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Four Models of Basic Emotions: A Review of Ekman and Cordaro, Izard, Levenson, and Panksepp and Watt

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Abstract

In this special section, Ekman and Cordaro (2011); Izard (2011); Levenson (2011); and Panksepp and Watt (2011) have each outlined the latest instantiation of each lead author's theoretical model of basic emotions. We identify four themes emerging from these models, and discuss areas of agreement and disagreement. We then briefly evaluate the models' usefulness by examining how they would account for an emotion that has received considerable empirical attention but does not fit clearly within or outside of the basic emotion category: pride. Finally, we compare the central themes covered by the four models with themes emerging from current emotion research, to conclude that, for the most part, the models are comprehensive; they largely converge with the current state of affective science research.

Keywords

basic emotion, pride, self-conscious emotion, theoretical model

As researchers seeking to understand emotions at a “basic” level, we were excited by the publication of this special section. What better way to proceed as basic emotion researchers than to review the current state of the science as expressed by four of the field's most eminent leaders? Furthermore, the field of basic emotions needs a coherent and comprehensive theoretical model, and, in answering the questions outlined by the editors, these researchers have each summarized the principle components of their own model, which, in most cases, is based on research conducted over the course of their career. Models such as these are precisely what generate good research; one of the best ways to ensure that the field progresses is to lay out a model with clear, testable predictions. The models articulated here are distinct yet overlapping, and indicate areas of agreement, disagreement, and where more research is needed. We will leave to future researchers the difficult empirical work of

determining which pieces of each model are most correct, but will use this commentary as an opportunity to examine which pieces are most *useful*—that is, which might best guide and influence emotion research.

In our view, a theoretical model of basic emotions should do three things. First, it should allow us to figure out if X —some unknown psychological entity—is a basic emotion. If more research is needed to answer this question, a strong model will provide clear direction on what that research is—what studies are needed to determine whether X is a basic emotion. Second, if we already know that X is a basic emotion, a strong model should allow us to learn a great deal about X , by virtue of its inclusion in the category. For example, if a model claims that all basic emotions have discrete neurobiological markers, then knowing that X is a basic emotion also tells us that it has distinct neurobiology, and, if that neurobiology is not currently known, this becomes an important direction for future research. If, for some reason, X is found to meet some of a model's criteria but not all, we should still learn something by determining which criteria X does and does not meet. This is because, in a strong model, each criterion is there for a pre-articulated reason. If a theory stipulates that all basic emotions have distinct nonverbal expressions because emotions evolved to serve a communicative function, we learn something about an emotion that meets other criteria but has no expression: this particular emotion may have evolved for some other reason, besides communication, or it may serve a communicative function through a different means. In this way, a strong model also does a third thing: it provides a set of instructions for how to go about studying newly uncovered emotional states.

With these three expectations in mind, we “tested” the four models proposed here by briefly examining how they account for a relatively recently studied emotion—one that is not on any of the four model's lists of basic emotions, but which has received a good deal of recent research attention: pride (e.g.,

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Carver, Sinclair, & Johnson, 2010; Oveis, Horberg, & Keltner, 2010; Tracy & Matsumoto, 2008; Tracy & Robins, 2004a, 2007a, 2007b, 2008a; Tracy, Shariff, & Cheng, 2010; Williams & DeSteno, 2008, 2009). Admittedly, we chose pride in large part because it is an emotion with which we are very familiar, having been a major focus of our research. However, pride also happens to be a good target for this test, because it has been studied largely from the basic emotion perspective, and is likely to meet some basic emotion criteria but also to be different in some ways from the known basic emotions included in the four models.

Pride belongs to a category of emotions long discussed for their uniqueness from basic emotions, known as “self-conscious” emotions (Campos, 1995; Levenson, 1994; Lewis, 2000; Tracy & Robins, 2004b). These emotions have something of a liminal status in the emotion literature; some have argued they should not be included in the basic emotion category, others have argued that at least some self-conscious emotions are basic, and still others have argued that certain self-conscious emotions are good exemplars of both the basic and self-conscious emotion categories (Ekman, 1992; Keltner & Buswell, 1997; Kemeny, Gruenewald, & Dickerson, 2004; Tracy & Robins, 2004c). Because self-conscious emotions clearly lie at the edge of standard conceptualizations of basic emotions, using the models of basic emotions outlined here to examine a self-conscious emotion which has received a good deal of research attention may allow us to evaluate the models’ utility—their ability to account for and increase our understanding of “X”. Thus, in this commentary we will review four major themes that emerge from the models, and examine the extent to which the contributors’ accounts of each theme: (a) allow us to determine whether pride is a basic emotion, (b) increase our understanding of pride, and (c) lay out clear future research directions for pride.

Finally, one last and somewhat separate requirement of a strong basic emotion model is that it be comprehensive; it should account for most research conducted within the field. In other words, if a researcher is currently studying emotions from a basic-level perspective, the questions he/she addresses should, at least to some extent, be incorporated within a strong theoretical model of basic emotions. To examine whether the four models discussed here are comprehensive at this broad level, we will conclude our commentary with a brief review of the major topics characterizing current basic emotion research, based on a nonempirical perusal (i.e., informal literature review) of articles published in the highest impact journal in the field, *Emotion*, in the past 3 years. This will allow us to determine the extent to which the four models encompass the full range of research regularly conducted by emotion researchers.

Themes Addressed by the Four Contributors

What is a Basic Emotion?

This theme is addressed by the authors’ responses to the editors’ Questions 1, 2, 5 and 7, all of which tackle the core issue of what it means to be a basic emotion. In general, the four authors

show considerable agreement in defining the criteria that must be met. All agree that a basic emotion should be discrete, have a fixed set of neural and bodily expressed components, and a fixed feeling or motivational component that has been selected for through longstanding interactions with ecologically valid stimuli (e.g., the subjective feeling and motivational component of fear is what it is because this response has historically been most adaptive in coping with typical fear elicitors).

There is also general consensus that basic emotions are psychologically primitive, although “primitive” was interpreted somewhat differently by the various authors. In one sense, basic emotions are primitive in that they must originate in subcortical brain structures. While higher order structures (e.g., the neocortex) may be involved in emotion processing, Panksepp and Watt assert that, to date, only subcortical structures have been found to house genetically determined, fixed processes, and thus that any truly primitive basic emotion must originate from one of these brain regions. In another sense, basic emotions are primitive in that they are most active in their purest form (i.e., occur with minimal cognitive or behavioral regulation) during early development or immediate crisis. Although basic emotions are assumed to play a major role in the everyday cognitive processing of adults, the four models largely agree (with the possible exception of Ekman and Cordaro) that in almost all such cases these emotions interact with each other and with higher order cognitive processes to produce an emotional experience and behavioral output that is more complex than the primitive, “pure” basic emotion affect program seen in young children, and adults during times of crisis.

Given these criteria, what kinds of evidence do the contributors believe should be sought to determine whether a particular state qualifies as a basic emotion? All agree that cross-species generalization (i.e., the observation of an emotion in nonhuman animals) is a clear indicator. While this is not a necessary criterion, it is sufficient. This has an important implication: if a researcher views as basic an emotion that exists only in humans, he/she must explain how humans’ unique environmental and social challenges would have led to the emergence of new neurological structures, not seen in other species, that allow for this phylogenetically more recent emotion.

Indeed, another agreed-upon gold standard is the presence of neurons dedicated to the emotion’s activation. While it may be difficult to pinpoint those neurons, especially in humans, researchers can meet this criterion by seeking evidence of genetically determined capacities to experience each emotion separately. Izard; Levenson; and Panksepp and Watt agree that while individual and cultural learning can change the conditions and intensity with which basic emotions are activated and experienced, they cannot create, *de novo*, a basic emotion that is not already possible via genetically encoded neural structures. Thus, evidence for a distinct emotion that seems to be at least partially genetically determined—for example, evidence of universality—may be taken as evidence (albeit preliminary) for distinct neurology. Only Panksepp and Watt place an additional requirement: the distinct neural networks associated with a basic emotion must be located in subcortical structures. This,

again, is based on their argument that there is no evidence for neural circuits dedicated to particular processes (e.g., vision, hearing) in the neocortex, nor any evidence that the neocortex can generate emotion on its own.

Thus, there is general consensus on the key criteria for considering psychological states to be basic emotions. However, there is greater disagreement about the prevalence of these emotions in daily life. Izard; Levenson; and Panksepp and Watt agree that basic emotions are critical in early development, but, as a result of learning and cognitive reflection, eventually develop into the more complex emotional states that are regularly experienced by adults; they argue that more primitive, basic emotions are experienced in “raw form” rarely in adult life. Only Ekman and Cordaro suggest that emotional experiences which seem to require cultural learning, such as *schadenfreude*, may eventually be considered “basic.”

Given the high level of consensus among the authors on the definition of a basic emotion, it is not surprising that their lists of currently known basic emotions are largely similar, with some notable exceptions, and disagreements over terminology (see Figure 1). To avoid becoming mired in terminological differences, we have consolidated items across the authors’ lists that seem to represent the same state, despite different labels. Doing so reveals that all four lists include a positive emotion labeled happiness (Ekman and Cordaro; Izard), enjoyment (Levenson), or PLAY (Panksepp and Watt); and three distinct negative emotions: sadness (labeled GRIEF by Panksepp and Watt), fear, and anger. One emotion on Izard’s; Levenson’s; and Panksepp and Watt’s lists that is challenged by Ekman and Cordaro is interest/SEEKING; Ekman and Cordaro consider interest a “cognitive state of focused attention.” In a similar vein, Panksepp and Watt’s model is the only one that does not include disgust, on the grounds that it evolved to help regulate more physiological needs, akin to physical pain or hunger. However, given that disgust influences behavior in response to

fairly specific stimuli regularly encountered in humans’ ancestral environment, has a distinct and cross-culturally recognized nonverbal expression (Ekman et al., 1987), dedicated neural circuitry (e.g., Wicker et al., 2003), and interacts with cultural learning to produce higher order emotional schemas (Chapman, Kim, Susskind, & Anderson, 2009), disgust seems to belong to a different category than purely physiological states and may merit inclusion, even on Panksepp and Watt’s list. Finally, there are a number of emotions, included on one or two lists, which are not typically considered basic. In the case of these controversial emotions, such as surprise, contempt, and lust, researchers must rely on the criteria laid out and generally agreed upon by the four models; future studies will likely reveal that there either is or is not sufficient evidence for their inclusion.

Is pride a basic emotion? Using these criteria, can pride be considered a basic emotion? Regarding the first agreed-upon criterion, of distinct bodily expressed and feeling/motivational components which have been evolutionarily selected for, pride seems to pass the test—it is associated with a nonverbal display that is reliably recognized across a wide range of populations (Tracy & Robins, 2008a; Tracy, Shariff, Zhao, & Henrich, 2011), and spontaneously shown in pride-eliciting situations by individuals across cultures, including the congenitally blind (Tracy & Matsumoto, 2008), suggesting that the emotion and its expression are human universals.

However, studies on pride are only beginning to address the two gold standard criteria mentioned by the contributors: presence in other animals and distinct neurobiology. There is some evidence for a pride-like nonverbal display in other primates; dominant chimpanzees are known to show a distinct set of behaviors, when seeking to intimidate a potential rival, which are morphologically similar to those that constitute the prototypical pride expression (Martens, Tracy, Cheng, Parr, & Price,

Theoretically and empirically supported basic emotions according to each model			
IZARD	PANKSEPP & WATT	LEVENSON	EKMAN & CORDARO
Happiness	PLAY	Enjoyment	Happiness
Sadness	PANIC/GRIEF	Sadness	Sadness
Fear	FEAR	Fear	Fear
Anger	RAGE	Anger	Anger
Disgust		Disgust	Disgust
Interest	SEEKING	Interest?	
Contempt?	LUST	Love?	Contempt
	CARE	Relief?	Surprise

Figure 1. Similarities and discrepancies among the clear-cut basic emotions included in each of the four models.
 Note: ? = Included in this author(s)’ model, but the author(s) suggested that clear-cut supporting evidence is not yet available.

2010). A next important step is to examine the extent to which these displays serve similar adaptive functions across species, and whether other mammals also show evidence of a pride-like display. That said, there is reason to expect that pride will be found only in animals with some capacity for self-awareness and self-representations, such as great apes (Hart & Karmel, 1996). Self-conscious emotions require an ability to reflect on the self's actions and abilities, compare self-representations to norms and goals, and make a self-evaluation. In this way, they differ from basic emotions, which can involve such self-reflective processes but need not. Almost certainly as a result of this requirement, self-conscious emotions likely emerged later in evolutionary history than typical basic emotions, after (or in tandem with) the emergence of these higher order cognitive capacities (Sedikides & Skowronski, 1997; Tracy & Robins, 2004b). Thus, the dominance displays observed in species throughout the animal kingdom, which do not have the capacity for complex self-evaluations, likely represent a more low-level stimulus-response tendency than a full-fledged *emotion*. Nonetheless, these phylogenetically ancient hierarchy-establishing behaviors may provide important clues about the earlier origins of pride.

Regarding the discrete neurobiology criterion, studies have not examined pride at a subcortical level. However, it seems unlikely that researchers will ever uncover a distinct neural network associated with pride that exists within subcortical regions alone, given the importance of higher level self-relevant processes in eliciting pride. One possibility is that, in certain primates, the lower level neurological mechanisms that allow for dominance displays and hierarchy formation interact with the higher level neurological mechanisms that allow for a complex self, to jointly produce pride experiences. As the models make clear, examining this question is an important direction for future research.

Thus, based on the models reviewed here, it seems that pride could be considered a potential basic emotion, in that there is evidence for its genetic basis in humans. However, pride is also different from other basic emotions, most notably in its steeper cognitive prerequisites and the related, debatable questions of whether it could ever be elicited via stimulation of some subcortical neural region alone and whether it will ever be found to be present in all mammals. More important for the present purposes, the models succeed in allowing us to address this question for the case of pride, or at least determining the next research steps needed to fully address it. Doing so also points to potential new insights about pride in the cases where it fails to fully satisfy basic emotion criteria; for example, might human pride emerge from a phylogenetically ancient dominance system combined with higher level capacities for self-evaluative processing?

What is the Function/Power/Purpose of a Basic Emotion?

This theme is largely answered in each author's response to Question 4, and again, there is considerable consensus. All agree that basic emotions must have direct causal powers over

motivation and behavior, at least in early developmental stages. In all cases, this argument is based on evolutionary principles. As Ekman and Cordaro explain, if an emotion evolved to facilitate adaptive coping with specific ecological challenges, then that emotion would need to cause and motivate appropriate behavioral and physiological responses to address the relevant challenges. However, as individuals develop higher level cognitive and social capacities that allow for emotion regulation, these causal effects become probabilistic, merely increasing the likelihood of emotion-congruent behavior. Levenson views this process as a reprioritizing of behaviors on a hierarchy, such that, for example, anger increases the likelihood of violence, but does not necessarily lead to violence, given that actual behaviors are almost always multiply determined. He suggests that basic emotions are most deterministic when their elicitors closely match evolutionarily valid prototypes, and when onset is sudden and intense. This is similar to Panksepp and Watt's description of emotions' causal powers, where the output of a basic emotion neurological circuit is based on strength of activation, but the affective and behavioral consequences occur only after complex interactions with higher cognitive processing. They suggest that one area where emotions may overwhelm higher cognition in producing behavior is during extreme loss, danger, or suffering—similar to Levenson's evolutionarily derived prototypes. In fact, in Panksepp and Watt's view, if the evolved behavioral output of emotions occurs chronically in adults, with little or no higher order cognitive influence or regulation, distinct psychiatric disorders can result.

Does pride have a distinct function/power/purpose? A growing body of evidence suggests that pride evolved in humans to serve a distinct adaptive function: promoting an individual's social status and group inclusion, outcomes which have been shown to promote fitness across species (e.g., Cowlshaw & Dunbar, 1991). Pride likely promotes social status through several causal paths: the reinforcement of achievement behaviors which in turn boost status; the motivation of perseverance at difficult tasks; and the communication of an individual's deservedness of higher status, both to observers, via the pride nonverbal expression, and to the proud individual, via the pride subjective feeling experience (see Tracy et al., 2010, for a review).

It is worth noting that while this function has clear adaptive benefits, they are different from the benefits typically associated with basic emotions—a direct increase in likelihood of survival and reproduction. High social status can facilitate survival and promote increased reproduction opportunities, but, consistent with its membership in the self-conscious emotion family, pride has only an indirect effect on these fitness-relevant outcomes, and a more direct effect on social outcomes. Indeed, self-conscious emotions seem to function largely to promote the maintenance of an individual's place within the social hierarchy—an essential goal for social species, but not, in all likelihood, all animals. One important question is why, in humans, a new set of emotions arose to deal with this critical social need, whereas in almost all other animals dominance and submission behaviors

are assumed to be driven by fear, anger, and other basic emotions. Presumably, animals such as humans, with complex self-processing abilities, benefit from experiencing highly self-reflective emotions; these emotions may be part of what allows for unique features of human societies such as cultural learning, social status based on prestige (i.e., earned respect) as well as dominance, and nontransitive hierarchies wherein the highest status warriors are not necessarily the highest status hunters (Cheng, Tracy, & Henrich, 2010; Henrich & Gil-White, 2001; Tracy & Robins, 2004b).

How Can We Distinguish Among Basic Emotions?

The authors addressed the question of how we can know that different emotions are discrete, and not simply variations of one another, in their responses to Questions 2 and 6. All agree that a basic emotion should have discrete antecedents, neural networks, physiology, and behavioral output. Thus, evidence of discreteness in any of these domains could be used to distinguish among basic emotions. Although evidence in all domains would be ideal, the authors discuss which domains are most convincing, and most amenable to empirical investigation.

Evidence that an emotion has discrete and dedicated neural circuitry is generally considered to make the strongest case for basicness. However, evidence of neural discreteness at the subcortical level is very difficult to obtain in humans, as it would involve unacceptably invasive testing. Levenson suggests that transcranial magnetic stimulation (TMS) may provide a solution, but, if Panksepp and Watt are correct that discrete basic emotion circuitry exists below the neocortex, methods that assess only cortical activity, such as TMS, will be of limited value. These methods might, however, reveal neural activity that is shared among several basic emotions, such as positive versus negative emotions, or emotions that motivate approach versus avoidance behaviors (Davidson & Fox, 1982; Harmon-Jones & Allen, 1997). Another strategy recommended by both Levenson, and Panksepp and Watt is the use of pharmacological agents to block or stimulate discrete emotions. While there is undoubtedly much to learn from this method, the fact that these agents affect multiple brain processes makes it unlikely that pharmacological manipulation studies will allow for strong conclusions about discrete neural networks or activation.

Recognizing these difficulties, Panksepp and Watt make a strong argument for causal, cross-species evidence as the gold standard in identifying basic emotion neural circuitry. Noting that basic emotion priming in humans always triggers secondary and tertiary cognitive processes, Panksepp and Watt point to recent advances in the animal literature, where controversies still present in the study of human emotions have been largely resolved. They argue, for example, that electrical brain stimulation studies of a range of mammals have shown that arousal is not a single continuous dimension, but, rather, has multiple discrete types, activated by distinct subcortical neurons, and each of these corresponds to a different, high-arousal basic emotion. Furthermore, studies have shown that animals produce distinct sets of emotion-related behaviors, calls, and

nonverbal displays in response to electrical stimulation of specific neurons; according to Panksepp and Watt, this is the best evidence for neurological discreteness. Given that these neural circuits are likely to exist in human brains as well, these findings may be taken to support the discreteness of human basic emotions.

Where, then, does this leave emotion research in human subjects? One area that may be fruitful is the study of minimal antecedent events needed to elicit an emotion; these should also be discrete. Ekman and Cordaro argue that a mental process that does not have a distinct antecedent event should not be considered a basic emotion. Another potentially useful approach is to deepen research on the perception of nonverbal displays—the component of emotions known to be distinct, universal, and behavioral. However, Levenson cautions that the presence of a distinct cross-cultural expression does not guarantee shared neural networks; it is possible that similar environments produce similar culturally learned responses, or that emotion-expression associations are transmitted between cultures—particularly likely as small-scale societies gain increasing access to global culture.

Can pride be distinguished from other emotions? In several prior accounts of basic emotions, only one positive emotion was included: happiness, also referred to as joy or enjoyment (e.g., Ekman, 1992).¹ Some models also included interest (Izard, 1971) or love (Panksepp, 1998; Shaver, Schwartz, Kirson, & O'Connor, 1987), but none included pride. Pride is a positively valenced emotional experience, so the question must be asked: is it distinct from other positive emotions typically assumed to be basic? Based on studies of the pride nonverbal expression, the answer is yes; pride expressions can reliably, quickly, and efficiently be discriminated from happiness expressions (Tracy & Robins, 2004a, 2007b, 2008b), even by children as young as 4 years old (Tracy, Robins, & Lagattuta, 2005). Furthermore, success reliably predicts the display of pride expression behaviors even when variance due to happy expression behaviors is statistically removed, suggesting that the two behavioral responses are largely independent (Tracy & Matsumoto, 2008).

At the level of nonverbal behaviors, then, a strong case can be made for pride's discreteness. At the level of antecedent events, however, this is less clear; given that happiness is a broad-level positive emotion, experienced in response to almost any goal-congruent event, the events that elicit pride are likely to also elicit happiness—though the reverse is probably not the case. Does this mean that pride is not discrete? In our view, it is more likely that happiness is the less discrete emotion, triggered in response to a wide range of antecedents that also elicit love, lust, contentment, interest, gratitude, awe, and any other positive emotion that could potentially be considered basic. Indeed, as research on positive emotions—a relatively new field—grows, there may be a major shift in our understanding of happiness, such that it comes to be seen more along the lines of “positive valence,” a dimension that underlies numerous emotional states, but which, like negative valence, should not be

considered a discrete basic emotion. Indeed, Levenson, and Panksepp and Watt do not include happiness in their lists of discrete basic emotions, instead referring to the narrower states of enjoyment and PLAY, respectively. Though neurobiological evidence may be needed to resolve this issue, the present models' focus on discreteness may make an important contribution to our understanding of positive emotions by calling for research on this topic.

What Are the Cognitive Prerequisites of Basic Emotions?

This theme is addressed in the authors' responses to Questions 3 and 8. All agree that basic emotions are elicited by some kind of core affect program, which evolved to elicit adaptive responses to fixed prototypes of antecedent stimuli. Ekman argues that this conclusion is necessitated by the evidence as well as evolutionary logic: in order for such complex, disparate systems to be triggered in a cohesive way (i.e., co-occurrence of nonverbal expression, physiology, and behavioral preparedness), and so similarly across individuals and cultures, there must be at least some minimal affect program that is hardwired in the brain and fixed.

However, despite agreement that an affect program begins with dedicated neural circuitry that responds to expected prototypical stimuli, it is generally agreed that novel stimuli which also trigger the program can be added to the human emotional repertoire, and alterations can be made to the program's output. There is less agreement, however, regarding the flexibility of these programs. Panksepp and Watt suggest that classically conditioned stimuli can activate basic emotions as robustly as the innate prototypes (e.g., pain may be the hardwired trigger for fear, but stimuli reliably associated with pain have come to reliably trigger fear). It is unclear, however, whether original, evolutionarily relevant stimuli can be completely overwritten or "deleted," such that they no longer trigger the emotion. Levenson argues that if a stimulus is powerful enough and closely matches the prototype, it will always trigger the expected basic emotion response, even after life-long efforts to dampen or suppress one's response to that stimulus.

As with input, the authors agree that novel emotional responses can be added to the core repertoire of behavioral output, but exactly how this occurs is an important topic for future research. For example, Ekman and Cordaro suggest that responses such as braking suddenly before a car accident are too quick to involve cognitive reflection, and must result from newly coded low-level stimulus and response programs that may emerge while learning to drive. Izard notes, however, that most behavioral output takes more than a second to activate, allowing plenty of time for cognitive interference. Indeed, Levenson, and Panksepp and Watt express concern that the majority of human emotion research measures secondary or tertiary responses, and thus can say little about fixed output programs of basic emotions. In sum, though there is agreement that the output of emotion programs can be altered, it is not yet clear if this occurs largely through higher order cognitive reflection, or if new basic

circuitry can be developed at the lower cognitive levels. Panksepp and Watt note that the best way to resolve this question is to conduct research on the neurological and pharmacological elicitors of basic emotions in nonhuman animals.

What are the cognitive prerequisites for pride? In contrast to the classic example of fear, it is unlikely that researchers will ever uncover a low-level stimulus-response affect program that reliably elicits pride, or, at least, a full-fledged human pride experience. It is possible, however, that certain aspects of pride, such as its nonverbal display, have dedicated neural circuits which evolved to facilitate coping with challenges associated with navigating a status hierarchy. Indeed, crayfish are known to have a distinct neural circuit that activates aggressive postures and tail flipping (an intraspecies combat maneuver) during situations of dominance (Barinaga, 1996). That said, the human pride experience is considerably more complex, and the elicitation of pride, and all self-conscious emotions, requires a series of high-level cognitive appraisals regarding the eliciting event's relevance to the individual's identity and identity goals, as well as attributions determining whether the individual is the cause of the event (see Tracy & Robins, 2004b). Indeed, in all theoretical accounts of self-conscious emotions, the primary feature that distinguishes these emotions from non-self-conscious emotions is the need for complex self-evaluations (e.g., Izard, Ackerman, & Schultz, 1999; Lewis, 2000; Tangney, 1991; Tracy & Robins, 2004b). While these appraisals can occur extremely quickly and implicitly, they cannot occur without complex higher order cognitive processes. It is for this reason that Izard and colleagues labeled shame, guilt, and pride "cognition-dependent" emotions, in comparison with the relatively "cognition-independent" basic emotions (Izard et al., 1999, p. 92).

Do the Four Models Improve Our Understanding of Pride?

Taking stock of what we learn about pride by examining it from the perspective of the four models outlined here, we can conclude that pride has many features considered essential to the basic emotion category (i.e., cross-cultural nonverbal expression, causal powers with adaptive functionality, discriminability from related emotions, presence in some nonhuman animals), but also a number of features which differentiate it from known basic emotions (i.e., greater cognitive complexity, likely absence in animals that cannot make complex self-evaluations, unlikely to have a discrete and dedicated subcortical neural circuitry). However, rather than prevent us from understanding pride, the models' pinpointing of these latter features allow for new insights on pride, which may ultimately point to its unique evolutionary origins. The models also suggest two clear future directions for research on pride, given that extant findings do not allow us to fully answer all of the questions raised. Specifically, studies are needed to examine pride from a neuroscientific perspective, and to examine pride across species. Research guided by the former direction should seek to

determine whether pride is associated with a distinct neural network and, if so, what aspects of the emotion account for any pride-specific neural activity found. Research guided by the latter direction should seek to determine whether pride is present only in species with the capacity for self-evaluative processing, and what form pride takes in nonhuman animals that do appear to experience it in some way. Such questions may make major headway in our understanding of pride's evolutionary origins and those of self-conscious emotions more generally, and may eventually allow us to clearly locate self-conscious emotions either within the basic emotion category—at least as defined by certain models—or outside of it. Ultimately, the fact that the models allow us to fruitfully conduct this evaluation indicates their utility.

The State of the Science of Basic Emotion Research

A final requirement of a strong model of basic emotions is that it be comprehensive; it should encompass and have useful predictions for the majority of current research in the field. With this in mind, we conducted a casual survey of research recently published in the highest impact journal for affective science, *Emotion*. Based on an examination of the abstracts of all articles published from 2008–2010, we identified six distinct themes that were at least somewhat regularly represented. Of these, four could easily be incorporated within the themes discussed here, namely: the effects of emotions on cognition and behavior, the perception of emotion-inducing stimuli, affective neuroscience, and the evolution of emotions. Two additional themes also emerged, which do not seem to fit easily into the topics emphasized here: individual differences in emotional experience and regulation, and the relation of emotions to long-term health. Below, we briefly explore each of these themes.

Effects of Emotions on Cognition and Behavior

That emotions influence cognition and behavior is accepted and discussed in all four models. Although some of these effects are well known (e.g., that fear increases the likelihood of fleeing), many are only beginning to be examined, making this an important direction for future research. Approximately 20% of articles published in the last 3 years in *Emotion* address this theme in some way, most typically examining how distinct emotions influence memory (e.g., Parzuchowski & Szymkow-Sudziarska, 2008), perceptual biases (e.g., Oosterhof & Todorov, 2009), motivation or willingness to engage in risky or cautious behaviors (e.g., Sherman, Haidt, & Coan, 2009), and social preferences (e.g., Jones & Fitness, 2008).

Perception of Emotion-Inducing Stimuli

Another major focus of recent emotion research is emotion elicitors, or the particular stimuli needed to evoke different emotions. Studies in this vein address questions about which subsets of the large amount of information humans are regularly bombarded with influence affect, and the extent to which

perception of these stimuli occurs automatically and implicitly or intentionally and explicitly (e.g., Calvo, Nummenmaa, & Hyona, 2008; Juslin, Liljestrom, Vastfjall, Barradas, & Silva, 2008). In general, understanding the specific sensory cues that trigger distinct emotions across cultures remains an important area of research. Approximately 20% of the articles examined address issues related to this theme.

Affective Neuroscience

Levenson, and Panksepp and Watt argue most strongly for the need for studies uncovering distinct neural networks associated with each emotion, but all contributors agree that a better understanding of emotional experiences requires a more complete knowledge of their accompanying neurology and physiology. Thus, studies examining which brain regions are activated during particular emotional experiences (e.g., Koenig & Mecklinger, 2008), and which emotions are elicited by the stimulation of various brain regions (e.g., Singer et al., 2008), will be critical in the next stage of basic emotion research. Approximately 15% of articles reviewed use neuroscientific or physiological assessment methods, or address neuroscientific questions, broadly construed. However, it is likely that this frequency underestimates the true proportion of emotion research that can be considered affective neuroscience, given the numerous other outlets available for publishing this kind of work.

Evolution of Emotions

All contributors argue for the importance of examining emotions from an evolutionary perspective, and take for granted that basic emotions are evolved. Although this theme is prominent in recently published articles (e.g., Murray et al., 2009), relatively few studies directly test evolutionary accounts; a central focus on evolution was identified in fewer than 10% of the articles surveyed. This may be due to our surveying abstracts only; it is possible that many more articles draw on evolutionary theory, but do not mention it in the abstract. Indeed, researchers may be hesitant to make explicit evolutionary conclusions from their data, as reviewers and editors tend to (appropriately) hold fairly strict requirements about the evidence needed to support such conclusions (e.g., cross-cultural or cross-species data). As a result, even in cases where studies were designed to test an account based on evolutionary principles, authors may tone down any direct acknowledgment of this goal, especially in the abstract.

Individual Differences

Given the emphasis, in all four models, on understanding the selection pressures that led to each basic emotion's emergence, it is important to explain and account for variation across individuals in emotional experiences (i.e., if emotions are adaptive, why are they experienced differently, and to a different extent, among individuals?). Although a discussion of individual differences is largely absent from this special section, approximately

20% of the recent *Emotion* articles address this topic, most typically examining individual differences in emotion regulation (e.g., Borelli et al., 2010) or the intensity of emotional experiences (Sallquist et al., 2009). Although there is strong evidence for universal basic emotions, there is also evidence for widespread differences within and between cultural groups in how these emotions are experienced and controlled, and these differences are likely to promote differences in various life outcomes.

Emotions and Long-Term Health

About 13% of recent *Emotion* articles examine the relation between emotions and health, most typically by observing long-term health consequences associated with particular emotional tendencies (e.g., Cohn, Fredrickson, Brown, Mikels, & Conway, 2009; Sallquist et al., 2009), and the effect of interventions (e.g., expressive writing, mindfulness training) on emotional responding and long-term mental health (e.g., Farb et al., 2010; Sloan, Marx, Epstein, & Dobbs, 2008). This is a topic that was not addressed by the contributors, probably in part because it is less relevant to the specific questions they were asked. Nonetheless, the role of emotions in health is a major current research direction, within both affective science and the burgeoning field of health psychology, and the frequency of published articles exploring these issues is probably underestimated here, given that there are numerous other outlets that publish this kind of work.

Are the Four Models Comprehensive?

Overall, the four models of basic emotions discussed here overlap to a large extent with the current pursuits of emotion researchers, based on our perusal of recent issues of *Emotion*. This convergence provides confirmatory support for the four models; in addition to laying out criteria that allow us to determine whether particular states should be considered basic emotions, suggesting new insights about emotions that both do and do not pass the test, and highlighting critical future research directions for these emotions, they also can be said to guide, and provide an explanatory framework for, current research in the field.

Note

- In later work, Ekman (2003) indicated that there may in fact be several distinct positive emotions, including two pride-like emotions.

References

- Barinaga, M. (1996). Neurobiology: Social status sculpts activity of crayfish neurons. *Science*, *271*, 290–291.
- Borelli, J. L., Crowley, M. J., David, D. H., Sbarra, D. A., Anderson, G. M., & Mayes, L. C. (2010). Attachment and emotion in school-aged children. *Emotion*, *10*, 475–485.
- Calvo, M. G., Nummenmaa, L., & Hyona, J. (2008). Emotional scenes in peripheral vision: Selective orienting and gist processing, but not content identification. *Emotion*, *8*, 68–80.
- Campos, J. J. (1995). Foreward. In J. P. Tangney & K. W. Fischer (Eds.), *Self-conscious emotions: The psychology of shame, guilt, embarrassment, and pride* (pp. ix–xi). New York, NY: Guilford.
- Carver, C. S., Sinclair, S., & Johnson, S. L. (2010). Authentic and hubristic pride: Differential relations to aspects of goal regulation, affect, and self-control. *Journal of Research in Personality*, *44*, 698–703.
- Chapman, H. A., Kim, D. A., Susskind, J. M., & Anderson, A. K. (2009). In bad taste: Evidence for the oral origins of moral disgust. *Science*, *323*, 1222–1226.
- Cheng, J. T., Tracy, J. L., & Henrich, J. (2010). Pride, personality, and the evolutionary foundations of human social status. *Evolution and Human Behavior*, *31*, 334–347.
- Cohn, M. A., Fredrickson, B. L., Brown, S. L., Mikels, J. A., & Conway, A. M. (2009). Happiness unpacked: Positive emotions increase life satisfaction by building resilience. *Emotion*, *9*, 361–368.
- Cowlshaw, G., & Dunbar, R. I. M. (1991). Dominance rank and mating success in male primates. *Animal Behaviour*, *41*, 1045–1056.
- Davidson, R. J., & Fox, N. A. (1982). Asymmetrical brain activity discriminates between positive and negative affective stimuli in human infants. *Science*, *218*, 1235–1237.
- Ekman, P. (1992). Facial expressions of emotion: New findings, new questions. *Psychological Science*, *3*, 34–38.
- Ekman, P. (2003). *Emotions revealed: Recognizing faces and feelings to improve communication and emotional life*. New York, NY: Times Books/Henry Holt.
- Ekman, P., & Cordaro, D. (2011). What is meant by calling emotions basic. *Emotion Review*, *3*, 364–370.
- Ekman, P., Friesen, W. V., O'Sullivan, M., Chan, A., Diacoyanni-Tarlatzis, I., Heider, K. ... Tzavaras, A. (1987). Universals and cultural differences in the judgments of facial expressions of emotion. *Journal of Personality and Social Psychology*, *53*, 712–717.
- Farb, N. A. S., Anderson, A. K., Mayberg, H., Bean, J., McKeon, D., & Segal, Z. V. (2010). Minding one's emotions: Mindfulness training alters the neural expression of sadness. *Emotion*, *10*, 25–33.
- Harmon-Jones, E., & Allen, J. J. B. (1997). Behavioral activation sensitivity and resting frontal EEG asymmetry: Covariation of putative indicators related to risk for mood disorders. *Journal of Abnormal Psychology*, *106*, 159–163.
- Hart, D., & Karmel, M. (1996). Self-awareness and self-knowledge in humans, apes, and monkeys. In A. E. Russon, K. A. Bard & S. Parker (Eds.), *Reaching into thought: The minds of the great apes* (pp. 325–347). New York, NY: Cambridge University Press.
- Henrich, J., & Gil-White, F. J. (2001). The evolution of prestige: Freely conferred deference as a mechanism for enhancing the benefits of cultural transmission. *Evolution and Human Behavior*, *22*, 165–196.
- Izard, C. E. (1971). *The face of emotion* (Vol. 23). New York, NY: Appleton-Century-Crofts.
- Izard, C. E. (2011). Forms and functions of emotions: Matters of emotion–cognition interactions. *Emotion Review*, *3*, 371–378.
- Izard, C. E., Ackerman, B. P., & Schultz, D. (1999). Independent emotions and consciousness: Self-consciousness and dependent emotions. In J. A. Singer, P. Salovey (Eds.), *At play in the fields of consciousness: Essays in honor of Jerome L. Singer* (pp. 83–102). Mahwah, NJ: Lawrence Erlbaum.
- Jones, A., & Fitness, J. (2008). Moral hypervigilance: The influence of disgust sensitivity in the moral domain. *Emotion*, *8*, 613–627.
- Juslin, P. N., Liljestrom, S., Vastfjall, D., Barradas, G., & Silva, A. (2008). An experience sampling study of emotional reactions to music: Listener, music and situation. *Emotion*, *8*, 668–683.
- Keltner, D., & Buswell, B. N. (1997). Embarrassment: Its distinct form and appeasement functions. *Psychological Bulletin*, *122*, 250–270.
- Kemeny, M. E., Gruenewald, T. L., & Dickerson, S. S. (2004). Shame as the emotional response to threat to the social self: Implications for behavior, physiology, and health. *Psychological Inquiry*, *15*, 153–160.
- Koenig, S., & Mecklinger, A. (2008). Electrophysiological correlates of encoding and retrieving emotional events. *Emotion*, *8*, 162–173.
- Levenson, R. W. (1994). Human emotion: A functional view. In P. Ekman & R. Davidson (Eds.), *The nature of emotion: Fundamental questions* (pp. 123–126). New York, NY: Oxford University Press.

- Levenson, R. W. (2011). Basic emotion questions. *Emotion Review*, 3, 379–386.
- Lewis, M. (2000). Self-conscious emotions: Embarrassment, pride, shame, and guilt. In M. Lewis & J. M. Haviland-Jones (Eds.), *Handbook of emotions* (2nd ed., pp. 623–636). New York, NY: Guilford.
- Martens, J. P., Tracy, J. L., Cheng, J., Parr, L. A., & Price, S. (2010, January). *Do the chimpanzee bluff display and human pride expression share evolutionary origins?* Poster presented at the Society for Personality and Social Psychology Pre-Conference on Evolutionary Psychology, Las Vegas, NV.
- Murray, G., Nicholas, C. L., Kleiman, J., Dwyer, R., Carrington, M. J., Allen, N. B., & Trinder, J. (2009). Nature's clock and human mood: The circadian system modulates reward motivation. *Emotion*, 9, 705–716.
- Oosterhof, N. N., & Todorov, A. (2009). Shared perceptual basis of emotional expressions and trustworthiness impressions from faces. *Emotion*, 9, 128–133.
- Oveis, C., Horberg, E., & Keltner, D. (2010). Compassion, pride, and social intuitions of self–other similarity. *Journal of Personality and Social Psychology*, 98, 618–630.
- Panksepp, J. (1998). *Affective neuroscience: The foundations of human and animal emotions*. New York, NY: Oxford University Press.
- Panksepp, J., & Watt, D. (2011). What is basic about basic emotions? Lasting lessons from affective neuroscience. *Emotion Review*, 3, 387–396.
- Parzuchowski, M., & Szymkow-Sudziarska, A. (2008). Well, slap my thigh: Expression of surprise facilitates memory for surprising material. *Emotion*, 8, 430–434.
- Sallquist, J. V., Eisenberg, N., Spinrad, T. L., Reiser, M., Hofer, C., Zhou, Q., ... Eggum, N. (2009). Positive and negative emotionality: Trajectories across six years and relations with social competence. *Emotion*, 9, 15–28.
- Sedikides, C., & Skowronski, J. J. (1997). The symbolic self in evolutionary context. *Personality and Social Psychology Review*, 1, 80–102.
- Shaver, P., Schwartz, J., Kirson, D., & O'Connor, C. (1987). Emotion knowledge: Further exploration of a prototype approach. *Journal of Personality and Social Psychology*, 52, 1061–1086.
- Sherman, G. D., Haidt, J., & Coan, J. A. (2009). Viewing cute images increases behavioral carefulness. *Emotion*, 9, 282–286.
- Singer, T., Snozzi, R., Bird, G., Petrovic, P., Silani, G., Heinrichs, M., & Dolan, R. J. (2008). Effects of oxytocin and prosocial behaviour on brain responses to direct and vicariously experienced pain. *Emotion*, 8, 781–791.
- Sloan, D. M., Marx, B. P., Epstein, E. M., & Dobbs, J. L. (2008). Expressive writing buffers against maladaptive rumination. *Emotion*, 8, 302–306.
- Tangney, J. P. (1991). Moral affect: The good, the bad, and the ugly. *Journal of Personality and Social Psychology*, 61, 598–607.
- Tracy, J. L., & Matsumoto, D. (2008). The spontaneous expression of pride and shame: Evidence for biologically innate nonverbal displays. *Proceedings of the National Academy of Sciences*, 105, 11655–11660.
- Tracy, J. L., & Robins, R. W. (2004a). Show your pride: Evidence for a discrete emotion expression. *Psychological Science*, 15, 194–197.
- Tracy, J. L., & Robins, R. W. (2004b). Putting the self into self-conscious emotions: A theoretical model. *Psychological Inquiry*, 15, 103–125.
- Tracy, J. L., & Robins, R. W. (2004c). Keeping the self in self-conscious emotions: Further arguments for a theoretical model. *Psychological Inquiry*, 15, 171–177.
- Tracy, J. L., & Robins, R. W. (2007a). The psychological structure of pride: A tale of two facets. *Journal of Personality and Social Psychology*, 92, 506–525.
- Tracy, J. L., & Robins, R. W. (2007b). The prototypical pride expression: Development of a nonverbal behavioral coding system. *Emotion*, 7, 789–801.
- Tracy, J. L., & Robins, R. W. (2008a). The nonverbal expression of pride: Evidence for cross-cultural recognition. *Journal of Personality and Social Psychology*, 94, 516–530.
- Tracy, J. L., & Robins, R. W. (2008b). The automaticity of emotion recognition. *Emotion*, 8, 81–95.
- Tracy, J. L., Robins, R. W., & Lagattuta, K. H. (2005). Can children recognize pride? *Emotion*, 5, 251–257.
- Tracy, J. L., Shariff, A. F., & Cheng, J. T. (2010). A naturalist's view of pride. *Emotion Review*, 2, 163–177.
- Tracy, J. L., Shariff, A. F., Zhao, W., & Henrich, J. (2011). *Cross-cultural evidence that the pride expression is a universal automatic status signal*. Manuscript submitted for publication.
- Wicker, B., Keysers, C., Plailly, J., Royet, J., Gallese, V., & Rizzolatti, J. (2003). Both of us disgusted in my insula: The common neural basis of seeing and feeling disgust. *Neuron*, 40, 655–664.
- Williams, L. A., & DeSteno, D. (2008). Pride and perseverance: The motivational role of pride. *Journal of Personality and Social Psychology*, 94, 1007–1017.
- Williams, L. A., & DeSteno, D. (2009). Pride: Adaptive social emotion or seventh sin? *Psychological Science*, 20, 284–288.