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An Evolutionary Approach to Understanding Distinct Emotions

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Abstract

According to evolutionary accounts of distinct emotions, these emotions are shaped by natural selection to adjust the physiological, psychological, cognitive, and behavioral parameters of an organism to facilitate its capacity to respond adaptively to threats and opportunities present in the environment. This account has a number of implications, most notably: (a) each distinct emotion serves, or served, an adaptive function, and (b) emotions are comprised of multiple components, all of which should be functional. In this article, I briefly outline an evolutionary approach to understanding distinct emotions, then explain how this approach could be falsified, how one's own emotion experience differs from the observation of an emotion experience in someone else, and why variability in emotional responding should be expected.

Keywords
distinct emotions, evolution, functionalist approach

1. What Are the Essential Elements of Your Theory of Emotion?

Defining emotions from an evolutionary perspective, Nesse (1990) wrote,

> The emotions are specialized modes of operation shaped by natural selection to adjust the physiological, psychological, and behavioral parameters of the organism in ways that increase its capacity and tendency to respond adaptively to the threats and opportunities characteristic of specific kinds of situations. (p. 268)

There are two critical points in this account that, in my view, constitute the central elements of the basic evolutionary model of distinct emotions.

First, each distinct emotion is a distinct adaptation. This means that fear is different from anger because fear and anger evolved to serve distinct functions, which may or may not be relevant to humans today, but which necessarily were relevant to humans' capacity to survive and reproduce during the period in which these emotions evolved. Furthermore, to understand an emotion, one must understand not only how it works, but what its function is (or was, in the ancestral environment). This means examining: (a) what recurrent evolutionarily significant situation (or, appraised situation)[1] elicits the emotion, (b) what the emotion does—that is, what effects it has on the organism, and (c) how the eliciting situation and emotional output are connected, or, more specifically, how (b) functions to solve (a). To take a specific example, understanding fear means determining: (a) the recurrent evolutionarily relevant situation that elicits fear (i.e., perception of threat), (b) what fear does to the individual experiencing it (e.g., in humans, its subjective, physiological, behavioral, cognitive, and motivational impact), and (c) how the eliciting situation of perceived threat is connected to the psychological and physical output (e.g., increased heart rate facilitates escape from threat). In this way, a complete analysis of each emotion requires an emphasis on the emotion's *function*. As a result, function provides an organizing theoretical framework for understanding each emotion, and thus the basis for hypotheses about all aspects of the emotion. It is this emphasis—on emotions as distinct functional units—that is the central point differentiating the evolutionary approach to distinct emotions from other emotion models or theories.

The second critical point embedded in Nesse's (1990) definition is that distinct emotions are multicomponential and unfold

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over time, and as a result may appear more like a process than a single event. Their components include (but do not, in any given instance of an emotion, require) subjective feelings, physiological or hormonal changes (e.g., autonomic nervous system, neuro-endocrine, respiratory, and gastrointestinal responses), motivated behavioral tendencies or "action readiness," a nonverbal signal (e.g., facial or bodily expression), cognitive changes (e.g., cognitive appraisals of the situation, which are typically what elicit the emotion; planning; prioritizing goals; enhanced memory or attentional focus), and sensory changes (e.g., heightened vision, smell). However, the relation between each instance of a given emotion and its constituent components are like everything else in psychological science, "beyond-chance probabilistic (rather than necessary)" (Roseman, 2011, p. 440; see also Levenson, 2011; and my responses to Questions 4 and 5 next).

2. One Way to Clarify Just What a Claim Includes Is to Ask What It Excludes. That Is, What Would Falsify a Claim? Please Elaborate on Those Distinguishing Elements of Your Theory by Stating How, at Least in Principle, They Would Be Falsified

This question is difficult to answer in the context of the enormous amount of evidence that has accumulated in support of the evolutionary account of distinct emotions (as well as the failure of competing models to fully explain these data in an equally satisfactory manner). Given this body of work, no single counterfinding could falsify the entire model; such a finding might challenge it, but would more likely raise questions for the specific component of the model being tested. For example, Cole, Balcetis, and Dunning (2013) found that fear and disgust promote opposite judgments about the closeness of objects, consistent with the predicted evolutionary function of each emotion. Specifically, because fear "necessitates active mobilization to withdraw or dispel potential threats" (p. 2), whereas disgust does not, fear was expected, and found, to make objects appear closer, compared to disgust. However, we might imagine that these researchers had instead found that fear promoted perceptions of objects as farther away, instead of closer. If so, this failure to support their hypothesis (which was derived from the evolutionary model expectation that fear promotes adaptive responding to threat, and perceiving potential threats as closer should increase the speed with which an organism responds to them) would not falsify the entire evolutionary theory of distinct emotions, because there remains a great deal of other evidence that would need to be accounted for. However, a finding like this would raise questions for the aspect of the theory suggesting that fear functions to help individuals cope with threat. If conceptually replicated—that is, if other studies found that fear promotes other behaviors that cannot be said to help individuals cope with threat—then, together, these findings might eventually falsify this component of the theory, and suggest that fear in fact serves some other function, or, in what would completely falsify the evolutionary account of fear, no function at all.

We can also think about this question in a hypothetical sense; that is, how might the theory be falsified if all of the extant supporting evidence had not yet emerged—for example, if the large body of research demonstrating that 6–8 emotions have distinct, universally recognized nonverbal expressions had not been conducted. This is precisely the position that Paul Ekman and Caroll Izard found themselves in in the 1960s, when their mentor Sylvan Tomkins, having read Darwin, told them of his belief that emotion expressions are evolved. Tomkins sent Ekman and Izard out to test Darwin's theory. They returned with studies showing that people from a wide range of cultural contexts recognized American emotion expressions at rates significantly greater than chance, and at substantially higher rates (e.g., 70–90% agreement) when methodological issues were surmounted (Ekman & Friesen, 1971; Ekman, Sorenson, & Friesen, 1969; Izard, 1971). However, Ekman, Izard, and their colleagues could have found the opposite. For example, they could have found that these expressions were largely confused with each other, even when methodological issues were addressed (e.g., when nonliterate Papua New Guineans were allowed to identify expressions with stories about each emotion, instead of single words; Ekman & Friesen, 1971). They could have found that fear displays were more reliably labeled with an anger story (e.g., "he/she is angry, about to fight") than with a fear story (e.g., "he/she is sitting in his/her house all alone, and there is no one else in the village. There is no knife, axe, or bow and arrow in the house. A wild pig is standing in the door of the house and the man/woman is looking at the pig and is very afraid of it"; Ekman & Friesen, 1971, p. 126). If this were the case, it would suggest that the fear expression has different meanings across cultures, and this finding would challenge the claim that emotion expressions are universally understood in the same way because each evolved to communicate a particular message.

To take one last example, this one from my own work, we found that congenitally blind Olympic athletes across cultures were substantially more likely to show all critical components of the pride expression after winning a judo match than after losing it, but were more likely to show shame expressions after losing (Tracy & Matsumoto, 2008). Given that these athletes could not have learned to show pride or shame through visual modeling, these findings provide strong support for the claim that these displays are innate behavioral responses (i.e., organized, via biological mechanisms, in advance of experience) to success and failure. However, if pride was not reliably displayed in response to success among the congenitally blind, or if we had instead found that success promoted shame displays, or anger displays, then this would raise questions for our theory that pride and shame are genetically predetermined emotional responses that evolved to facilitate an individual's ability to best cope with and benefit from the challenges and opportunities afforded by success and failure, respectively.

3. How Does Your Theory View the Relation of Emotional Experience (the Subjective Conscious Feeling in an Emotion) to the Perception of Emotion in Another? What Is Each Process? Are They Qualitatively Different Processes? The Same Process? Are They Linked?

Emotion experience and the perception of someone else's emotion are distinct processes, but both are part of the emotion's functional output. To take an example, fear evolved to help individuals cope with threat, and the emotional experience of fear does so in a number of ways, such as by increasing an individual's vigilance to threats, physiological capacity to deal with threats, and motivation to behave in ways that most effectively deal with threat. Viewing someone else's fear expression also produces an adaptive response, but one that is different from that of the experiencer. When we see a fear expression, we automatically know that the expresser is feeling fear, and also that there may be danger in the environment. This knowledge allows us to act quickly to help protect the fearful person (who, in the environment in which emotions originally evolved, was likely to share some of our genes) and to avoid or otherwise cope with the threat ourselves.

Indeed, a relatively new line of research emerging from the evolutionary approach is examining *what* the functional response to viewing each emotion expression is, beyond recognition of the emotion displayed. That is, we know, from the large body of studies demonstrating cross-cultural recognition of 5–8 distinct emotion expressions, that when people see someone else's emotion expression they have an automatic tendency to correctly infer the emotion that person is feeling (e.g., Elfenbein & Ambady, 2002; Tracy & Robins, 2008a, 2008b). But, recent studies suggest that additional functional knowledge is also acquired, and that perceivers show an automatic tendency to respond to others' displays with their own functional behavior (see Shariff & Tracy, 2011, for a review). For example, studies have found that viewing others' anger displays promotes automatic avoidance-oriented behaviors, whereas viewing others' fear displays promotes approach-oriented behaviors (e.g., Marsh, Ambady, & Kleck, 2005; Wilkowski & Meier, 2010). A recent study by Kriegelmeyer and Deutsch (2013) qualified this finding by showing that anger displays promote approach behaviors that are aggressive, but not ones that are peaceful (or helpful), whereas fear displays promote approach behaviors that are peaceful but not aggressive. This study illustrates how the functions that emotion expressions serve are simultaneously broad (i.e., both fear and anger can promote approach) and narrow (i.e., fear and anger promote different kinds of approach behavior), and thus why models proposing one-size-fits-all behavioral responses typically fail to account for emergent data.

To take another example, from my own research, we have found that when people view someone else showing a pride expression, observers respond by automatically perceiving the expresser as high status, and this holds even in cases where the expresser is known, from contextual information, to be low in status (e.g., when a homeless person displays pride; Shariff & Tracy, 2009; Shariff, Tracy, & Markusoff, 2012). This automatic response is functional for the expresser, who may subsequently acquire higher status by virtue of showing pride, but also for the observer, who quickly learns which group members should receive deference and potentially be used as a source of knowledge and wisdom (Martens & Tracy, 2013; Williams & DeSteno, 2009). Furthermore, this response, which is unique to pride, generalizes across highly disparate populations; we replicated this effect in a small-scale traditional society in Fiji, suggesting that status signaling may be a universal function of pride displays (Tracy, Shariff, Zhao, & Henrich, 2013).

Finally, for certain emotions, viewing someone else's expression can elicit a comparable or equivalent state in the observer, and thereby unleash the corresponding adaptive components of the emotion experience. One example of this dyadic process is when a parent sees a child express fear and becomes fearful him or herself, or when a child sees a parent express fear and displays a fearful behavioral response (e.g., avoidance of a visual cliff; Sorce, Emde, Campos, & Klinnert, 1985). In such cases, the perception and the experience are necessarily intertwined. However, not every emotion expression will have this effect on observers, and the likelihood of this process occurring depends on the emotion, the situation, and the relationship between the two individuals.

4. Emotions Are Now Typically Thought of as Having Components, Such as Changes in the Peripheral Nervous System, Facial Movements, and Instrumental Behavior. What Precisely Does Your Theory Say About the Relation of Emotion to the Components?

These components are the parts of the emotion; they are, in essence, what the emotion is. They are the functional output that should be linked to the evolutionarily recurrent situation that elicits the emotion, in such a way that each component acts on some level to increase the organism's likelihood of surviving or reproducing in response to the particular elicitor. However, especially in humans (who have a particularly high degree of cognitively driven flexibility in stimulus–response patterns), there will never be a one-to-one relation between the elicitation of a given emotion and each of its components; likewise, there may be little or no correlation among the various components themselves. This is because in any given emotion instance, there are numerous reasons why each component may or may not occur, resulting in a high degree of variability in emotional responding (see my response to Question 5, next).

From a methodological perspective, this variability creates a dilemma. Researchers typically want to manipulate a specific emotion then measure a particular set of output responses, with the assumption that, if a theory predicts a particular output to a particular emotion, that output should be observable in any given instance of the emotion. However, due to the many reasons for

variability (see Question 5), as well as the considerable error in measurement that typically occurs for many emotion components, we should not expect a distinct and observable set of predicted responses for *every* instance of a given emotion. Rather, we should expect a tendency for each response to occur on average, such that, across a sample of individuals representative of a population, the predicted response is more likely to occur than some other response not theoretically linked to the manipulated emotion, or is more likely to occur than no response; and the predicted response is more likely to occur during the predicted emotion than during some other emotional experience, or no emotion.

5. Is There Variability in Emotional Responding Within a Given Category of Emotion (Such as Fear, Anger, etc.)? If so, How Does Your Theory Explain That Variability?

Tooby and Cosmides (1990) explained:

> Cues need not be of uniform sensory characteristics but can be defined in relation to any recurrently identifiable properties of the world or the animal. For example, rats will eat a novel food if they smell it on the mouth of another rat, but not if they smell it on some other part of the rat's body (Galef, 1990).… The "acceptable to eat" category is defined according to specific templates about when and where the rat encountered and smelled other rats.… Superficial variability in cultural phenomena masks an underlying uniformity in cues and algorithms. (p. 409)

This explanation encapsulates the broad-level reason why most emotions are associated not with a single behavioral response, but rather with multiple responses, and why the response that occurs in a given emotional situation depends on a number of factors, related to the particular situation and cultural context, and the person experiencing it. This variability highlights another benefit of the functionalist approach; only by examining the behavioral (or physiological, motivational, experiential, and cognitive) responses at the functionalist level can we understand *why* different responses might occur in response to the same emotion.

At a more practical level, Roseman (2011) outlined a number of reasons why variability should be expected in studies that assess emotional responding, both across people and across instances of the same emotion within people. To summarize his arguments, which are all consistent with the evolutionary account:

1. Multiple emotions can occur (and co-occur) in response to the same elicitor (if the elicitor is appraised in several different ways), resulting in confusion about which emotion is being measured.
2. The same emotion can elicit different kinds of behaviors which fall in the same action-readiness category, consistent with the emotion's broader goal. For example, anger can elicit yelling or hitting, both of which are consistent with the function served by anger (preventing goal blockage), but which behavior occurs will vary depending on the situation, the person, the person's relationship to the target of anger, and so on. This variability is likely present to some extent in all animals, but it is compounded in humans, whose consciousness allows us to think through numerous various response options before responding. At this broad category level of behavioral response, there is a good deal of evidence for consistency within indices of emotion (e.g., Frijda, Kuipers, & ter Schure, 1989; Roseman, Swartz, Newman, & Nichols, 2010; Shaver, Schwartz, Kirson, & O'Connor 1987).
3. Humans frequently (in all likelihood, more often than not) modulate their emotional responses in some manner, and the manner of regulation that occurs (e.g., reappraisal to inhibit the emotion experience, suppression to inhibit the expression; Gross, 2013) is also variable. One way to address this issue is to simultaneously measure the emotional response and its regulation. For example, Roseman, Wiest, and Swartz (1994) found that those participants who reported not engaging in the predicted action in response to a given emotion also reported *wanting* to engage in it, but regulating their behavior. All participants who were asked to recall an episode of fear reported *wanting* to run away, at least to some extent, and this desired action was reported to a greater extent for fear than for any other negative emotion examined.
4. Individuals frequently experience other motivational or cognitive states at the same time as a given emotion (e.g., hunger, fatigue, lust), and these other states can take priority in influencing behavior, over the motivational impact of the emotion, depending on relative strength of each and the availability of means for satisfying each.
5. The intensity of emotions is variable, and high-intensity emotions may indicate the need to respond with the most direct action, and thus be more likely to result in the predicted output. If this is the case, intensity should predict degree of consistency (or, observable co-occurrence) across the various components of an emotion. This prediction leads to one plausible account for the relatively weak correlations found among various components of a given emotion in laboratory studies (e.g., Mauss, Levenson, McCarter, Wilhelm, & Gross, 2005). Emotions elicited in the laboratory, in response to somewhat artificial stimuli such as evocative films, are likely to be far less intense than those that occur in the real world, in response to actual evolutionarily recurrent environmental events.

In summary, the relation between emotions and their predicted output should be considered contingent, rather than absolute. Despite this contingency, the evolutionary model has a great deal of predictive power. As Roseman (2011) explained,

> Knowing that a fearful animal is more likely to either freeze, fight defensively, or flee—depending on the imminence of the danger and the availability of an escape route—gives systematic understanding of emotion–behavior relationships under specifiable conditions … [This] represents significant predictive capacity. (p. 436)

So, the question a researcher needs to ask is, is the angry person in my study more likely to yell, hit, or behave in a hostile manner than to laugh, flee, become sick, or do nothing? If so, and if the difference between these two categories of response is statistically significant, then that is a main effect, and it is likely to be meaningful even if not everyone engages in the predicted behavior.

Note

1 By evolutionary recurrent situation, I mean the *appraised*, or interpreted situation, which is more predictive of the emotion experienced than the specific situation itself. To take an example, the image of a gun can elicit fear because in contemporary industrial societies guns are associated with threat. But, prior to the invention of guns, the image of a gun would not elicit fear. It is the appraisal of threat, and not the potentially threatening object itself, that elicits the fear. It is noteworthy that this emphasis on appraisal results in a good deal of common ground between evolutionary approaches to emotion and many appraisal theories of emotion.

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