorists' lists of basic emotions contain states that others do not consider to be emotions at all, let alone basic ones. One of the most prevalent examples of this source of disagreement is surprise.

Although surprise is often included in lists of basic emotions (Campos & Barrett, 1984; Ekman, Friesen, & Ellsworth, 1982; Izard, 1971, 1977; Plutchik, 1980; Tomkins, 1962),¹ it is by no means self-evident that surprise is an emotion (G. Mandler, 1984; Mees, 1985; Oatley & Johnson-Laird, 1987; Ortony, 1987; Ortony, Clore, & Foss, 1987). One reason for questioning the claim that surprise is an emotion is that in all clear, nondebatable examples (fear, anger, shame, relief, happiness, etc.), emotions are affectively valenced states (Ortony et al., 1988; Ortony et al., 1987). That emotions are either positive or negative seems to be an eminently reasonable weak assumption. Furthermore, it is an assumption that appears to be tacitly shared by subjects rating their confidence that different states are emotions, at least insofar as ratings of surprise and interest are concerned (Ortony, 1987). Thus, we assume that being affectively valenced is a necessary condition for a state to be an emotion. Excluded from this view is the possibility that an emotion could be affectively neutral. However, surprise can be affectively neutral. When a person is surprised by something, nothing is entailed about the affective state of the person. It could be positive, negative, or neutral.² From this perspective, surprise is better viewed as an (intrinsically unvalenced) cognitive state (Ortony et al., 1987), that is, as a state that focuses on aspects of knowledge and belief rather than on affect per se. Surprise is not itself an emotion, although it often plays a major role in the elicitation and intensification of emotions. When surprise is valenced,

¹ Some authors vacillate on the status of surprise. For example, Izard (1971) included it as one of his nine fundamental emotions but later said, “Tomkins has theorized, and I agree, that surprise is not an emotion in the same sense as the others” (p. 291). Shaver, Schwartz, Kirson, and O'Connor (1987) also considered surprise to have a status rather different from the other main clusters of emotions that they cautiously labeled *basic*.

² To see this, compare the cases of being surprised about winning a huge prize in a lottery (positive), being surprised about the failure of one's brand-new car to start one morning (negative), and being surprised by some highly improbable but personally irrelevant fact such as that all the members of some committee by chance share the same birthday (neutral).

as in the case of shock, for example, the valence results from aspects of the surprising situation other than the surprise itself. Of course, it is true that we have only assumed, rather than proved, that emotions must be valenced and that therefore surprise is not an emotion. However, we are no more guilty in this respect than are those who assume that surprise is an emotion, and at the very least, it is indisputable that there exists no consensus that surprise is an emotion.

Surprise is not the only questionable example of an emotion to be found in lists of basic emotions. Interest has been called a basic emotion by some researchers (e.g., Frijda, 1986; Izard, 1977; Tomkins, 1984), sometimes on the grounds that it exhibits a distinctive facial expression. Psychobiologists also sometimes include something roughly interpretable as interest in their proposals (e.g., Panksepp's 1982 "expectancy" system). We, on the other hand, do not consider interest to be an emotion (see also G. Mandler, 1984; Oatley & Johnson-Laird, 1987). Our rejection of it is again based on the fact that it is not intrinsically valenced, even though some argue that it is positively valenced. We view interest as a cognitive state, not an affective one. To be interested in something is to have one's attention captured by it, or to be curious about it. For example, if one returns to one's house to discover that it has been ransacked, one might well have an intense interest in discovering who did it. There is no reason to suppose, however, that this state of interest is a positive state (or a negative one). It would seem much more fruitful to view it as a motivational state (a desire; possibly, in some sense, even a basic desire), but for desires, we argue later, the question of valence does not arise. Viewed in this way, interest is no more an emotion than is thinking. It may be caused by emotions, and it may give rise to them, but there is no reason to suppose that it is one.

We have argued that the status of surprise and interest as emotions is questionable, but our discussion of interest raises the question of how to deal with desire. Is desire an emotion? If Table 1 is used as a benchmark, most theorists do not believe that desires are emotions (or at least not basic emotions). Of those who do (e.g., Arnold, 1960; Frijda, 1986), the basic desires are aversion and desire itself. Assuming, again, that emotions must be intrinsically valenced, one might be inclined to reject desires as emotions. The locus of valence for desires lies in the object of desire, not in the desire itself. Whereas nobody would want to deny that anticipated pleasure (positive valence) can sometimes be intimately related to a desire, one cannot argue that wanting something is the same as anticipating the pleasure of having it. Indeed, desires do not necessarily involve anticipated pleasure at all. For example, one might want to fill one's car with gas before going on a trip, while neither anticipating nor experiencing any pleasure on success. In this example, anticipated pleasure plays no role. One might propose that in such a case the real desire is to avoid the anticipated displeasure at failing to fill the car, but it seems much less strained to retain the notion that the object of the desire is to fill the car with gas and that any role of anticipated displeasure (or pleasure) is as a cause of the desire, not as the desire itself. On this view, the role of valence in motivational states is one of cause, not of content, which means that the question of valence simply does not arise with respect to the content of motivational states as it does for emotional ones. So, there is an intimate connection between

emotional and motivational states, but the fact that emotion and motivation are often causally related does not entail that they are reducible one to the other. If desires are not emotions, then lists of basic emotions that include either specific desires or desire itself are in error.

However, even if one were to grant, for the sake of argument, that desires are emotions, the question still remains as to why authors who include desire as a basic emotion suggest desire in general, rather than particular desires. None of the authors listed in Table 1 listed specific desires (apart from interest, if it is so viewed), although Campos and Barrett (1984), who are not listed, considered sexual ardor to be a basic emotion. Surely, however, in whatever sense the word *basic* is used, the desire to escape a threat would have to be at least as basic as the related (basic?) emotion of fear, and the desire to attack as basic as anger. If this is the case, then those who view desire (in general) as a basic emotion commit a kind of category mistake by treating it on the same level as particular emotions rather than recognizing that desire and emotion are both superordinate categories, with specific desires and specific emotions as exemplars. One reason why lists of basic emotions tend to include only desire in general, rather than specific desires, may be that whereas English has individual terms for many of the specific emotions, it has relatively few for specific desires. Furthermore, many of the specific desires that are lexicalized in English do not sit well as emotions: Consider *hunger*, the desire for nourishment; *thirst*, the desire for drink; *lust*, the desire for sex; and *curiosity*, the desire for information. Yet, regardless of how desires are labeled in language, there is a prima facie case for supposing that the number of specific desires is of the same order of magnitude as the number of specific emotions. Thus, one must conclude that if one takes desires to be emotions, then desires are underrepresented in lists of basic emotions and that this underrepresentation may be the result of linguistic rather than psychological considerations.

It seems to us, then, that there are many words in lists of basic emotions that refer not to emotions (i.e., necessarily valenced, affective states) but to (not necessarily valenced) cognitive states and that the status of desires is problematic. Such problems probably go some way toward explaining the lack of agreement in lists of basic emotions. However, the main problem remains, namely that of whether the proposed emotions are really basic, and if so, in what sense.

As we have already indicated, in the context of emotions, terms such as *basic*, *fundamental*, and *primary* are used by different theorists in at least three ways. The first way is concerned with whether certain emotion words represent basic-level concepts in the sense of Rosch's theory (e.g., Rosch, Mervis, Gray, Johnson, & Boyes-Braem, 1976), and therefore it does not deal directly with whether the corresponding emotions are basic. The second and third senses of the word *basic* are concerned with the status of the emotions themselves. The first of these treats an emotion as basic if it is biologically given. The second treats an emotion as basic if it is psychologically primitive, that is, if it is not decomposable into other emotions. It is helpful to consider these different senses separately because they have rather different empirical consequences. Nevertheless, although the different notions of basic emotions tend to be associated with different empirical criteria, we should reiterate

that protagonists of basic emotions do not necessarily treat these three conceptions as being mutually exclusive. Some theorists use criteria associated with many views. Izard (1977), for example, described fundamental emotions as those that have a specific, innately determined neural substrate, a characteristic facial expression, and a distinct phenomenal quality. Kemper (1987) went further and proposed five criteria, including evolutionary significance, ontogenetic primacy, cross-cultural universality, differentiated autonomic patterns, and the integration of social relations, emotions, and physiological processes.

We start our review by briefly discussing the issue of basic-level emotion concepts.

Basic-Level Emotion Concepts

During the last few years, several theorists (e.g., Averill, 1982; de Rivera, 1981; Fehr & Russell, 1984; Kagan, 1984; Kövecses, 1986; Shaver et al., 1987) have discussed, and in some cases begun to explore empirically, the concept of emotion with respect to the notions of basic-level categories and prototype theory (e.g., Rosch, 1973; Rosch et al., 1976). To do this, they have had to extrapolate the notion of basic-level objects to the domain of abstract psychological objects, even though many of the characteristics of basic-level objects that Rosch identified are not and cannot be present because they can only be applied to concrete objects. Nevertheless, some theorists have proposed that a number of emotion words are basic-level terms that refer to basic emotions. For example, Shaver et al. (1987) proposed five basic-level emotion terms: *fear*, *sadness*, *anger*, *joy*, and *love*. They supported their claims by arguing that speakers of English regard these labels as the best exemplars of the emotion category (Fehr & Russell, 1984), that it is easy to picture angry or fearful people but difficult to picture people who are experiencing what fear and anger have in common, that people have scripted or programmed ways of interacting with others who are experiencing basic-level emotions but have no scripts for interacting with people who are feeling an emotion from a more general category of emotions, that emotions are first encoded in terms of basic-level categories, and that each of the five categories has an internal structure (fear is broken up into anxiety and fear proper) that differentiates among different forms of the basic emotion.

If one considers these criteria, one notices a shift of reference of the terms involved—a shift that is no doubt inescapable in any attempt to apply such criteria to emotions. For example, it is suggested that part of the evidence for the claim that *anger* is a basic-emotion term is the fact that it is easy to form an image of an angry person, but, of course, an angry person is not the emotion of anger. The word *anger* refers to an emotion, and whatever an emotion is, it is not simply somebody behaving in a certain kind of way. Thus, whereas in the case of concrete objects, criteria based on the physical appearance and properties of the referent can readily be applied, in the case of abstract objects like emotions, the referents have to be changed from the emotions themselves to people experiencing or exhibiting evidence of experiencing them. However, this shift in reference of emotion terms, from emotions to the display of them, is not, and perhaps cannot be, justified. If, in the context of reasoning about basic-level categories, there is anything to be inferred

from the fact that people find it easy to imagine an angry person, it is something about their concept of an angry person, rather than something about anger. Furthermore, recent research raises questions about the early acquisition of basic-level concepts. J. Mandler, Bauer, and McDonough (1990) reported various developmental data that “pose a dilemma for either the notion that basic-level categories are the first to be formed or that the use of basic-level terms is evidence for the primacy of basic-level categorization” (p. 40). They presented evidence suggesting that the conceptual entry level for the child is not the basic level but the global categories out of which basic-level categories are differentiated (see also L. B. Smith, 1989), and to some extent this appears to borne out by some of the developmental work on emotion (e.g., Sroufe, 1984).

We do not deny that one can derive informative taxonomic hierarchies of emotion terms, at least in a language as rich in emotion terms as is English. Nor do we deny that in such languages one finds a number of general terms for emotions, such as *happiness*, *anger*, and *sadness*, with other emotion terms subordinate to these general labels (Fehr & Russell, 1984; Shaver et al., 1987). Certainly, it is reasonable to suggest that indignation and resentment are kinds of anger, grief and disappointment kinds of sadness, and pride and relief kinds of happiness. What is less certain, however, is that the available arguments or data force one to accept the conclusion that the basic-level terms refer to basic emotions. To be fair, we acknowledge that many investigators are rather cautious in this regard. They raise the possibility rather than assert the conclusion. For example, Shaver et al. (1987), after noting that the basic-level terms revealed by their analyses overlapped with many theorists' lists of basic emotions, said:

It is common for prototype researchers . . . to argue that the structure of representation necessarily reflects the gross structure of reality, or at least the distinct features of reality that are most important for human transactions with the world. This suggests that a prototype analysis of the emotion domain *might* produce useful information not only about the cognitive representation of emotion episodes but also about *the actual nature of human emotions*. (p. 1062, italics added)

Yet, the fact remains that examinations of the hierarchical structure of emotion words are concerned with “the nature of emotion concepts rather than with the events to which those concepts are applied” (Fehr & Russell, 1984, p. 482).

When features are correlated in the environment, as the features of possessing wings and feathers are for members of the category *bird*, then one can properly say that the category indicates something about the world, not just something about language. But do basic-level emotion terms cut nature at its joints in this way? To answer this question, we need evidence of a quite different kind than that used by Fehr and Russell (1984) and Shaver et al. (1987) to classify basic-level terms. We would need to show, for example, that these emotions are biological givens in humans. It is to this possibility that we now turn.

Basic Emotions as Biologically Primitive

When emotion theorists conceive of basic emotions as being biologically primitive, they usually do so because they believe that the basic emotions possess particular evolutionary signifi-

cance related to needs that must be met if the individual or species is to survive. The most explicit modern statement of this essentially Darwinian position is to be found in Plutchik's psychoevolutionary theory of emotion (e.g., Plutchik, 1962, 1980), which maintains that happiness is related to the need to reproduce, fear to the need for protection, sadness to the need to maintain possession of a pleasurable object, and so on (see also Oatley & Johnson-Laird, 1987).

The biologically based view of basic emotions has several empirical consequences. The most general of these is that if some emotions—basic emotions—are biologically given, then they must in some sense be universal. For example, if basic emotions are part of the biological makeup of a species, then one might expect them to be “hardwired,” and so one would expect to find neurophysiological or anatomical evidence of them in all (normal) members of the species. Furthermore, from a phylogenetic point of view, one might expect to find evidence of basic emotions in other (phylogenetically close) species, whereas there would be no reason for such an expectation vis-à-vis non-basic emotions.

Empirical studies of basic emotions as biologically primitive have used both direct and indirect techniques. Recently, the direct techniques, used by psychobiologists, have sought to identify specific neural structures corresponding to different emotions, although there is a considerable body of literature reporting attempts to relate specific patterns of physiological, especially *autonomic nervous system, activity to different emotions* that we shall not discuss in any detail (see Frijda, 1986, for a survey). The most widely used indirect technique seeks to establish basic emotions by identifying emotions that are universally associated with and recognizable by distinctive facial expressions (see, for example, Darwin, 1872/1965; Ekman et al., 1982; Izard, 1977; Tomkins, 1962, 1963). Indeed, Ekman (1984) went so far as to propose that if there is no distinctive universal facial expression associated with a state, then the state should not be called an emotion at all.

As far as the neural structure criterion is concerned, certainly if particular emotions were shown to be uniquely tied to specific brain structures, one might be inclined to think that the emotions in question were biologically basic. Unfortunately, existing research results do not provide encouraging evidence for neural structures corresponding to recognizably different discrete emotions. The research suggests not so much hardwired neural circuitry for individual emotions, but circuitry for emotion, or perhaps better termed response *systems*. Indeed, in responding to commentaries on his arguments for four basic emotions (expectancy, fear, panic, and rage), Panksepp (1982) conceded that he was not really talking about individual emotions at all; rather, he was talking about four systems, which, he said, might be referred to as exploration–curiosity–foraging–expectation–desire, flight–caution–anxiety–fear–horror, offense–irritability–anger–rage–fury, and crying–sadness–sorrow–grief–panic. Similarly, Gray (in press) discussed three separable emotion subsystems embedded within separate punishment and reward structures in the brain. These systems are the approach system, which one might loosely associate with a positive emotion such as joy; the fight–flight system, which one might associate with rage and terror; and the behavioral inhibition system, which is the source of anxiety. However, Gray generally avoided

relating these systems to recognizable everyday emotion terms, which, in light of the kinds of groupings that Panksepp proposed, might be regarded as a prudent decision. In fact, Gray (in press), argued that systems responsible for aggression cannot be separated from those responsible for flight, both of which are closely tied to the mechanisms that mediate the central perception of pain. He thus preferred to “speak of a single ‘fight/flight system’ rather than differentiating between two such apparently grossly different forms of response” (Gray, in press). Care is needed in interpreting this claim because Gray considered fear (along with anxiety) to be mediated by the behavioral inhibition system rather than by the fight–flight system. He considered the emotion associated with the flight response to be not fear, but rather some “quite different emotional state” (Gray, personal communication, May 3, 1988), one that might perhaps be called *terror*. It strikes us as implausible that the terrorlike emotional state associated with a strong urge to flee should be fundamentally unrelated to the emotion of fear. Insofar as it is related, and insofar as Gray identified the same separable subsystem for terror as he did for anger (he preferred to call it *rage*), the neural structure criterion does not readily lead to the conclusion that fear is a (biologically) basic emotion, even though it provides evidence that certain response patterns are biologically determined.

In view of such facts, to conclude that the little neural and physiological evidence that exists supports the idea of basic emotions would be at best premature. On the other hand, the evidence does seem to be consistent with the possibility that some of the response patterns associated with emotions are hardwired. The significance of this possibility will become clear after we discuss the question of the universality of facial expressions of emotions.

Several studies have been conducted to investigate the possibility that some emotions have a similar facial expression across cultures, and indeed across species. For example, Darwin (1872/1965), in his book on the expression of emotion in humans and animals, argued that emotions such as sadness and happiness are innate in humans, partly because they are similarly expressed in all cultures. This conclusion has been echoed in more recent research by various investigators (e.g., Ekman, 1982; Izard, 1969), who have argued that emotions such as happiness, sadness, anger, disgust, and fear are indicated by similar facial expressions in Europe, the United States, Japan, and Africa. Even in cultures with virtually no contact with Western people, such as the Dani of Iran and the South Fore of New Guinea, these emotions (and perhaps others) are shown in the face in the same way as they are in the West (Ekman, 1973). On this basis, Ekman concluded that happiness, anger, disgust, sadness, fear, and surprise are universal and innate emotions. Izard's (1971) list of basic emotions includes these, plus interest, contempt (added by implication, by Ekman & Friesen, 1986), distress, guilt, and shame.

Intuitively attractive as it may be as a criterion for the biological primitiveness of certain emotions, the universal display and recognition of facial expressions is problematic. The main argument used in favor of this position is that if some emotions are expressed in the face in all human cultures, then those emotions must have a special, biologically given status. The problem that we see with this line of reasoning is that the universality of a

facial expression associated with some particular emotion does not establish that it is the emotion that has a special status. It might be more profitable to consider the linkage between certain components of emotions and other components of expressions as being basic and biologically given than it is to attribute this property to the emotions themselves.

We take the impressive collection of evidence on the relation between facial expressions and emotions as indicating first that emotion expressions are built up by drawing on a repertoire of biologically determined components, and second that many emotions are often, but by no means always, associated with the same limited subset of such components. This view has certain empirical implications that are borne out by existing data. First, facial expressions can arise independently of emotions. There is a great deal of empirical evidence (e.g., Darwin, 1872/1965; Ekman, 1982; Izard, 1969, 1971, 1977) that there is a characteristic facial expression that often accompanies states that we earlier rejected as emotions, namely interest and surprise. And, lest readers remain unconvinced that these states are not emotions, one might consider the case of effort. Suppose that we were to observe across all human cultures (as we almost certainly could) that the expenditure of a great amount of physical effort (such as lifting something extremely heavy) universally produced a distinct and recognizable facial expression. There would be no reason to suppose that anything observed in the face in such a case would be the expression of an emotion.

Second, the view that we are proposing allows for the possibility that the linkage between facial expressions and emotions is not inviolable and that in some cases it is possible to observe facial expressions that might be typical of one emotion arising in conjunction with a different emotion. For example, in many cases of extremely intense positive emotions, such as intense relief or pride, the facial expressions (including weeping) often are indistinguishable from those associated with extreme distress.

It seems to us, therefore, that the most prudent approach is to admit that the universal production of distinctive facial expressions is neither necessary nor sufficient for (basic) emotions. We think it more profitable to suppose that some facial expressions are characteristic of some emotions—that they constitute a guide rather than a guarantee. However, there is no reason to believe that emotions that are reliably associated with particular facial expressions have some special, basic status. As we have already indicated, and argue in greater detail in the next section, it is plausible to suppose that some components of facial expressions are biologically given and that these components may be hardwired to emotional and nonemotional states. However, this is a quite different claim from one that postulates that the emotions themselves are biologically given.

A different approach to the relation between facial (and other kinds of) expressions and basic emotions can be found in animal studies. Certainly it is reasonable to suppose that many higher animals experience emotions similar to some of the human emotions, and humans frequently attribute such emotions to them. In the case of chimpanzees, the evidence that they experience fear, anger, and other emotions is almost as compelling as it is for humans, as was argued more than 40 years ago by Hebb (1946). For example, Chevalier-Skolnikoff (1973), in her review of the facial expression of emotion in nonhuman pri-

mates, argued that some human expressions, such as those for anger, sadness, and affection and the expressions of crying and laughter or play, appear to be homologous and phylogenetically related to primate expressions. At the same time, it seems less plausible to suppose that such animals can experience the same range of emotions as humans can. Perhaps, therefore, the basic emotions are those that can be experienced by humans and other animals and therefore are those that are likely to serve important biological and evolutionary functions. The problem, of course, is to know what these emotions are and for those that are not experienced by animals, to know why they are not. So, for example, one may feel confident in attributing anger and fear to chimpanzees, cats, dogs, and even rats, but how would humans know whether a chimpanzee could have the emotion of, say, envy? And, assuming that a chimpanzee could be embarrassed or ashamed, one surely would be most reluctant to attribute such emotions to rats. The general conclusion is that one could order emotions in terms of their assumed prevalence in different species, and one could then argue that fear, being quite prevalent in different species, is *more* basic than envy or embarrassment, which we would presumably assume to be less prevalent. However, such a conclusion (that emotions vary in the degree to which they are basic) is quite different from one that postulates a dichotomy into basic and nonbasic emotions. Not only does there appear to be no possible objective basis for drawing the line between basic and nonbasic emotions, but, more seriously, abandoning a categorical distinction between basic and nonbasic emotions would undermine the potential usefulness of the basic-emotion construct.

Finally, there is a problem with the assumption, often made in the animal studies, that the universality of certain facial expressions (and other responses) indicates that the corresponding emotions are basic. As we have already indicated, our view is that the universality of such expressions (responses) indicates that certain components of the emotional response might be basic but that this does not entail that the emotions of which they are a part are basic emotions (see also Scherer, 1984). In the next section, we explore this possibility.

An Alternative Approach to the Biological Building Blocks of Emotions

To illustrate the kinds of biologically determined subcomponents that might underlie emotions, we take the facial expression component of anger as an example and discuss what the various components of the expression might imply about the mental state of the person experiencing anger and about the status of anger as a basic emotion.

There is a prototypical expression of anger that, because it appears to be species wide, has led many researchers to conclude that anger is a biologically basic emotion (e.g., see Darwin, 1872/1965; Ekman, 1973; Izard, 1969; Tomkins, 1962, 1963, 1984). We focus on four parts (or components) of this expression. Our interpretations of the meanings of these components are tentative and should be read merely as illustrations of how we consider one might think about the data on facial expressions (see also, C. A. Smith, 1989).

Consider first the furrowed brow that plays such a large role in the prototypical expression of anger. This component of the

anger expression seems to reflect not anger *per se*, but a mental state in which the person is conscious of being unable to attain a goal, due to some unexpected blockage. This interpretation is compatible with the evidence that a frown often accompanies states such as frustration, puzzlement, concentrated attention to a problem, a difficulty encountered in a task, and so on (Cacioppo, Petty, & Morris, 1985; Darwin, 1872/1965). The reason a frown is part of the prototypical anger expression might therefore be that one of the common components of the eliciting conditions of this emotion is the frustration of an attempt to attain a goal: One is frustrated by (and angry at) the car that refuses to start or a person who stands in the way of what one wants. Recently, C. A. Smith (1989) reported empirical evidence for the connection between the perception of an obstacle (goal blockage) and the frown.

A second component of anger is the desire or the tendency to aggress against the agent who is blamed for what has happened. Such aggression might take the form of a physical assault, shouting or screaming, or other actions. This tendency is evidenced by many components of facial expression and bodily action. For example, an open, "square" mouth, with the teeth showing, seems to reflect this tendency, as do, at least in Western culture, clenched fists. Because the tendency to attack is, in adults, only appropriate when the instigator has done a major wrong, these subcomponents tend to be seen only when a person is intensely angered and, more important, is confronting the target in a situation where physically aggressive responses are possible and perhaps normative. They are rarely seen when physical aggression is impossible, in reality or in imagination, which suggests that these expressive subcomponents are dissociable from anger.

Another common, and related, component of anger is a determination or resolve, usually to take some unpleasant action, typically not aggression against the instigator, but perhaps action to remove the source of the goal blockage. As Darwin (1872/1965) suggested, determination appears to be expressed in the face by the compression of the lips (Frijda, 1986, offered the related and interesting suggestion that this response may reflect an attempt at self-control). Again, this component of facial expression is dissociable; it is not essential to anger, nor limited to it, and seems to appear only when the appropriate mental state occurs.

Finally, the upper eyelids are often raised in anger and, like Darwin (1872/1965), we take this as a manifestation of the fact that the person is devoting considerable attention to the visual environment. This component of facial expression is also found in many other response patterns apart from anger and is not always found in anger (e.g., angry people sometimes narrow their eyes rather than widening them). In anger, this subcomponent is likely to be evident only when the target of the anger can be seen (and perhaps when the angered person is considering aggression against the target).

Thus, in the prototypical anger expression (furrowed brow, square mouth, compression of lips, and raising of the eyelids), there seems to be no necessary connection between each of the four subcomponents and the existence of anger. Each can occur apart from anger and in fact seems to indicate the occurrence, not of anger, but of some other mental state. Thus, perhaps these subcomponents are better regarded as dissociable elements that

can appear separately and that combine to form the prototypical anger expression only under specific circumstances. Because they are dissociable, such subcomponents can appear in other emotions without the implication that anger is somehow blended into the new emotion. Their presence suggests instead that the underlying appraisal that activated the subcomponent is present in the new emotion.

These kinds of arguments are not limited to the facial expression and behavioral subcomponents of emotions. There is a long history of research seeking signs of different emotions in different patterns of physiological responding. The results are not encouraging and suggest that many physiological responses are better understood not as indicators of a specific emotional state but as responses to specific evaluations of the situation and of how it can be dealt with—that is, as meaningful subcomponents of the emotional response. For example, situations in which actions, such as flight or attack, are desirable and possible, appear to produce physiological responses indicative of sympathetic nervous system activation, whereas situations where escape is highly desirable but impossible tend to be dominated by parasympathetic activation (Weiss, 1971). Also, although researchers have suggested that a pattern of physiological responses characteristic of epinephrine release is associated with fear and that a different pattern of responses characteristic of both norepinephrine and epinephrine release is associated with anger (Ax, 1953), the results seem better interpreted in terms of whether the situation calls for active or passive responses (Frankenhauser, 1975). Some physiological responses, such as piloerection (sometimes read as a sign of intense fear), are due simply to the level of autonomic nervous system arousal (Dumas, 1933, cited in Frijda, 1986). Others, such as a global increase in muscle tension, seem to indicate a general readiness for action or the level of effort currently being expended (Duffy, 1972) and can therefore be mistaken for responses to specific emotions such as rage or fear when they are merely signs of correlated activities. Even a recent, sophisticated study (Ekman, Levenson, & Friesen, 1983), which has been interpreted as providing strong evidence of the differentiation of emotions by physiological responses, is open to alternative accounts. Ekman et al. (1983) found differences in heart rate and skin temperature among their six basic emotions (anger, disgust, fear, joy, sadness, and surprise). But it is not clear whether the differences they reported were due to the emotions *per se* or to correlated differences in appraisals, emotional intensities, or response tendencies, which were not controlled for. Our view is that such differences in physiological responses are usually better interpreted as indicating not so much the presence of specific emotions as the presence of certain dissociable components of emotions, namely specific appraisals and their corresponding responses.

These examples illustrate why we think it is more profitable to analyze emotional expressions and responses in terms of dissociable components and subcomponents rather than in terms of basic emotions. We suspect that examining such issues below the level at which components and subcomponents have coalesced into a prototypical emotion response permits not only a more fruitful decoding of emotion expressions than does a basic-emotion approach but also permits a systematic and detailed account of the formation of new emotions by the creation

of new combinations of such elements. Too much information revealed by an analysis of the subcomponents is ignored in a more molar approach. Moreover, a molar approach suffers from an inability to specify how, for example, whole-face expressions of two or more emotions might blend to form a new emotion or how the two or more sets of physiological responses might combine (we discuss this issue more fully later).

Two kinds of objections could be raised to the analysis that we are suggesting. First, it could be argued that we have offered little evidence that the subcomponents rather than the whole are the candidates for being biologically basic. It is true that in terms of the nature and meaning of specific elements we can offer little in reply other than to point out that there is some empirical evidence of the meaning of specific subcomponents (e.g., see Cacioppo et al., 1985, and C. A. Smith, 1989, on the furrowed brow). However, the subcomponents we have differentiated in facial expressions are ones that are widely interpreted (at least in Western culture) in the way we have specified. We do not think this is accidental; rather, we believe that it results from the fact that the components we have discussed are indeed biologically determined. In favor of our view that an analysis into subcomponents is a more useful way of examining emotional responses is the evidence showing that such subcomponents are often dissociated. Fear is a case in point. Researchers, with good reason, have traditionally divided fear into three parts: the subjective experience, physiological changes, and attempts to avoid or to escape from the situation (e.g., Lang, 1970; Rachman, 1978). These elements are poorly correlated, suggesting that desynchrony and dissociation is common (Rachman, 1978). Lacey (1967), in a review of the evidence, suggested that the dissociations of the subcomponents of fear within individuals are due frequently to situational stereotypy (the tendency for different situations to evoke different fear responses), thus implying that an analysis at the level of components and subcomponents might be the most profitable.

A second, more potent objection might be that even if the facial expression components have meanings of the kind we have suggested, this does not explain why the subcomponents of a given "basic" emotion tend to co-occur. Thus, the possibility that the association of the components of an emotion expression is hardwired, or at least "prepared" (Seligman & Hager, 1972), remains open, as does the question of whether the emotion is biologically basic. Although we acknowledge the possibility of some hardwired associations of this sort in emotion, we believe that they are not common.

The way we think about the causes of the correlations found among subcomponents of emotional responses can be illustrated with an analogy. Consider the behavior of a tennis ball during a tennis match. A player serves, and (normally) the ball soon strikes the court surface on the other side of the net and then is returned by the other player. This series of deformations and accelerations of the ball constitutes a reliable pattern of behavior on the part of the ball, a pattern that would hold for all tennis balls during matches. On the other hand, this pattern reveals nothing whatsoever about basic response patterns in tennis balls. Rather, it reveals patterning in the environment in which the balls find themselves (if a different game were being played, the balls would show a different pattern of behavior). We consider this to be analogous to the patterning of behavior

in emotional responses. The correlations found among subcomponents of emotional responses are due not to hardwired connections among subcomponents but to connections external to the feeling person.

There are three external causes of co-occurrences of subcomponents of emotion. First, two subcomponents can co-occur because the eliciting conditions of one of them are embedded within those for the other. For example, although the square mouth of aggression and the frown of goal blockage are conceptually distinguishable, the urge to attack (and thus the appearance of a square mouth, clenched fists, etc.) is primarily elicited by an agent blocking one's progress toward a goal. Thus, the conditions for the elicitation of a furrowed brow are part of the eliciting conditions for the square mouth and clenched fists of aggression. In the second source of association, the eliciting conditions are contingently rather than necessarily nested. For example, goal blockage is not a necessary condition for determination, but goal blockage is one of several circumstances that can elicit determination to overcome an obstacle. The third cause of association is due to correlations in the environment. Thus, for instance, although there is no embeddedness relation between paying attention to the visual field (indicated by raised upper eyelids) and goal blockage, the latter is often visually perceived, and so these subcomponents can be correlated in practice. Such environmental correlations are of enormous importance in coordinating mental and behavioral responses.

The fact that emotions come as assemblies of elements such as specific appraisals, action tendencies, desires, feelings, and physiological responses raises the question of whether some of the components should be regarded as necessary or defining features of emotions. Building on the work of Rosch and her colleagues (e.g., see Rosch, 1978; Rosch et al., 1976), some have suggested that different instances of a given emotion, such as anger, do not share a set of defining components but instead are related by family resemblance and that the different assemblies resemble the prototypical member of the category to varying degrees (e.g., see Averill, 1982; Fehr & Russell, 1984; Shaver et al., 1987). We are sympathetic to the positive aspect of this view because we assume that the individual subcomponents of emotions are capable of being decoupled and of reappearing in combination with other elements. Moreover, the prototype view appears to be a correct description of the commonsense use of emotion labels. However, we are less sanguine about the negative part of the view, which denies the possibility of a classical definition of emotion. We think that the boundaries of the concept of emotion, and even of individual emotions, can in principle be specified. An extensive discussion with respect to individual emotions can be found in Ortony et al. (1988). As far as the concept of emotion in general is concerned, the defining feature that we consider most reasonable and least contentious is that the appraisal underlying the emotion be valenced, either positively or negatively (see Ortony et al., 1987). Thus, for example, if a facial expression of sadness were known to have occurred without a negative appraisal, we would normally assume that the person was acting rather than that he or she was genuinely sad; if a person attacked another without the appropriate valenced appraisal, we would label this cold aggression, not anger, and so on.

If one accepts that a necessary component of an emotion is a

valenced appraisal, then one can construct a criterion for determining whether an emotion is biologically basic. The criterion we suggest is that biologically basic emotions are those for which the connection between the valenced appraisal and some other response is hardwired. The reason we think it so important that any distinctive reactions associated with an emotion must result from the appraisal that underlies the emotion itself, rather than being a reflection of some correlated nonemotional state, can be seen by considering the case of reactions to cold. The state of feeling cold is intrinsically unpleasant (that is, negatively valenced) and is associated with hardwired physiological reactions. The phenomenology of the affective reaction is both distinctive and biologically based, so why, then, is "cold-distress" not considered a basic emotion? Why is being cold merely an occasion for distress? The reason is that the shivering and numbness of cold are not the result of the appraisal that one is cold. Rather, they are part of the body's automatic reaction to low ambient temperature and are independent of the evaluative appraisal itself.

An important point about our criterion is that it is silent on whether inessential components of the emotional response are hardwired. Hardwiring of nondefinitional components says something about the innateness of subcomponents of an emotion but nothing about whether the emotion itself is biologically basic. This point has been largely ignored in discussions of basic emotions, but it is crucial. As we have just argued, some of the components of the expression of anger may not be reactions to the appraisal that an agent has done something blameworthy, which we assume is the principal appraisal that underlies anger (Ortony et al., 1988; Turner, 1987).³ Rather, the components of the expression are responses to other associated construals, such as that a goal blockage has occurred or that attention should be paid to the visual environment. Clearly, neither of these subcomponents, although they appear in many cases of anger, are the same as anger, nor are they essential features of it, and therefore the question of whether these subcomponents are hardwired is not relevant to the question of whether anger is a basic emotion. In general, there is no reason to suppose that the properties of parts are necessarily inherited by the whole of which they are parts.

Although one could use our criterion to construct a list of biologically basic emotions, we think this would be a mistake. In particular, and contrary to the claims of some investigators (e.g., Izard, 1977; Tomkins, 1962, 1963), we do not think that lists of biologically basic emotions provide much help in accounting for the entire range of emotions. We consider that the explanatory focus should be on how the large set of subcomponents of emotions combine to form new emotions, not on how a particular subset of emotions might do so. This is because, as we argued earlier, the generative basis of emotions appears to reside in the subcomponents, not in a small set of basic emotions.

Basic Emotions as Psychologically Primitive

The second general approach to basic emotions rests on the idea that they are psychologically irreducible. There appear to be two main criteria used by those who argue for basic emotions in this sense. One is that the basic emotions are those that have

elementary eliciting conditions, and the other, related criterion is that basic emotions do not have other emotions as constituents. In addition, from an ontogenetic perspective, one might expect to observe an early universal culture-independent emergence of basic emotions more reliably than of nonbasic emotions.

An example of the approach in which basic emotions have simple or elementary eliciting conditions can be found in the proposals of Arnold (1960), who used as her criterion the requirement that such emotions be elicited as a result of the combination of three fundamental dichotomous factors: the desirability or undesirability of the object of the emotion, the presence or absence of that object, and the ease or difficulty of attaining it. This is why Arnold believed courage (or rashness and daring) to be a basic emotion; courage occurs when an *undesirable* object is *not present* but is *difficult* to avoid or overcome. If one feels uncomfortable with the idea that courage is an emotion, as do we and hundreds of subjects in numerous experiments in which *courage* was either not elicited as an emotion word (e.g., Fehr & Russell, 1984) or in which it was judged to be a poor example of one (e.g., Averill, 1975; Clore, Ortony, & Foss, 1987), one might be inclined to conclude that there is something unsatisfactory about the criterion advocated by Arnold or at least about the particular form of it that she invoked.

The main criterion used by those who advocate basic emotions in the psychological sense focuses on the interrelationship of the emotions, rather than directly on the nature of the eliciting conditions. Here, an emotion is regarded as basic if it contains no other emotion as a component (i.e., if it is not reducible to one or more other emotions). For example, Frijda (1986) defined emotions in terms of changes in action readinesses and considered basic emotions to be those that are behaviorally and conceptually distinguishable from each other and that are not composites of other tendencies or emotions. For Frijda (1986), anger is basic because the corresponding action readiness (to remove an obstruction) is basic, and that tendency is basic primarily because it cannot be reduced to any other action tendency. On the other hand, he claimed that emotions such as

³ Although we know of no studies that definitively justify this assumption, empirical studies of anger (e.g., Averill, 1982; Wallbott & Scherer, 1986) have shown that a violation of a normative standard is the source of most cases of what people call anger, and many theoretical discussions of the eliciting conditions of anger have also stressed the centrality of normative standards to anger (see Turner, 1987, for a review). It might be argued that infants appear to feel anger but surely do not blame an agent. However, it is equally plausible to suppose that in cases where infants are not simply frustrated, they do indeed make an indictment (Solomon, 1976) when they feel anger and that their anger is based on a perception that something is wrong, not just undesirable (tantrums are more than tears). Of course, the basis of their judgment is different from that for an adult. Thus, one might suppose that an infant's indictment always (and an adult's indictment sometimes) rests on the assumption that what is wanted and expected should occur. For example, the infant believes that it ought to be fed when it indicates that it is hungry. Only later in development does the child learn that not all violations of such expectations are signs that something is not as it ought to be, that anticipations can be erroneous, and that the blameworthy actions of others can often be justified.

shame, jealousy, and contempt are not basic because they are "defined by their objects." Any correlated action tendencies are a result of the involvement of basic emotions such as hatred.

Another example of this approach can be found in the proposals of Oatley and Johnson-Laird (1987; Johnson-Laird & Oatley, 1989). Whereas they started with a biologically motivated proposal of five distinct basic emotion modes, they also held that a semantic analysis of emotion words can reveal that all nonbasic emotions have one or another of the five basic emotions as an elementary constituent and that the basic emotions themselves cannot be further reduced. The criterion they used was that for the basic emotions, it is possible to say "I feel *X* but I don't know why" (where *X* is an emotion term). It seems to us, however, that this approach is fraught with difficulties (discussed more fully in Ortony & Clore, 1989) and that it is most unlikely to be the royal road to basic emotions.

The final criterion is ontogenetic primacy. More than 50 years ago, Bridges (1930) suggested that excitement was the ontogenetically basic emotional state. A related position has been put forward recently by Weiner and Graham (1984), who suggested that the ontogenetically basic emotions are the least differentiated ones, namely happiness and sadness. In fact, Weiner and Graham suggested that the ontogenetically basic emotions are those with less complex eliciting conditions and so subscribe to the simple eliciting-conditions criterion too. Other researchers have suggested different ontogenetically basic emotions, using different developmental criteria (e.g., see Sroufe, 1984).

Regardless of whether one adopts the simplicity of eliciting conditions as the criterion of basic emotions or the absence of emotions as constituents, the view of them as psychological primitives runs into a serious conceptual problem, namely that some basic emotions turn out to be more basic than others. From this it follows that some of the proposed basic emotions, by the very criteria used by the theorists who propose them, are not in fact basic in any ultimate sense at all. For example, suppose one makes the not unreasonable claim that an essential component of anger is a negative affective state of general unhappiness—let us call it *distress*, conceived of as simply the emotion corresponding to displeasure about some undesirable event. One cannot be angry without being distressed in this sense.⁴ This implies that distress is more basic than anger. Given this, any theory that proposes both anger and distress (unhappiness, displeasure, etc.) as psychologically basic is not using the notion of a basic emotion in a coherent way. An emotion cannot both be basic (in an absolute way) and have another emotion embedded within it. A similar argument can be made about emotions that do not appear on lists of basic emotions. For example, frustration (as the reaction to simple goal blockage) does not appear on any of the lists in Table 1, but anger appears on most of them. Yet, one could perfectly easily claim that anger is a particular kind of frustration and thus that frustration is a separable part of anger. Frustration occurs when a person feels thwarted in a desire to attain a goal (e.g., Ortony et al., 1988; Roseman, 1984). Anger occurs when the person blames some object or agent for that thwarting. Thus, the eliciting conditions for frustration are contained within those for anger, and so, using the psychological notion of basic, frustration is more basic than the allegedly basic emotion of anger.

The same problem arises for fear. Suppose that the eliciting conditions of fear are the perception of some kind of threat. This seems reasonable and uncontentious enough. Now let us ask what a threat is. We might say that in general terms a threat is the perception of the prospect of some sort of event deemed to be undesirable by the fearful person. However, we can go further than this and suggest that fear is the particular reaction of displeasure about the prospect of such an undesirable event (Ortony et al., 1988). This, too, seems reasonable enough, but its consequences are not very encouraging for a view of fear as psychologically primitive. This is because, if one allows that the prospect of an undesirable event itself constitutes an undesirable event, fear becomes a special case of distress. To put the matter concretely, if a person swimming in shark-infested waters fears an attack by sharks, then he or she will necessarily find that prospect distressing. This means that distress (as we have characterized it) is a component of fear (as we have characterized it), which in turn means that fear cannot be psychologically primitive if one adopts as one's criterion either the simplicity of eliciting conditions (because those of fear are more complex than those of distress) or the absence of other emotions as constituents (because fear has distress as a constituent). Furthermore, although problems about the possible maturation-dependent emergence of some emotions might lead one to be cautious in using the ontogenetic primacy criterion, if one were to apply it, one would find that children show evidence of distress before evidence of fear (e.g., Sroufe, 1984).

The difficulties with regarding anger and fear as psychologically primitive and the absence of frustration from most lists of psychologically basic emotions suggests that emotions might sometimes be proposed as being basic on grounds that are irrelevant to whether they are basic in the psychological sense. One should not rule out the possibility that hypothesized basic emotions are simply emotions that are particularly salient in the culture (anger might be more culturally salient and important than embarrassment), or in experience (anger is experientially more salient than frustration when they co-occur), or that represent a level in an emotion hierarchy at which the emotion terms carry the most meaning in a culture (and can thus be called basic in the sense of Rosch et al., 1976). These would all be good reasons for regarding the emotions on such lists to be among those that are dominant in the culture. However, they are poor reasons for concluding that such lists tell us anything about the psychologically or biologically primitive emotions. The fact that the most popular candidates for basic emotions (happiness, sadness, anger, and fear) are among the most frequently occurring and frequently referred to in Western culture (e.g., see Conway & Bekerian, 1987) raises the possibility that theorists unwittingly attribute special status to them simply because of their frequency-related salience. Whatever basic emotions may be, their identity cannot be determined by a popularity poll, even though one might reasonably expect the converse—that basic emotions would be very prevalent—to be true. This suggests that a theoretically more neutral label for basic emotions might be *common* emotions, or better yet, per-

⁴ This does not mean that one cannot be pleased about being angry, only that being angry about something entails that one is distressed (as here defined) about it.

haps, *culturally common* emotions. But, of course, such labels lack the connotation of privilege.

In fact, not only is there a potential problem with respect to cultural biases as far as which emotions are included as candidates for being basic, there is also a problem concerning those that are excluded. Embarrassment, for example, does not appear on any of the lists of basic emotions given in Table 1, yet it seems to satisfy many of the criteria for being a basic emotion. Embarrassment has its own unique phenomenal quality. It is associated with specific physiological reactions (e.g., blushing) that appear to be hardwired and that seem to result from the appraisal that elicits it. Why, then, should embarrassment not be widely regarded as a basic emotion? We believe that this possibility is not considered mainly because embarrassment is not particularly salient in our culture. In other cultures, such as the Balinese society (Geertz, 1973), it is. One cannot help wondering whether a hypothetical Balinese psychologist would propose embarrassment in a list of basic emotions.

The Relation Between Basic and Nonbasic Emotions

One of the main theoretical benefits that ought to accrue from the notion of basic emotions is an account of the full array of emotional experiences. We now consider the extent to which proposals about basic emotions have succeeded, or can succeed, in achieving this goal, starting with the notion of basic emotions as biologically primitive.

Even if psychobiologists were to agree among themselves on what the basic biological response systems are, these systems probably could not bear the theoretical burden that more cognitively and phenomenally oriented theorists would demand of them. We have already suggested that such systems of biologically basic response patterns are not by themselves sufficient to account for putative basic emotions, let alone other, nonbasic emotions. In other domains in which basic constituents (e.g., the chemical elements) are accepted, the basic constituents do precisely this kind of theoretical work; essentially, they permit the explanation of the entire domain. The main reason that the psychobiological approach is unlikely to lead to the attainment of this goal is that the structures it reveals do not map well onto the kinds of distinct emotions that are recognized in human cultures. Rather, it tends to identify systems that relate primarily to emotion-driven behaviors and that tend to blur distinctions such as those between distress and panic (Panksepp, 1982) or between rage and terror (Gray, in press). One might also complain that the psychobiological approach devalues the phenomenal aspects of emotion. Thus, for example, we find Gray (1985a) has proposed an almost circular account of anxiety, one that is tantamount to characterizing anxiety as whatever it is that is reduced by anxiety-relieving drugs. Furthermore, insofar as anxiolytic drugs, such as benzodiazepines, are as effective for goldfish as they are for humans, the state that is alleviated by them does not correspond well to the ordinary human notion of the emotion of anxiety, for some of us might need convincing that a goldfish can be anxious.

What of the more psychologically oriented approaches to basic emotions? Several proposals for relating basic to nonbasic emotions have been made, including fusing, blending, mixing, and compounding, although it is not always clear how these

methods of combination differ. McDougall (1926) discussed the combination of basic emotions (which he saw as related to instincts) in terms of fusing: The emotion of admiration results from fusing the basic emotions of wonder and subjection. The even more complex emotion of awe occurs if admiration is then fused with fear. Tomkins (1963) also provided an extensive discussion of how various emotions come to be combined. He argued, for example, that certain patterns of parenting create a child who experiences an emotional state that is a mixture of fear and shame. More recently, Izard (1977) has argued that anxiety is the result of the combination of fear with two or more of the emotions of distress, anger, shame, guilt, and excitement. The various possible combinations yield different forms of anxiety.

Plutchik (1962) adopted a color metaphor for the process whereby basic emotions combine, suggesting that combination takes place in a manner similar to the way in which, for example, blue and yellow paints mix together to create a green pigment. Of particular interest in this context is his suggestion that the combination of two or more basic emotions yields a new emotion that may be phenomenally quite different from the elements from which it was derived. Plutchik has further suggested that the basic emotions that are close to each other on his "circle" of emotions can combine easily, indeed fuse, whereas those farther apart tend to lead to conflict when combined into a new emotion. Thus, his emotions of joy and acceptance are adjacent to each other and, if mixed, fuse into the new emotion of love, whereas if joy is mixed with the distant emotion of fear, guilt is created, but this new emotion often takes the form of an oscillation between the two conflicting basic emotions. This view is not without its problems. For example, anger and joy are adjacent, but it is not clear how they combine easily, or into what. In contrast to Plutchik, Izard (1977) suggested that when a new emotion is formed from a mixture of basic emotions, it retains the phenomenal qualities of the emotions that go into it.

The main problem with the kind of proposals put forward by Plutchik and Izard is that these theories suggest that each of the basic emotions has a distinct physiological basis, yet that these distinct emotions can be blended or merged to form new emotions. However, no general principles of combination are presented, and no details are offered about the kinds of mechanisms that might be involved in the creation of such combinations. Is the intention to claim that emotion combinations result from an averaging of reactions? If so, it is quite unclear how very different physiological reactions and other bodily concomitants can be averaged (e.g., one emotion might involve weeping and a downturned mouth, whereas another might be characterized by a furrowed brow and a compressed mouth). Furthermore, even if such reactions could be averaged in some way, how would the phenomenology of the basic emotions be preserved in the derived emotion, as Izard (1977) suggested happens?

An Alternative Approach to the Relations Among Emotions

It seems, then, that the multitude of psychological states called emotions cannot be explained in terms of a chemical or color metaphor wherein a few basic emotions form new emo-

tions by combining. We think there are other ways of explaining the facts, ways that do not depend on the notion of basic emotions at all, but rather that hinge on the idea, discussed earlier, of the assembly of diverse components (some of which are themselves biologically basic) into a complete emotional response (see Scherer, 1984, for a related approach).

Take, for example, the case of fear. Because we consider emotions to be formed from sets of elements, it is natural to think of fear as being variously embodied. There are various kinds of fear, each consisting of somewhat different components. A typical case of fear is the kind that might occur if a person were to suddenly meet William James's (1884) bear in the woods. The expression of fear in this case would probably include an open mouth, raised eyebrows, widely opened eyes, and a staring expression (e.g., see Ekman & Friesen, 1971). If one examines the components of this fear expression, one notices that many of them are also found in surprise and in situations where a person is attending alertly to the visual world. The expression thus combines these two components with a kind of distress. Not all of the components in this fear expression are due to these two states, however; the tightly stretched mouth seems to be specific to fear (and may reflect an inclination to flee, as Frijda, 1986, suggested). This state is quite different from that produced by another kind of fearful situation, one that does not induce surprise, and from which one cannot flee, such as the fear that could result from the thought that one might have cancer. In this situation, the person's facial expression and his or her feelings might differ little from those found in simple distress. These two varieties of fear have thus been assembled out of partially overlapping sets of elements, the nature of which depends on the details of how the situation is appraised by the person and how he or she attempts to cope with it.

Other, rarer components can also be added to the assembly to form another variety of fear. One such component is an uncanny feeling, manifested by such responses as goosebumps, raising of the hair, shivering, "crawling" skin, and the like (Levy, 1984). Uncanny or eerie feelings typically occur in Western culture when something happens that is far outside one's experience of the world (e.g., apparently supernatural events). Even natural events can elicit this reaction, as when one hears inexplicable eerie noises in one's otherwise quiet home late at night. The experience of fear in this kind of situation is strongly influenced by uncanny feelings, so that it is the distinctiveness of these uncanny feelings that makes the phenomenology of uncanny fear so different from that of other emotions, including other varieties of fear.⁵

Considerations such as these lead us to conclude that different emotions can emerge simply from different configurations of emotionally significant appraisals and other constituent elements and therefore that it is not necessary to view them as being generated from other, basic emotions. However, there is a sense in which new emotions emerge from old ones. This occurs by two complementary processes, namely generalization (of more complex emotions) and specialization (of less complex ones).

When new emotions arise as a result of generalization of relatively more complex ones, the new emotions are formed by the suppression of components of an existing emotion. Take, for example, the emotion of disgust. The visceral form of disgust

consists of a feeling of revulsion and of one's gorge rising. It is a highly specific emotion with a characteristic facial expression (Ekman, 1982) and seems to be hardwired. However, through a process of generalization, the visceral form of disgust can give rise to other less visceral forms. For example, we might quite accurately say we are disgusted by a person's violation of standards of morality or decency. This emotion of disgust would not normally be accompanied by the physiological reactions intrinsic to the visceral form, such as the feeling of a rising gorge. What is common to the class of emotions we are willing to call *disgust* is the feeling of revulsion, yet this is only a part of what constitutes visceral disgust.⁶ Thus, when the set of components that make up the original emotion is reduced, a discriminably different emotion can be born.

A similar argument might be made if one focuses on those components that make up the eliciting conditions of emotions. Consider the case of anger. If one insists on maintaining that anger is a basic emotion and then takes a combinatorial view, arguing that other emotions are formed by combining it with other basic emotions, how is one going to characterize the relation between anger and frustration (again conceived of as the emotion resulting from simple goal blockage)? No easy answer within the combinatorial paradigm suggests itself because, as we have already argued, frustration consists of a subset of the attributes of anger. Thus, we have another example of a purportedly basic emotion (anger) that seems to be related to another emotion (frustration) by generalization—that is, by the elimination of a characteristic feature or component of the allegedly basic emotion.

So far, we have argued that a discriminably different emotion can be formed when some of the components that make up another emotion are eliminated. For example, anger without the attribution of responsibility might be thought of as frustration, contempt might be viewed as disgust without the rising gorge, and worry might be fear without the inclination to flee. The possibility that emotions often held to be basic may in fact yield more general emotions by the elimination of components poses a problem for those who advocate basic emotions. When we

⁵ Although Western culture does not provide a simple label for uncanny feelings, they are labeled in other cultures, such as the Tahitian culture (Levy, 1984), where they play a significant part in emotional life.

⁶ It is not an accident that in discussing the generalization process we talk about "the class of emotions we are willing to call *disgust*." There certainly is an issue of labeling that is involved here. There is no reason to suppose that the language of emotions bears a one-to-one relation to distinct emotions. The disgust we feel at a foul smell may be biologically quite different from the disgust induced by moral revulsion. If so, then moral disgust is not a generalization of visceral disgust, and we have been misled by the fact that the two emotions share a label in English. We do not believe this to be so (labeling a feeling of moral revulsion as *disgust* is more than merely a metaphoric extension of the meaning of visceral disgust), but it remains a possibility that needs to be considered, particularly because there are many emotion words that cut across a range of different types of emotions. For example, the English word *upset* is used to refer to various negative and distinctly different emotional states, including anger, distress, and even certain cases of fear. To look for the one emotion referred to by the word *upset* would clearly be a mistake.

consider the second, complementary way in which emotions can be related to one another—specialization—the case for a nontrivial set of basic emotions (i.e., more than two) becomes even weaker.

The specialization of old emotions into new ones is, we believe, much more common than generalization. Emotional specialization arises as a result of the addition rather than the deletion of components, particularly with respect to the emotion's eliciting conditions. In fact, the addition of elements is often manifested as an increase in specificity in the cognitive construals that elicit the emotion. For example, if, as we suggested earlier, the eliciting conditions for distress are that something undesirable occurs, then grief can be viewed as a specialized form of distress in which the undesirable event is constrained to the loss of a loved person (or, occasionally, a loved animal or thing), making grief the distress at such loss. Similarly, as argued earlier, fear would be the distress resulting from the prospect of an undesirable event, and disappointment (in one of its senses) the distress at a particular kind of undesirable event, specifically the disconfirmation of a prospective (relatively) desirable event, and so on (Ortony et al., 1988).

If one focuses on eliciting conditions, an analysis by components ultimately leads to the conclusion that all distinct emotions are specialized forms of one of two kinds of affective reactions, positive ones and negative ones, a position held by Weiner and Graham (1984). How, then, might the huge variety of responses that differentiate emotions be generated? Two components alone cannot possibly account for the diversity of emotional experiences (Johnson-Laird & Oatley, 1988). Suppose one argues that distress (unhappiness, displeasure, or whatever) is the only negative basic emotion. What, then, would be the difference between this basic emotion of distress and some other emotion, say, fear? We would answer that differences in appraisals result in a new set of response components being elicited and that these appraisals and responses can yield a new, distinct emotion.

Take, for example, the construal that one is under threat. Because humans need to protect themselves from harm, they have evolved a set of responses, including aggression and flight, to such construals. One of the responses is the appraisal that this threat is undesirable, and this elicits an emotional state of distress. Along with this feeling may come other components, depending on the details of the construal of the situation, such as the desire to attack the source of the threat. These feelings and desires are partly manifested in bodily action, such as clenched fists and various components of facial expression, including perhaps a frown, compressed lips, and so on. This familiar coherent combination of responses, feelings, desires, and appraisals is what people call *anger*, and the phenomenological representation of these components is what people mean when they say they are angry. If the situation had been slightly different, the appraisal might have been that the threat was undesirable but escapable, and the responses might have included a desire to flee instead of an inclination to fight. This desire and that appraisal might have been expressed in the face by widely opened eyes, a distorted mouth, and so on. This amalgamation of components forms a whole that we call *fear*. Thus, in both anger and fear, the intrinsically emotional component of the response, namely the appraisal that something is undesirable, is

the same. What differs is the large set of other components that accompany it, and these components account for the differences in the nature and experience of the various emotions.

Do these arguments mean that we should conclude that there are just two basic emotions, something like pleasure (or happiness) and displeasure (or distress, or pain), as suggested by Mowrer (1960), Weiner and Graham (1984), and most recently, although somewhat rhetorically, by Frijda (1987)? We believe not, because nothing is gained by such a move. It has minimal theoretical usefulness, that is, little explanatory value, and not much predictive power. It is difficult to imagine making much progress in understanding the nature, function, and diversity of emotions on the basis of such a conclusion. To make such progress, we believe that the focus of research must be directed at the processes underlying the generation of emotions, namely the generalization and specialization of construals, and the variety of physiological and other responses that are evoked by these construals. This approach does not require the concept of basic emotions, and in fact runs counter to the very notion because it claims that the basic elements of emotions are the kinds of components we talked about earlier and not other, somehow more fundamental, emotions (see also Scherer, 1984). We still need to retain the notion that all emotions contain either one or the other of the two states (pleasure or displeasure), but this requirement is merely an attempt to place reasonable boundaries around the domain to be explained by theories of emotion. It does not imply that the two states are basic emotions, in the sense that they allow the whole domain to be explained. It makes as much sense to label as basic emotions the two kinds of valenced appraisals that underly all emotions as it does to argue that because there are only two kinds of humans, men and women, men and women are basic people. Gender is merely a universal attribute of humans, just as valenced appraisal is of emotions.

On this view, the only coherent theoretical role for "basicness" is a graded one that characterizes a relation between emotions. We can legitimately say that one emotion is more basic than another if it is part of that emotion. More accurately, Emotion A is more basic than Emotion B if the components of Emotion A are a subset of the components of Emotion B. Thus, if relief were simply happiness at an outcome that one thinks could have turned out worse, then happiness would be more basic than relief.

Finally, in this discussion of generalization and specialization, we have intentionally not distinguished between two uses of the terms: a logical use and a psychological one. In the logical sense, generalization and specialization simply reflect logical relations among emotions that share attributes. Thus, if Emotion A consists of a subset of the attributes of Emotion B, then Emotion A can be said to be a more general form of Emotion B and Emotion B a more specialized form of Emotion A. This sense of the terms is relevant to a discussion of emotion concepts, and thus to notions of basic emotion concepts, but it implies nothing about emotions themselves. In the psychological sense, we are making an empirical claim, namely that generalization and specialization are psychological processes involved in the generation of emotions. For example, we argue that disappointment is formed by a specialization of the more general emotion of distress. We would therefore expect distress to appear earlier in

human development than disappointment and for people to be incapable of disappointment if they are incapable of distress. Similar arguments can be made about anger, which we believe is formed by a process of specialization out of the more general emotion of frustration. Inasmuch as we do not assume that all emotions that are logically related by generalization and specialization are also psychologically related, this appears to be a reasonable working hypothesis.

Conclusion

In chemistry and in color vision, which some investigators use as metaphors for thinking about emotions, a great deal of theoretical progress was made by adopting the notion of basic, irreducible elements. However, in the case of emotions, no such progress has been achieved. The problem is not just that investigators cannot find the basic emotions; we do not even have, and probably cannot have, a satisfactory criterion of basicness that is generally acceptable to emotion theorists. As Hallam (1985a) argued in his critique of Gray, the kind of biologically based emotion systems that Gray (1985a, 1985b) proposed as the elements of a theory of "emotion pigments" are not real emotions at all. In fact, Hallam (1985b) asserted, and we concur,

Brain systems, or the sensory consequences of the behaviors they mediate, do not "mix together" or make themselves available as "states." . . . The "primary emotion" or "emotion pigment" concepts do not, in the manner of good scientific analogies, help us to account for the experimental observations. (p. 341)

We also think it is always appropriate to ask of those who propose basic emotions, "What exactly do you mean? In what sense are you using the word 'basic'? What would count as empirical evidence for or against your claim, and why?" and "What would you do with them if you had them?" We have suggested that current uses of the notion do not permit coherent answers to be given to such questions. More likely, the nearest one can come to some notion of ultimate basic emotions is that there are some basic classes of appraisals, such as the perception of an escapable or unescapable threat, that are associated with response patterns, such as fleeing or immobility, and that in some organisms, such responses, or better, the urge to produce them, occur in physiological, cognitive, phenomenal, and behavioral complexes. It would be a cluster of such components that constitutes an emotion, rather than a single constituent of them, so that by the time these ingredients have combined to produce a full-fledged emotion, the notion of a basic emotion no longer applies. In this view, the complexity and the apparent limitlessness of different emotional feelings can be explained without recourse to a notion of basic emotions. We have suggested that what might help is a focus on meaningful components of emotions and on mechanisms such as generalization and specialization.

Perhaps the best analogy that can be drawn is one between emotions and natural languages. There are hundreds of human languages, and many more are possible. Yet, linguists do not seek to explain them by postulating a small set of basic languages out of which all others are built (even though linguists acknowledge that there may have been an evolution from a few early ones). At the same time, they certainly recognize that

there are constraints on possible languages, and they recognize that there are basic building blocks of languages such that any one language comprises some particular subset of a finite (but large) number of basic constituent elements (e.g., phonological properties and syntactic properties). Furthermore, some of the constraints have their roots in the biological nature of people. What is basic, however, are the constituents of languages, and these constituents are patently not themselves languages. So, too, with emotions.

We conclude that the study of emotions is no more dependent on the existence of a nontrivial subset of basic emotions in terms of which all other emotions can be explained than is the study of language dependent on the existence of a small subset of elemental languages, or the study of animals on a set of basic animals. To believe otherwise is to adhere to an unsubstantiated and probably unsubstantiable dogma—an air, earth, fire, and water theory of emotion. At the same time, a reluctance to accept the notion of basic emotions does not mean that it is unreasonable as a research strategy to classify emotions in certain ways; for example, if one were interested in the nonverbal communication of emotion, one might want to classify emotions according to whether they have characteristic facial expressions. However, one ought not to reify the classification and assume that the emotions in one class are somehow more fundamental than those in another. A refusal to accept the notion of basic emotions does not commit one to rejecting the idea that there might be basic elements out of which different emotions are built. It is only to say that there is no reason to believe that such elements are themselves emotions. They are much more likely to be components of cognitions, feeling states, emotion responses, and the like. Thus, the question "Which are the basic emotions?" is not only one that probably cannot be answered, it is a misdirected question, as though we asked, "Which are the basic people?" and hoped to get a reply that would explain human diversity.

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