What Basic Emotions Really Are

Encapsulated or Integrated?

Abstract: While there is ongoing debate about the existence of basic emotions (BEs) and about their status as natural kinds, these debates usually carry on under the assumption that BEs are encapsulated from cognition and that this is one of the criteria that separates the products of evolution from the products of culture and experience. I aim to show that this assumption is entirely unwarranted, that there is empirical evidence against it, and that evolutionary theory itself should not lead us to expect that cognitive encapsulation marks the distinction between basic and higher cognitive emotions. Finally, I draw out the implications of these claims for debates about the existence of basic emotions in humans.

1. Introduction

It is widely held among emotion theorists that there is some theoretically interesting distinction between basic and higher cognitive emotions. On this picture, basic emotions (BEs) are primarily structured by evolution whereas higher cognitive emotions are substantially structured by either culture or individual experience. While there is ongoing debate about the existence of BEs and about their status as natural kinds, these debates usually carry on under the assumption that BEs are encapsulated from cognition and that encapsulation is one of the criteria that separates the products of evolution from the products of culture and experience. I aim to show that this assumptions is entirely unwarranted, that there is empirical evidence against it, and that evolutionary theory itself should not lead us to

expect that cognitive encapsulation marks the distinction between basic and higher cognitive emotions. Finally, I draw out the implications of these claims for the existence of basic emotions in humans.

In the following section, I characterize the received view of BEs, which holds (among other things) that BEs are solutions to *basic life problems* in our evolutionary past. Then I consider and reject some of the reasons to think that BEs are cognitively encapsulated. In the second section, I provide an example of a BE in rodents that bears the marks of cognitive integration (as opposed to encapsulation). The basic life problem that likely shaped this emotion appears to demand substantial cognitive integration. In the third section, I draw out the implications for a current debate in emotion theory concerning the existence of BEs in humans.

2. Basic Emotions

BEs – including anger, fear, happiness, sadness, disgust, and surprise (for an extended list, see Ekman & Cordaro, 2011) – are thought to be human-typical behavioral syndromes that include involuntary facial expressions of emotion, physiological changes (e.g. in heart rate, blood pressure, and hormone levels), and changes in bodily posture (including bodily social displays and orienting responses). According to BE theory, these syndromes have a similar kind of evolutionary explanation and similar neural and psychological mechanisms. Specifically, they each evolved to address basic life problems or adaptive problems (such as

resource competition, avoidance of predators and avoidance of poisons and parasites). Some of these basic life problems are ones that we share with non-human animals.

Moreover, the elicitation and production of these syndromes (including the coordination of various response components) are supposed to be explained by *automatic appraisal mechanisms* and *affect programs*, respectively (Ekman, 1977, 1999). For instance, affect programs explain phenomena observed in experiments that ask people to distinguish photographs of facial expressions of emotions, connect these expressions with emotion terms, or rate their appropriateness in response to vignettes (for an overview, see Ekman, 2003). They are also supposed to explain the results of experiments that connect facial expressions with changes in physiological response components (Ekman, Levenson, & Friesen, 1983; Levenson, Ekman, & Friesen, 1990). To generalize, affect programs are introduced to explain the observed coordination of various response components and the cross-cultural production of these various syndromes (which is thought to explain widespread recognition of facial expressions across cultures).

3. Unwarranted Assumptions Concerning Cognitive Integration

Many emotion theorists claim that BEs lack cognitive integration. In this section, I argue that these claims are based on unwarranted assumptions.

Assumption 1: Cognitively Integrated only if Informationally Integrated

In most cases, questions about the integration of emotions with cognition concern the possibility that emotions are modular in Fodor's (1983) sense. This depends (among other

things) on whether they can store *information* that cognitive systems cannot access (*informational encapsulation*); or whether *information* from other cognitive systems can interfere with the operations of an emotion (*cognitive penetrability*); or whether people have conscious access to emotional processes or merely their outputs (*opacity*); or whether the *information* that an emotion provides is general as opposed to specific (which would imply *shallow outputs*). These are some of the more well-known marks of cognitive integration or its absence, encapsulation.

Philosophers and psychologists alike usually proceed under the assumption that integration with cognition depends entirely on whether information is integrated in these ways. These assumptions translate to discussions about BEs, where evidence for lack of *informational* integration is sometimes used as evidence for lack of *cognitive* integration *simpliciter*:

> Three other types of evidence suggest that [basic] emotion processes can operate independently of cognition. Emotions have been induced by unanticipated pain…, manipulation of facial expressions…, and changing the temperature of cerebral blood… In all these conditions the immediate cause of the emotion was noncognitive. (Izard, 1992, p. 563, see also his 2007)

Here, Izard apparently assumes that the impenetrability of BEs constitutes evidence that BEs operate independently of cognition. The fact that they respond to low level inputs or processes to which other systems have limited access certainly suggests that emotional states can respond to information that is not integrated with cognition. In addition, there is evidence

that people cannot fully control facial expressions of BEs (Ekman, 1972; Friesen, 1973), suggesting that BEs are cognitively impenetrable. Overall, BEs appear to lack informational integration.

Nevertheless, the realm of the cognitive picks out not only informational states, but also includes a broader range of internal states that function as causal intermediates between stimulus and response, perception and action (Rey, 1997). Cognitive states so understood include not only informational states (such as beliefs) but also motivational states (such as desires). Moreover, questions about cognitive integration may be asked about either informational or motivational states. If so, the possibility arises that the two forms of cognitive integration are independent of one another. If so, any inference from the one to the other is invalid.

This becomes clear when we consider hunger. Hunger may very well be akin to desire (a paradigmatic case of a cognitively integrated state) in the sense that it can interact with other cognitive systems to produce flexible or novel behaviors, as when rodents take novel "short cuts" to get to a food box in a maze (Olton, 1979; Tolman, 1948). Short cut behaviors suggest that hunger is a motivational state that can incline rodents to the pursuit of an end (e.g. food consumption) by selecting from a range of different means, perhaps by interacting with informational states that relate means to ends (e.g. means-ends beliefs). Even so, hunger may be cognitively impenetrable in that it may be triggered by low level stimuli and processes (e.g. low-level detection of changes in blood sugar). Moreover, when one feels hungry, one cannot interfere with the feeling of hunger by thinking about it (e.g. by noticing

that the amount of energy one's body has stored in fat deposits is more than enough to sustain oneself). One can even imagine that it is informationally encapsulated: it might store information (e.g. about which foods are more calorically dense) that other systems cannot directly access.

These conceptual possibilities suggest that questions concerning the integration of informational states are conceptually independent of questions concerning the integration of motivational states. Hunger may be informationally encapsulated while retaining a degree of integration as a motivational state. Wholesale encapsulation, therefore, does not follow from informational encapsulation. If this is correct, then inferences like the one Izard draws above are invalid: having non-cognitive inputs is not a reason to think that emotions operate independently of cognition. They might very well operate in concert with cognition on the output side or as motivational states. Before I raise that possibility, consider another reason to rule it out at the outset: that BEs are not integrated with propositional attitudes, including beliefs *and* desires.

Assumption 2: Integration with Beliefs and Desires is the Criterion for Cognitive Integration

Contrary to the previous assumption, this one respects the distinction between motivational and informational integration. Nevertheless, I argue that it sets the bar for cognitive integration too high.

To see this, consider Griffiths' (Griffiths, 1997, 2004) views on the distinction between basic and higher cognitive emotions. First, he draws on some of the same evidence as Izard to conclude that BEs are opaque and informationally encapsulated. Since they have these and other marks of modularity, Griffiths thinks BEs have "limited involvement" with higher cognitive processes, which are "…the processes in which people use the information of the sort they verbally assent to (traditional beliefs) and the goals they can be brought to recognize (traditional desires) to guide relatively long-term action and to solve theoretical problems." (Griffiths, 1997, p. 92) Here, Griffiths may be making the same faulty assumption as Izard (that informational encapsulation implies cognitive encapsulation more broadly). However, let us grant that he may have additional reasons to think that emotions are not integrated on the output side or qua motivational states.

From this, Griffiths draws a broader conclusion: that BEs are not "flexible [or] integrated with long-term, planned action" and are instead "restricted to short-term, stereotyped responses" (Griffiths, 1997, p. 241). The apparent assumption is that if BEs are not integrated with beliefs, desires and long-term planning, then the only alternative is that they are similar to fixed action patterns, being inflexible and stereotyped. Griffiths makes no explicit argument for this assumption, perhaps at the time it was widespread enough to make further argument otiose.

Nevertheless, it has become a tendentious assumption for several reasons. First, the phenomena of intelligent action are much broader than deliberate, "long-term, planned action" mediated by beliefs and desires. For instance, Ginet (1990) argues that many clear

cases of actions (as distinct from mere behaviors, such as reflexes or fixed action patterns) are not plausibly mediated by conscious beliefs, desires or intentions: involuntarily crossing one's legs, kicking a door in anger, impulsively pulling a loose thread from one's clothes, and slamming on the brakes to avoid hitting a dog. These actions are not mere behaviors or reflexes. That is, they appear to be purposive and guided by the agent, but it is difficult to find belief-desire style explanations that render them intelligible.[1] Why not think that BEs can influence actions more akin to this variety than to "long-term, planned actions"? Griffiths never raises this question, neither does he give reason to rule out the possibility that BEs cause actions intermediate between long-term planned action and stereotyped behavioral responses.

Second, if we ask what might explain the other varieties of action that Ginet picks out, it may be that such actions are guided by other representational states, aside from conscious or verbally reportable beliefs, desires and intentions. For instance, in the last twenty years, cognitive scientists have begun to emphasize the role of unconscious or non-conceptual representational states in generating flexible and intelligent behavior (Bermúdez, 2003). Informational states aside from beliefs include perceptual representations, map-like spatial representations and representations of affordances. Motivational states aside from desires include drives, incentives and feedback mechanisms.

[1] See also Hursthouse (1991).

The flexibility and intelligence of these representational states becomes clear when we consider animal behavior. Nonhuman animals display forms of intelligent or purposive or instrumental behavior (see e.g. Balleine & Dickinson, 1998), even while lacking linguistically mediated propositional attitudes. This suggests that instrumental behaviors in non-human animals are underwritten by a different form of cognitive integration. Consider what Susan Hurley calls *holistic flexibility*:

> The holistic flexibility of intentional agency contributes a degree of generality to the agent's skills: a given means can be transferred to a novel end, or a novel means adopted toward a given end. The end or goal functions as an intervening variable that organizes varying inputs and outputs and allows a degree of transfer across contexts. (Hurley, 2003, pp. 237–38)

Where this sort of flexibility is found, it suggests that behavior is best explained with reference to informational states which represent the means available to an organism (e.g. affordances) and motivational states that represent its ends (e.g. drive states), which can interact interchangeably in order to bring about the same end by various means or to deploy a single means to bring about various ends.

Nevertheless, these informational and motivational states may sometimes lack inferential integration with beliefs and desires. Even in humans, phenomena like "blind-sight" suggest that perceptual representations can flexibly guide behavior without being integrated with verbally reportable states. That is, even though these perceptual states are not verbally reportable or consciously accessible, these informational states mediate goal-

directed behaviors (e.g. putting a plate in a slot) rather than just reflexes and fixed action patterns (see e.g. Goodale, Milner, Jakobson, & Carey, 1991). All this suggests that Griffiths' requirements on cognitive integration are too stringent. Verbal reportability and conscious accessibility of a representational state is not necessary for such a state to influence flexible behaviors. To my knowledge there is no evidence that BEs fail to meet less stringent requirements on cognitive integration such as holistic integration.

Once the full range of representational states is expanded in this way (beyond beliefs and desires), it becomes possible that BEs have some degree of motivational integration with other representational states aside from conscious beliefs and desires to produce behaviors that are more flexible and purposive than stereotyped behaviors. Griffiths provides no reason to rule out this possibility.

4. Evidence of Integration in a Basic Emotion

In fact, there is some reason to rule it in. Consider the instinctive patterns of territorial behavior of rodents. These behaviors have been investigated in great detail using a resident-intruder experimental paradigm (for an overview, see D. C. Blanchard & Blanchard, 1984, 2003) add it Adams RRR) in which resident (who have occupied a cage or colony for a few weeks) will attack unfamiliar male intruders introduced into their cage. The attacks of the resident and the defensive maneuvers of the intruder comprise sets of stereotyped behaviors. Each attack behavior of the resident is paired with a matching defensive maneuver of the intruder. The resident adopts a set of stereotyped postures and attacks aimed at biting the

dorsal surfaces of the intruder. On the other hand, the intruder adopts a distinctive set of stereotyped behaviors aimed at avoiding or blocking the resident's attempts to bite its back.

While these behaviors are certainly stereotyped, they are not brittle or reflexive. For instance, attacks of residents vary depending on the defensive strategy adopted by the intruder, and they seem to be governed by a motive to approach and attack that persists the entire time that the intruder is present. By contrast, the intruder rat's whole suite of behaviors seems to be governed by a persistent motive to escape and avoid.

Figure 1 Confrontation and avoidance behaviors (e.g. facial expressions, postures and maneuvers) of resident and intruder mice (respectively). From Defensor and Corley (2012), p. 683 permission pending © Elsevier. Originally published in Physiology and Behavior.

What scientists have discovered about these behaviors (the flexibility of these behaviors and their coherent aims) indicates that they are produced by two underlying motivational systems, what I call the confrontation and avoidance systems (D. C. Blanchard & Blanchard, 1984, 2003; D. C. Blanchard, Litvin, Pentkowski, & Blanchard, 2009). The confrontation system is tuned to bring about a specific end state, repeated back-biting. Moreover, this motive does not depend on learning: rats which have been socially isolated from birth will still attempt to bite the back of an intruder (Eibl-Eibesfeldt, 1961). So far, the focus has been on cases in which a given rodent is purely motivated by confrontation or avoidance, but aggressive encounters in the wild usually involve a mix of offensive and defensive postures. This suggests that these motivational systems can be activated simultaneously or in close succession to produce mixed patterns of behavior.

Regardless, these systems have many of the characteristics of affect programs in humans. They are posited to explain a coordinated suite of behaviors and physiological changes that may include facial expressions, cardiovascular changes, and endocrine responses (Defensor, Corley, Blanchard, & Blanchard, 2012; Fokkema, Koolhaas, & van der Gugten, 1995). Moreover, these systems are tailored to solve basic life problems. Specifically, the confrontation system solves the problem of defending territories from other males for breeding purposes (and without fatally injuring kin in the process), whereas the avoidance system solves the problem of avoiding occupied territories and failing that, defending against the attacks of residents. For these reasons, we have all the same reasons to

postulate BEs in rodent that we have in humans. Let us suppose then that the confrontation and avoidance systems are BEs in rodents.

Interesting for my purposes, under certain conditions, the presence of the unfamiliar male can produce highly flexible and novel behaviors. In the bound-intruder task, an intruder is tied down on a Plexiglas plate with only its ventral surfaces (belly-side) exposed and placed in the cage of a resident, so that the resident cannot easily bite the back of the intruder. As a result, the resident will sometimes bite at the bands that tie down the intruder or dig under the intruder so that the resident can bite the intruder's back (R. J. Blanchard, Blanchard, Takahashi, & Kelley, 1977). In contrast, none of these behaviors are adopted when the intruder is tied down with his back exposed.

These instrumental behaviors are clearly not stereotyped forms of attack, rather they are forms of flexible behavior adjustment to achieve the aim of biting the intruder's back: they exhibit holistic integration. In this case, the same end can be achieved by several, novel means. Attempts to bite the intruder's bonds or to dig underneath the intruder are novel means toward the end of biting the back of the intruder. Moreover, some of a resident's means can be deployed toward novel ends. Digging is an element of the rat's behavioral repertoire that is ordinarily used for an entirely different purpose: constructing burrow systems for shelter and nesting (Boice, 1977). This suggests that there are informational states, representations of means (e.g. motor representations of digging, biting, lateral attack, etc.), that can interact interchangeably with motivational states, representations of various ends (e.g. nesting, back-biting, eating etc.), in order to produce flexible behaviors.

Importantly, the confrontation system seems to be involved in coordinating flexible back-biting behavior. Moreover, this is something we would predict if it is a solution to the basic life problem of defending a territory from intruders. Flexibility is required to successfully repel an intruder because it is not in the intruder's best interest to be repelled easily or to act predictably. For instance, the intruder would be sure to fare poorly if it acted in a way that accommodates the attacks of the resident. So a single fixed action pattern or even a whole suite of fixed action patterns on the part of the resident would not tend to be successful against the most likely strategy of the intruder. It is more adaptive to have a flexible motivational state that leads to repeated back biting across a wide range of strategies or postures that the intruder might adopt. Rather than leading only to inflexible, stereotyped responses, it appears that solutions to basic life problems sometimes require some degree of motivational integration.

5. Implications for Emotion Theory

If we understand BEs in this way, this changes the shape of an ongoing debate in emotion theory concerning the existence of BEs in humans. In the past, this debate has carried on under the assumption that if an emotion is biologically basic, then one should predict that the various response components of the emotion will have a high degree of coherence; that for example "all instances of anger should have a characteristic facial display, cardiovascular pattern, and voluntary action that are coordinated in time and correlated in intensity."

(Barrett, 2006, p. 29) This high degree of coherence is not observed across many emotions (Gentsch, Grandjean, & Scherer, 2013; Reisenzein, Studtmann, & Horstmann, 2013). For instance, when anger is elicited in experimental settings, it is uncommon to observe facial expressions in conjunction with the other putative components of BE anger.

One way of defending the basicality of an emotion against this criticism is to reassess what patterns of emotional response are predicted by BE theory. As we saw in the section above the motivational component of a basic emotion can select novel, instrumental behaviors. Moreover, the motivational component can be indispensable for solving a basic life problem. I think we can add to this the possibility that other response components are not as indispensable as the motivational state. To see this, suppose that anger in humans is a solution to basic life problems of deterring conspecifics from challenges and insults. If so, it may be that the only reliable requirement of successful deterrence (at least in our lineage) is a flexible motivation to retaliate against perceived wrongs (e.g. McCullough, Kurzban, & Tabak, 2012). For instance, a reliable disposition to garner a reputation for revenge (e.g. by avenging personal offenses) appears to be a highly reliable strategy for deterrence (e.g. Daly & Wilson, 1988; Frank, 1988), perhaps more so than any facial expression or physiological responses. If revenge can be served cold, then anger may not always require anything more than a motivation to avenge. If so, then we might *expect* that the only reliably occurring component of anger is the relevant motivational state. But if this is correct, then evidence of low coherence is not evidence against the existence of BE anger. While this is a just-so story that may or may not end up being true, it shows that the expected level of coherence in a BE

depends on which basic life problem shaped that emotion. In some cases, we might expect the motivational state to be the only component that does not significantly vary across the situations in which these problems arise. In that case, contextually variable responses will be the norm rather than the exception.

6. Conclusion: What Basic Emotions Really Are

So what are basic emotions? Like other theoretical terms, part of the theoretical function of basic emotions is to place selective stress on competing theories (e.g. Kroon, 1985). In this case, BEs and competing conceptions of emotion allow us to discriminate between evolutionary theories of emotion in competition with radical social constructivist theories (e.g. Barrett, 2014; Lindquist, Siegel, Quigley, & Barrett, 2013).

BEs help distinguish these theories by specifying an architecture for emotion production predicted by evolutionary considerations. The distinguishing factor is whether emotion production is categorical or dimensional (see figure 2). If each BE is a solution to a different basic life problem, then when a BE is elicited, we should see emotional responses that are relevant to that basic life problem and distinct from the responses manifested by other BEs. Emotion production is categorical in the sense that the behavioral responses are controlled by a single emotional state (as distinct from other emotional states that might control a distinct pattern of response). By contrast, if all emotions are socially constructed as

some theorists claim, we might expect to see emotional behaviors controlled directly by multiple dimensions of appraisal (as in the bottom half of figure 2).

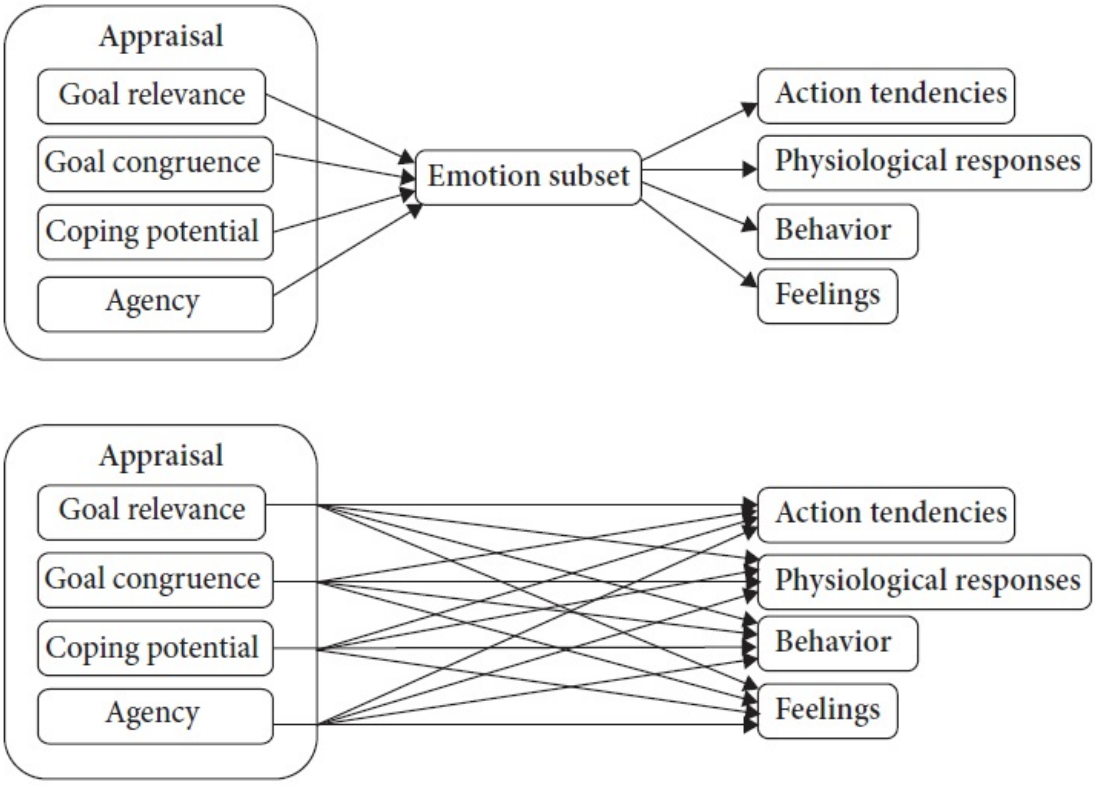

Figure 2 Competing architectures for emotion production. Top diagram is a categorical architecture, whereas the bottom is dimensional. From Moors (2012), p. 266 permission pending © John Benjamins Publishing Company. Originally published in Zachar and Ellis (2012).

Until the present, contextual variability of emotional responses has played a decisive role in distinguishing between these two architectures for emotion production. If flexible motivational states are not included among the components of BEs, then discrete emotion production predicts insensitivity to context subsequent to elicitation (though emotion regulation processes can perhaps inhibit or augment emotional responses according to context). However, once flexible motivational states are possible, categorical emotion production is compatible with a greater amount of contextual variability.

Admittedly, this added complexity makes it more difficult to test whether humans have BEs. Nevertheless, it is not impossible. For instance, in the case of anger, researchers have developed a neurological measure of approach motivation (for a review, see Carver & Harmon-jones, 2009). If this motivational state is a component of anger, we can measure whether approach motivation itself is better predicted by contextual variables subsequent to anger elicitation or rather by contextual variables prior to or during elicitation. If contextual variables prior to elicitation do not independently predict approach motivation as BE theory might lead us to expect, then we would have evidence against the existence of BE anger.

I have argued against prevailing assumptions that BEs lack cognitive integration. In the past, evidence against cognitive integration has been concerned with informational integration, and motivational integration has not been considered. Moreover, the assumed requirements for integration concern interaction with verbally reportable or consciously accessible states, and integration with other representational states is ignored. Moreover, BEs in rodents exhibit a form of motivational integration that plausibly hinges on interaction with

a wider variety of representational states. Properly understood, BEs are more likely to refer to emotional states in humans.

References

Balleine, B. W., & Dickinson, A. (1998). Goal-directed instrumental action: contingency and incentive learning and their cortical substrates. *Neuropharmacology*, *37*, 407–419.

Barrett, L. F. (2006). Are Emotions Natural Kinds? *Perspectives on Psychological Science*, *1*(1), 28–58. http://doi.org/10.1111/j.1745-6916.2006.00003.x

Barrett, L. F. (2014). The Conceptual Act Theory: A Précis. *Emotion Review*, 1–20. http://doi.org/10.1177/1754073914534479

Bermúdez, J. (2003). *Thinking without words*.

Blanchard, D. C., & Blanchard, R. J. (1984). Affect and aggression: An animal model applied to human behavior. In R. J. Blanchard & D. C. Blanchard (Eds.), *Advances in the Study of Aggression* (Vol. 1, pp. 1–62).

Blanchard, D. C., & Blanchard, R. J. (2003). What can animal aggression research tell us about human aggression? *Hormones and Behavior*, *44*(3), 171–177. http://doi.org/10.1016/S0018-506X(03)00133-8

Blanchard, D. C., Litvin, Y., Pentkowski, N. S., & Blanchard, R. J. (2009). Defense and Aggression. In G. G. Berntson & J. T. Cacioppo (Eds.), *Handbook of Neuroscience for the Behavioral Sciences* (pp. 958–974). Hoboken: Wiley.

Blanchard, R. J., Blanchard, D. C., Takahashi, T., & Kelley, M. J. (1977). Attack and defensive behaviour in the albino rat. *Animal Behaviour*, *25*, 622–634.

Boice, R. (1977). Burrows of wild and albino rats: effects of domestication, outdoor raising, age, experience, and maternal state. *Journal of Comparative and Physiological Psychology*, *91*(3), 649–61.

Carver, C. S., & Harmon-jones, E. (2009). Anger Is an Approach-Related Affect : Evidence and Implications. *Psychological Bulletin*, *135*(2), 183–204. http://doi.org/10.1037/a0013965

Daly, M., & Wilson, M. (1988). *Homicide*. Transaction Publishers.

Defensor, E. B., Corley, M. J., Blanchard, R. J., & Blanchard, D. C. (2012). Facial expressions of mice in aggressive and fearful contexts. *Physiology & Behavior*, *107*(5), 680–5. http://doi.org/10.1016/j.physbeh.2012.03.024

Eibl-Eibesfeldt, I. (1961). The Fighting Behavior of Animals. *Scientific American*, *205*, 112–122.

Ekman, P. (1972). Universals and cultural differences in facial expressions of emotion. *Nebraska Symposium on Motivation*. University of Nebraska Press Lincoln. http://doi.org/10.1037/0022-3514.53.4.712

Ekman, P. (1977). Biological and cultural contributions to body and facial movement. In J. Blacking (Ed.), *Anthropology of the body* (pp. 34–84).

Ekman, P. (1999). Basic Emotions. In T. Dalgleish & M. Power (Eds.), *The Handbook of Cognition and Emotion* (pp. 45–60). Sussex: John Wiley & Sons.

Ekman, P. (2003). *Emotion Revealed: Understanding Faces and Feelings*. Phoenix Press.

Ekman, P., & Cordaro, D. (2011). What is Meant by Calling Emotions Basic. *Emotion Review*, *3*(4), 364–370. http://doi.org/10.1177/1754073911410740

Ekman, P., Levenson, R. W., & Friesen, W. V. (1983). Autonomic nervous system activity distinguishes among emotions. *Science*, *221*(4616), 1208–1210.

Fodor, J. (1983). *The modularity of mind: An essay on faculty psychology*.

Fokkema, D. S., Koolhaas, J. M., & van der Gugten, J. (1995). Individual characteristics of behavior, blood pressure, and adrenal hormones in colony rats. *Physiology & Behavior*, *57*(5), 857–62.

Frank, R. H. (1988). *Passions Within Reason: The Strategic Role of the Emotions.* New York: Norton. http://doi.org/10.2307/2072516

Friesen, W. (1973). *Cultural differences in facial expressions in a social situation: An experimental test on the concept of display rules.* University of California, San Francisco.

Gentsch, K., Grandjean, D., & Scherer, K. R. (2013). Coherence explored between emotion components: Evidence from event-related potentials and facial electromyography. *Biological Psychology*. http://doi.org/10.1016/j.biopsycho.2013.11.007

Ginet, C. (1990). *On action*.

Goodale, M., Milner, A., Jakobson, L., & Carey, D. (1991). A neurological dissociation

between perceiving objects and grasping them. *Nature*.

Griffiths, P. E. (1997). *What emotions really are: The problem of psychological categories* (Vol. 1997). University of Chicago Press.

Griffiths, P. E. (2004). Emotions as Natural and Normative Kinds, *71*(December), 901–911.

Hurley, S. (2003). Animal action in the space of reasons. *Mind & Language*, *18*(3), 231–256.

Hursthouse, R. (1991). Arational actions. *The Journal of Philosophy*.

Izard, C. E. (1992). Basic emotions, relations among emotions, and emotion-cognition relations.

Izard, C. E. (2007). Basic Emotions, Natural Kinds, Emotion Schemas, and a New Paradigm. *Perspectives on Psychological Science*, *2*(3), 260–280. http://doi.org/10.1111/j.1745-6916.2007.00044.x

Kroon, F. (1985). Theoretical terms and the causal view of reference. *Australasian Journal of Philosophy*, (February 2014), 37–41.

Levenson, R. W., Ekman, P., & Friesen, W. V. (1990). Voluntary facial action generates emotion-specific autonomic nervous system activity. *Psychophysiology*, *27*(4), 363–384.

Lindquist, K. A., Siegel, E. H., Quigley, K. S., & Barrett, L. F. (2013). The Hundred-Year Emotion War : Are Emotions Natural Kinds or Psychological Constructions ? Comment on Lench , *139*(1), 255–263. http://doi.org/10.1037/a0029038

McCullough, M. E., Kurzban, R., & Tabak, B. a. (2012). Cognitive systems for revenge and forgiveness. *The Behavioral and Brain Sciences*, 1–15. http://doi.org/10.1017/S0140525X11002160

Moors, A. (2012). Comparison of affect program theories, appraisal theories, and psychological construction theories. *Categorical versus Dimensional Models of Affect. A Seminar on the Theories of Panksepp and Russell*, 257–278.

Olton, D. (1979). Mazes, maps, and memory. *American Psychologist*.

Reisenzein, R., Studtmann, M., & Horstmann, G. (2013). Coherence between Emotion and Facial Expression: Evidence from Laboratory Experiments. *Emotion Review*, *5*, 16–23. http://doi.org/10.1177/1754073912457228

Rey, G. (1997). Contemporary philosophy of mind: A contentiously classical approach.

Tolman, E. (1948). Cognitive maps in rats and men. *Psychological Review*.

Zachar, P., & Ellis, R. (2012). *Categorical versus dimensional models of affect: a seminar on the theories of Panksepp and Russell*.