

**Afterword: *How are emotions regulated by context and cognition?***

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In the first edition of *The Nature of Emotion*, Ekman and Davidson asked, *Can we control our emotions?* Two decades later, it is clear that the answer is a resounding *Yes* (Buhle et al., 2014; Etkin, Buchel, & Gross, 2015; Gross, 2015a, 2015b; Sheppes, Suri, & Gross, 2015). With this in mind, the Editors posed a much broader question for the second edition: *How are emotions regulated by context and cognition?*

### ***Cognition and the Generation of Emotion***

Several contributors emphasize the important role that cognition plays in the generation of emotion (Lazarus, 1991). Engen & Singer and Clore & Reinhard remind us that moods and emotions are often triggered by our thoughts; that humans are prone to worrying (or fantasizing) about the future and ruminating about (or nostalgically reflecting on) the past (Killingsworth & Gilbert, 2010). Engen & Singer argue that humans are endowed with the capacity to deliberately generate particular emotions (e.g., Damasio et al., 2000; Velten, 1968). They suggest that this kind of ‘endogenous’ emotion generation reflects the cooperation of numerous large-scale brain circuits (cf. Barrett and Wager’s responses to Question 5), including the frontoparietal control, ventral attention, salience, limbic, and default mode networks.

Blanchard & Pearson and Marin & Milad note that learning and memory play a crucial role in determining which cues and contexts elicit emotion. Blanchard & Pearson note that emotional learning does not require direct experience; it can be vicariously acquired through observation or, in humans at least, through exposure to other media (Olsson & Phelps, 2007; Raio & Phelps, 2015; Schindler, Vriends, Margraf, & Stieglitz, 2016). They write that, “people are capable of showing rapid acquisition of fear or anxiety responses to stimuli that they have never even encountered, after hearing, reading, or watching actors portray tales of the horrors associated with such stimuli. One of the present authors slept for nearly two years with a scarf tied around her neck after reading Bram Stoker’s *Dracula* at an unwisely

precocious age.” Marin & Milad review recent advances in our understanding of the neural circuitry underlying normal and pathological fear learning in humans, highlighting the importance of the amygdala, hippocampus, dorsal cingulate (i.e. mid-cingulate), and ventromedial prefrontal cortex for fear learning and extinction.

A number of contributors argue that cognitive appraisals (Lazarus, 1991) or what LeDoux called ‘emotional evaluations’ (LeDoux, 1994) are key determinants of *whether* a particular emotion is generated and, if so, how strongly it is expressed and experienced. Blanchard & Pearson suggest that anger and other aggressive states require an appraisal of the goal that is being thwarted or the object that is being disputed (e.g., what is the nature of the attachment or claim, how important or desirable is the goal or object; for related views, see Averill, 1983; Ekman & Friesen, 1975; Frijda, 1994a, 1994c; Lazarus, 1994a, 1994b). They argue that cognitive appraisals also determine the probability and intensity of overt behavioral aggression (see Lemay’s response to Question 9). In social contexts, for example, this involves sizing up both the opponent (e.g., bigger or dominant opponents inhibit aggressive behaviors) and the longer-term prospects of punishment or retaliation. Atlas makes a related point, noting that placebo effects on pain intensity and pain-related affect hinge on patients’ appraisals of the treatment context, including the nature of the patient-provider relationship. Clore & Reinhard argue that the intensity, duration, or recurrence of feelings reflect the perceived importance of challenges, which scales with the number of undesirable or desirable implications that spring to mind (echoing part of Rolls’ response to Question 8). They go on to suggest that emotional intensity also depends on the degree to which an elicitor dominates the focus of attention. As the spotlight of attention narrows to include only the eliciting stimulus, intensity increases.

Blanchard & Pearson tell us that cognitive appraisals can determine *which* emotion is elicited (for related perspectives, see Adolphs’ and Lang & Bradley’s response to Question 1 and Rolls, 2005). Here, they draw

a distinction between states of ‘fear’ and ‘anxiety’ (Lazarus, 1994b; LeDoux & Pine, *in press*; Shackman & Fox, 2016). They propose that ‘fear’ is generated when danger is deemed certain and inescapable, as with a rapidly approaching predator. ‘Anxiety,’ by contrast, is elicited by less certain or acute threats, including predator odors, conspecific alarm calls, or novelty. Appraisals can be quick and automatic (e.g., *Is escape possible?*) or slow, deliberate, and conscious (Ekman, 1977, 1994; Lazarus, 1991) and Maoz and Bar-Haim seem to focus on the latter, telling us: “if a colleague is late for a meeting, one may become angry if he or she recalls prior incidents in which this colleague was late, and thus interpret this behavior as disrespectful or careless. Alternatively, if...this particular colleague is always on time, one may feel surprised or concerned” (for related perspectives, see Averill, 1983; Clore, 1994; Frijda, 1994b).

### ***Cognition and the Regulation of Emotion***

A number of contributors underscore the importance of deliberate attempts to regulate emotion. As Lieberman notes, “Whether we are trying to avoid showing how nervous we are at the beginning of a presentation, taking our mind away from the current moment to reduce the distress of a broken arm, or trying to reframe things in a new light to recover from a broken heart – we often try to manage our emotions to feel differently or at least look like we are feeling differently” (see also Lemay’s response to Question 9). van Reekum & Johnstone describe evidence that dysfunctions in emotion regulation can contribute to the development and maintenance of mood disorders. Both sets of authors describe several strategies for regulating emotion, including suppression of the emotional response, distraction or the redirection of attention, and different forms of cognitive reappraisal (e.g., reframing the valence or importance of the elicitor; “this will be good for me;” “who cares anyway;” “this is even better than I expected”). Lieberman and van Reekum & Johnstone highlight evidence that cognitive reappraisal strategies are effective at reducing both the outward expression and inner experience of negative affect. Both sets of authors note that this is associated with increased activation in prefrontal control regions

and reduced activation in the amygdala (a point also highlighted in Okon-Singer and colleagues' response to Question 8). Engen & Singer tell us that the endogenous generation of emotion (see above) is an important, but frequently overlooked, component of our self-regulatory toolbox and that such techniques may be particularly useful for individuals who, by virtue of their occupation, regularly witness emotional suffering (e.g., healthcare professionals, clergy, social workers, first-responders). They suggest that the capacity to endogenously generate positive emotions is plastic and can be systematically cultivated using a variety of traditional contemplative techniques (e.g., loving-kindness and compassion meditation)

Lieberman and van Reekum & Johnstone draw a distinction between deliberate and more automatic or implicit forms of emotion regulation, such as fear extinction (Etkin et al., 2015) or gaze aversion (see Okon-Singer and colleagues' response to Question 8). Lieberman reviews an emerging body of evidence that simply putting feelings into words, which he terms 'affect labeling,' can dampen the experience and expression of negative affect—as indexed by changes in self report, peripheral-physiological and neural measures—in ways that resemble the cascade of effects observed following engagement of more direct regulatory strategies, like cognitive reappraisal.

Dissecting implicit emotion regulation from the natural decay of transiently elicited emotions can be challenging (Goldsmith & Davidson, 2004; Gross & Barrett, 2011). Van Reekum & Johnstone question, "when does the reactivity stop and the regulation start?" noting that it often remains unclear whether emotions are actively managed in contexts where regulation is not explicitly manipulated (e.g., as with 'display rules' for emotion; Ekman, 1972; Safdar et al., 2009). Ekman and Davidson make a related point in the first edition of this volume: "There might never be a point where emotion is completely uncontrolled. Rather, it might be more appropriate to consider the degree of regulation that is in effect, not whether such regulation is present." (Ekman & Davidson, 1994, p. 281). With this in mind, Van Reekum & Johnstone describe recent work focused on emotional 'recovery' (i.e., return to baseline)

following the offset of an elicitor. While it is not a clear-cut example of either reactivity or regulation, this kind of emotional ‘spill-over’ may be particularly important for understanding temperament, personality, and the development of emotional disorders (see Shackman and colleagues’ response to Question 3 and Shackman et al., *in press*).

### ***Future Challenges***

Several authors describe the challenges of understanding how context and cognition influence emotion. van Reekum & Johnstone emphasize the need to develop a deeper understanding of the elementary cognitive processes that mediate deliberate attempts to regulate emotion (Urry, 2010). They highlight the importance of well-matched control conditions and the value of studying the temporal dynamics or ‘chronometry’ of emotion generation and regulation (Davidson, 1998; Heller, Johnstone, Light, et al., 2013; Heller, Johnstone, Peterson, et al., 2013; Heller et al., 2009). Marin & Milad underscore the need to clarify the role of demographic variables (e.g., age, sex, ethnicity, education, and IQ) that are known to influence risk for emotional disorders. Atlas suggests that a number of approaches developed in the pain and placebo literatures could be profitably applied to understanding the influence of specific contexts and cognitive processes (e.g., expectancies) on emotion.

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