

Emotion and Emotion Regulation: Two Sides of the Developing Coin

Ross A. Thompson

Department of Psychology, University of California, Davis, USA

Abstract

Systems theory holds that emotional responses derive from the continuous, mutual interaction between multiple neurobiological and behavioral systems associated with emotion as they are contextually embedded. Developmental systems theory portrays these systems as becoming progressively integrated as they mature. From this perspective, regulatory processes are incorporated into emotion throughout the course of emotional development. This article examines the implications of developmental systems theory in understanding the association between emotion and emotion regulation, enlisting the functionalist orientation of contemporary emotions theory, a broad portrayal of emotion regulatory influences, and attention to the role of context in the management of emotion.

Keywords

development, emotion, emotion regulation, functionalism, systems theory

Nine-year-old Adam arrived home from playing outside to find his parents angry at each other. He knew from past experience that their avoidance of eye contact, looking annoyed, and clipped speech were the prelude to a full-blown conflict. He could feel his stomach tense and his heart beating rapidly as he began working on homework before dinner. He was not doing well in math, and although he tried to concentrate on his problem set, Adam was unable to keep his mind from focusing on his parents. Finally he left his desk to stretch out on his bed, headphones on his ears and music on his iPod, to help him feel better.

The effects of marital conflict described in this vignette are typical of children of this age (Davies & Woitach, 2008). But how should we understand this as a story of emotion activation and its regulation? Is the first part of the vignette concerned with emotional arousal, and the second part an account of emotion regulation? Can we distinguish the brain regions at work in the activation and maintenance of anxiety from those relevant to its regulation? How much is Adam's developmental history influential in his emotional response and its management? Should this story be viewed as an account of emotion regulation, dysregulation, or both?

In recent years, emotion researchers have been approaching questions like these from the perspective of developmental

systems theory (e.g., Gottlieb, Wahlsten, & Lickliter, 2006). A systems view is essential to conceptualizing how the multiple components of emotion (including sensory, attentional, and appraisal processes, neurobiological and hormonal functioning, cognitive activity, social and cultural influences, and expressive and action tendencies) are continuously and mutually influential in the course of emotional responding, and are contextually embedded. From a systems perspective, for example, comes inquiry into the bidirectional influences between perception, cognition and emotion that is reflected in Adam's story (Barrett, 2009; Barrett & Bar, 2009; Izard, 2007). A developmental systems view is equally important in understanding how these emotion components are mutually influential as they mature and become progressively integrated. It encourages attention, for example, to the influence of early experience on developing neurobiology and its consequences for emotion activation and self-regulation (e.g., Boyce & Ellis, 2005).

This article examines the implications of developmental systems theory in understanding the association between emotion and emotion regulation. It argues that regulatory processes are developmentally incorporated into emotion itself—both neurobiologically and behaviorally—so that “unregulated emotion” in any pure sense does not exist, especially when an

appropriately-inclusive conceptualization of emotion regulation is used. Emotion regulation should thus be studied not in terms of uniquely dedicated neurobiological or executive cognitive processes, but rather as multifaceted influences on emotion that assume regulatory function depending on the context. This permits a contextually-sensitive approach that encourages the study of emotion regulation with attention to its adaptation to different neurobiological and situational demands. Consistent with this view, emotion regulatory processes are neither inherently adaptive nor maladaptive, but are relative to the individual's emotion goals in particular circumstances. Especially for children at risk, emotion regulation may sometimes purchase immediate benefits at the cost of long-term adaptive functioning.

In the first part of the discussion that follows, recent studies of the neurobiology of emotion-related brain processes are discussed to highlight the usefulness of a systems view that emphasizes bidirectional influences between higher and lower emotion-related areas, each of which is relevant to emotion activation and emotion regulation. Next, developmental changes in emotion are surveyed to illustrate how the development of emotion regulation is intertwined with the growth of emotion itself. In the third section, a definition of emotion regulation is offered that emphasizes both implicit and explicit regulatory processes, the contextual construction of emotion from family and cultural influences, and the roles of self-regulation and extrinsic regulation of emotion. The next section focuses on the functionalist orientation that is characteristic of contemporary approaches to emotion and emotion regulation, and explores its implications for the adaptive functioning of emotion regulatory processes. This is followed by concluding reflections.

Neurobiology of Emotion and its Regulation

There are at least two reasons why a systems view is helpful in understanding brain processes relevant to emotion and its regulation. First, it is now increasingly apparent that neurobiological regions that are higher and lower on the neuroaxis exert mutually regulatory influences: "top-down" regulatory control (such as influences from the prefrontal cortex to the amygdala) are certainly evident, but so also are "bottom-up" regulatory influences from the limbic system to higher cortical regions (Thompson, Lewis, & Calkins, 2008). Second, these neurobiological systems are also shaped by the quality of early experience and thus reflect developmental history (Calkins & Hill, 2007).

Neuroimaging studies show that responses to emotion tasks are widely distributed throughout the brain, including areas commonly regarded as relevant to emotion activation (including the amygdala, hypothalamus, brain stem, and central gray) and areas often viewed as relevant to emotion regulation (including medial and ventral prefrontal cortex and anterior cingulate). Although it is often true that cortical areas higher on the neuroaxis exert inhibitory influence on lower

limbic areas, there is increasing evidence from neuroimaging studies that cortical and limbic areas are coactive in responses to emotion probes. In a meta-analysis of 162 neuroimaging studies of responses to emotion tasks, for example, Kober and colleagues (2008) reported that several frontal areas were found to coactivate with multiple limbic areas, with little evidence that these were negative (or inhibitory) coactions. Other researchers have reported similar findings, suggesting the recruitment of cognitive-perceptual processes in emotion activation, not just emotional control (e.g., Barrett & Bar, 2009; Ochsner et al., 2009).

More importantly, there is also growing evidence that limbic systems exert influence over these cognitive-perceptual processes (Lewis & Todd, 2007). Activation of the amygdala is associated, for example, with enhanced perceptual sensitivity to cues of danger (Ochsner et al., 2009; Surguladze et al., 2003; see also Barrett & Bar, 2009), consistent with its role in affective learning. The circuits connecting the amygdala (and other limbic structures) with the anterior cingulate also help to account for its influence on emotional appraisals and self-regulatory processes (Cardinal, Parkinson, Hall, & Everitt, 2002; Quirk, 2007; Woltering & Lewis, 2009). As a result, emotion regulation should be regarded not only as inhibitory control by cortical areas, but also as a widely-distributed function involving bidirectional associations among many emotion-relevant regions (Ochsner et al., 2009). This conclusion underscores the value of a systems perspective to the neurobiology of emotion regulation.

A systems perspective is also useful in understanding the development of the neurobiological systems relevant to emotion and emotion regulation because of how these systems are affected by early experience. Neural and neuroendocrine arousal systems associated with emotion, including the hypothalamic-pituitary-adrenocortical (HPA) axis, are functional in newborns and mature significantly during the early years in ways that help to account for declining emotional lability and permit greater self-control (Gunnar & Vazquez, 2006). Developmental studies with humans and animals indicate that these changes with age are affected by the responsiveness of caregivers and the quality of early experiences to calibrate enduring capacities for stress reactivity and self-regulation (Boyce & Ellis, 2005; Gunnar & Donzella, 2002). Children growing up in early adversity, for example, are more sensitive to contextual demands, more likely to become biologically and emotionally reactive to challenge, and less capable of adaptive self-regulation. With respect to the concurrent growth of neurobiological systems governing self-regulation, developmental studies indicate that there is also considerable maturation of parasympathetic regulation in the early years. Moreover, individual differences in physiological self-regulation are also affected by the quality of care experienced early in life (Propper & Moore, 2006).

Simply put, the nature and nurture of the neurobiology of emotion are intertwined from birth in ways that affect the development of emotion and the growth of emotion regulation. This conclusion poses new questions about how early experiences, particularly of stress or adversity, influence the development of

specific neurobiological systems related to emotion at different levels of the neuroaxis, such as altering the threshold for reactivity of limbic structures, or changing characteristic perceptual and cognitive appraisals related to threat. The developmental plasticity of these neurobiological processes associated with emotion regulation is also important to future research on the development of emotion and emotion regulation (e.g., Goldsmith, Pollak, & Davidson, 2008).

This developmental systems view is also important in understanding the origins of affective psychopathology. There is increasing evidence that vulnerability to internalizing and externalizing disorders can arise from emotion biases encoded in the functioning of emotion-related brain processes at lower levels of the neuroaxis. In one study, for example, 2-year-olds who were behaviorally identified as emotionally shy/inhibited or uninhibited were later studied as adults, and fMRI analyses revealed heightened amygdala activation in the inhibited group when viewing novel (vs. familiar) faces, but no differences in the uninhibited group (Schwartz, Wright, Shin, Kagan, & Rauch, 2003). Early temperamental or experience-based emotional biases can have enduring influences on emotion responding even as cortical regulatory areas are maturing, in part through their influence on higher cognitive processes (e.g., anxious rumination; Calkins & Hill, 2007).

Emotion regulatory problems can also arise from disrupted interactions between cortical and limbic systems that normally function to modulate emotional arousal. This has been found in studies of depression and anxiety in children and adults, with changes in the functioning and coordination of limbic and/or cortical emotion-related areas coinciding with treatment efficacy (Johnstone, van Reekum, Urry, Kalin, & Davidson, 2007; Lewis et al., 2008; Nitschke et al., 2009). Thus, risk for affective psychopathology can arise from various levels of the neurobiological networks related to emotion activation and regulation, with alternative potential routes of therapeutic intervention based on the brain systems targeted (Ochsner et al., 2009).

Emotion and Emotion Regulation in Behavioral Development

Emotion research has been characterized by rich debates over how emotion should be defined. Inherent in most of these definitions, however, is the association of different emotions with distinctive goals, as well as with relevant attentional processes, situational appraisals, action tendencies, patterns of physiological and neurobiological activity, expressions, and subjective experience. Although emotion theorists differ in their relative emphasis on the functional, conceptual, or biological constituents of emotion, a developmental systems view emphasizes the mutual influences among these components of emotion, their progressive integration over development, contextual adaptation, and the intersection of emotion and emotional regulatory processes. This view finds support from research on the neurobiology of emotion and its regulation reviewed earlier, and from behavioral studies of emotional development.

If emotion arises from one's goals in specific situations, as contemporary functionalist accounts claim, then developmental changes in emotion derive, in part, from significant changes in the goals and appraisals that underlie emotion (Saarni, Campos, Camras, & Witherington, 2006; Thompson & Goodvin, 2007). Very early emotional expressions are associated with a young infant's efforts to maintain or terminate stimulation that is enjoyable or unpleasant—such as crying that arises from hunger or cold, or smiling that derives from animated social interaction—for which caregiver responsiveness is important. Emotional arousal and self-regulation are jointly influenced by the early maturation of attentional systems that enable progressively voluntary control over looking and the ability to disengage from emotionally arousing events (Posner & Rothbart, 2000). Later in the first year, new emotional capacities emerge with the growth of new forms of cognitive appraisal (e.g., fear in response to a visual cliff or a stranger) and means–ends understanding (e.g., anger in response to a blocked goal). Late in the second year, advances in self-awareness anticipate the development of self-conscious evaluative emotions like pride, guilt, shame, and embarrassment that are elicited in response to circumstances involving the child's public evaluation by others. With growth in theory of mind understanding later in the third year, preschoolers more self-consciously associate their emotional experience with the satisfaction or frustration of their desires because of their explicit awareness of the connection between these processes.

These early developmental advances illustrate how pervasively emotion interacts with cognition in its development. From the simple preverbal appraisals of familiarity to the lexicalization of emotional experience (with the advent of language) to sophisticated assessments of the psychological causes of one's adult feelings, emotion and its development are intimately connected to conceptual processes related to emotion (Barrett, 2009; Izard, 2007; Russell, 2003). Emotion–cognition interactions are important to emotion understanding and self-awareness, emotion communication, and also to emotion regulation as the same conceptual processes guide children's enlistment of implicit and explicit strategies of emotion management (Thompson, 1990). The conceptual systems associated with emotion (or "emotion schemas," according to Izard, 2007) also enable the cultural construction of emotion. This begins early, with the social evaluations associated with the emergence of self-conscious evaluative emotions. As a result of how emotion is represented in language and culture, for example, young Tamang children in Nepal say that it is useless to feel anger when wronged (instead endorsing shame), whereas Nepalese Brahman children endorse feeling angry but not expressing it, and children in the United States say they would feel and express anger, albeit within socially acceptable parameters (Cole, Bruschi, & Tamang, 2002).

With increasing age, the goals and appraisals associated with emotion become more socially and psychologically complex and increasingly colored by sociocultural values. Emotions are influenced by inferences of others' intentions and motives, social rules for emotional behavior in specific and general

social situations, moral obligations, concerns with social standing and status, and the balancing of immediate with long-term social objectives. These appraisals related to emotion are significantly influenced by sociocultural goals and values. Lower-income children have very different expectations for how peers will respond to their distress compared to the expectations of middle-income children, for example, and this influences their emotional reactivity and self-regulation (Raver, 2004).

How do these emotional schemas develop? As their conceptual understanding of internal mental and emotional states unfolds in early childhood, the concurrent growth of language enables young children to access adults' representations of emotion through parent-child conversation (Thompson, 2006). Conversational references to emotion initially contribute to developing emotion understanding by offering insight into the causes and consequences of emotion, as well as giving young children lexical categories for defining their emotional experiences. With increasing age, parent-child conversation also becomes an avenue for communicating expectations for the appropriate expression of emotion in social situations, beliefs about emotion and its consequences, understanding others' emotional reactions, and strategies of emotion regulation. Studies in our lab have shown, for example, that how mothers converse with their preschoolers about the child's feelings is affected by the mother's representations of her own emotions (cf. Gottman, Katz, & Hooven, 1997), and that strategies for emotion regulation are incorporated into those conversations (Raikes & Thompson, 2008; Thompson, in press; Waters et al., 2010).

This précis of behavioral research on emotional development supports two conclusions from the preceding review of research in developmental neurobiology. First, component processes of emotion (e.g., emotion-related goals, attentional processes, emotion appraisals and understanding) develop early and are mutually influential throughout the course of emotional development. Early in infancy, for example, changes in attentional control permit more acute scanning of human faces that enable different appraisals of environmental activity that lead to the emotional experiences of social interaction (Thompson & Lagattuta, 2006). This is consistent with a systems view, as is the importance of emotion–cognition interactions to emotional growth. Second, intrinsic and extrinsic regulatory influences are incorporated into the process of emotional development from the beginning. Intrinsic self-regulatory processes begin to emerge with the growth of attentional control and simple forms of self-soothing, and concurrently the extrinsic regulation of emotion is manifested in caregiver responsiveness to the baby's emotional expressions, and in cultural influences on developing emotion appraisals. In both developmental neurobiology and in behavioral development, emotion does not develop from an early unregulated condition into a more complexly regulated psychological state. Instead, emotion is regulated from its earliest emergence, and the developmental story is how regulatory influences become more multifaceted, widely distributed among multiple components, and increasingly integrated into emotional functioning.

Conceptualizing Emotion Regulation

The discussion thus far has focused on the nature of emotion and emotional development. Understanding the association between emotion and emotion regulation is also based on how emotion regulation is conceptualized in contemporary emotions theory. While the study of emotional development has a long history, contemporary interest in emotion regulation is more recent, reemerging at about the same time that functionalist theories of emotion came into renewed prominence in psychology in the 1990s. The coincidence of these scientific interests was no accident. If emotions are portrayed in functionalist emotions theory as arising from ongoing transactions between a person and significant features of the context, then emotion regulation can be viewed as enlisting emotion more effectively into these person–context transactions. From this perspective, therefore, regulatory processes are crucial to ensuring that emotional arousal, which has the potential to undermine behavioral organization, contributes constructively to adaptive functioning. Viewed in this light, it is easy to see why emotion regulation is studied as an important element of personal adjustment, social competence, and even cognitive skill, and why aggression and social withdrawal are often portrayed as problems of emotional dysregulation. From this perspective, moreover, many forms of child and adult psychopathology—including depression, anxiety disorders, conduct problems, and other internalizing and externalizing disorders—are also viewed, at least in part, as problems of emotion regulation.

Conceptualizations of emotion regulation as processes of self-regulation that foster behavioral competence have contributed to the initial explosion of research interest in emotion regulation and its continued scientific vitality during the past 15 years. They have also contributed to the applications of research on emotion regulation to therapeutic intervention. But this approach may not provide a comprehensive portrayal of regulatory influences on emotion or their development. This may be true if regulatory influences on emotion are implicit and involuntary as well as explicit and strategic, arise from other people as well as the individual's self-initiated efforts, and in certain contexts have the potential to undermine rather than support behavioral competence. An alternative definition of emotion regulation may provide a more inclusive, comprehensive portrayal of these regulatory influences (Thompson, 1994):

Emotion regulation consists of the extrinsic and intrinsic processes responsible for monitoring, evaluating, and modifying emotional reactions, especially their intensive and temporal features, to accomplish one's goals (pp. 27–28).

Embedded in this definition are several central assumptions in conceptualizing emotion regulation. The first is that emotion regulation derives both from a person's *self*-regulatory efforts and also from the regulatory influences of other people. Both are important, particularly in developmental analysis because caregivers assume such an important role in managing young children's feelings early in life. Even for adults, however, extrinsic emotion regulation occurs in many ways (e.g., comforting support

when distressed or anxious; coaching calmness when angry). For both children and adults, extrinsic emotion regulation is usually enlisted to accomplish the target's emotional goals (e.g., comforting a baby who cannot calm herself; cheering up a friend who needs an emotional boost), although this is not always so (such as when parents seek to redirect a young child's justifiably negative response to a medical or dental exam). Consideration of extrinsic influences on emotion regulation is important not only because it is a direct influence on emotion, but also because of how social facilitation or inhibition can influence the effectiveness of an individual's efforts to manage emotion. These social influences can be proximal (e.g., coaching emotion regulatory strategies) and distal (e.g., feeling rules of the culture or social group), and in the case of risk for affective psychopathology, can include potentially overwhelming emotional demands on the individual by other people and the self-regulatory requirements they impose.

A second assumption of this conceptualization is that emotion regulation can target positive as well as negative emotions, and can entail maintaining and enhancing emotional arousal as well as inhibiting or blunting it. It is a reflection of prevalent views of the potential influence of unregulated emotion on behavioral organization, and of our culture's valuing moderated affect, that researchers tend to portray emotion regulation primarily as emotional inhibition. But it is not only true that strategies of emotion management are used to maintain or enhance emotional arousal (such as dwelling on guilty or angry feelings to motivate oneself to appropriate action, or enhancing shared delight in enjoyable activity), but also that emotion regulation often occurs by arousing an alternative emotion (such as thinking positive thoughts in fearful or anxious situations).

Emotion regulation can also affect the temporal features of an emotional response. These include altering the speed of onset, persistence, and duration of recovery from an emotional response, as well as changing the range and lability of positive or negative emotions. It is important to have a broadened view of the outcomes of emotion regulatory influences because emotions are often managed with these outcomes in mind: individuals seek to reduce how long they feel sadness, or to end more quickly a fearful episode, or to achieve greater emotional stability. Moreover, affective psychopathology is usually characterized not just by the prevalence of negative affect but also by disturbances in the intensity, persistence, or lability of negative and/or positive emotions, such as in the enduring sadness of depression, or the uncontrollable lability of bipolar disorder (Luby & Belden, 2006). These are problems, therefore, not merely of emotional inhibition, but also of the temporal features of emotion that are also the targets of regulatory influences.

A third assumption of this view of emotion regulation is that it involves multiple component processes. Monitoring and evaluating emotions are necessary preludes to modifying them. Often the monitoring and evaluation of one's emotional states are implicit and nonconscious rather than explicit and strategic, and colored by cultural values. The importance of monitoring and evaluation processes is inherent in most conceptualizations of emotion regulation, but there is value in distinguishing these components for several reasons. First, there are significant

developmental changes in children's capacities to monitor their feelings and in how they evaluate their emotions in ways that have significant implications for their capacities for emotion management. One reason young children seem so emotionally undercontrolled, for example, is that (a) they lack the metacognitive skill to monitor their feelings in light of their ongoing goals; and (b) their emotional evaluations are often limited simply to how they *want* to feel rather than considering the longer-term consequences of their emotional reactions. Second, monitoring and evaluating emotions can also occur by others, and this influences how emotion regulation becomes socialized. Indeed, acquisition of relevant feeling rules for emotional behavior in family and peer groups readily occurs through how others evaluate one's emotional behavior.

Finally, emotional monitoring and evaluation are likely to be significantly different for children who differ temperamentally, or who have experienced trauma or chronic stress, or who have had other experiences that significantly alter their evaluations of their feelings or the circumstances commonly eliciting emotion in them. Young children who are temperamentally inhibited, or have experienced intense marital conflict, or who are maltreated, share in common their implicit hypersensitivity to anticipatory cues of threat or danger from others which contributes to their difficulty in managing negative emotion when stressful events occur (Thompson & Calkins, 1996; Thompson, Flood, & Lundquist, 1995).

This expanded conceptualization of emotion regulation suggests that regulatory influences arise not just through the strategic efforts of the person to function competently but also through a variety of extrinsic, nonconscious, implicit processes by which emotion is managed in response to complex contextual demands and cultural expectations. It suggests that regulatory processes influence not just emotion tone but also the temporal characteristics of emotional responding and the individual's emotional goals and their interpretation of their emotional experience. In a broader sense, this conceptualization of emotion regulation is consistent with current portrayals of the cultural and personal construction of emotional experience (Barrett, 2009). In this light, it is arguable that this portrayal of emotion regulation is too inclusive by comparison with portrayals that emphasize self-regulatory processes that advance behavioral competence. But if the multifaceted ways that emotion is regulated—both directly and indirectly mediated by self-regulatory strategies—are to be taken seriously, a more comprehensive conceptualization merits consideration.

A Functionalist Analysis of Emotion Regulation

Virtually all definitions of emotion regulation emphasize its goal orientation (see, e.g., Frijda, 1987; Izard, 2009; Saarni et al., 2006). This means that any assessment of emotion regulation must take into account the goals of the individual in the contexts in which emotions are managed. In this light, strategies of emotion regulation are rarely inherently optimal or maladaptive.

Rather, they are more or less adaptive in the context of specific goals in particular circumstances. Because there are significant developmental changes in the goals underlying emotion regulatory efforts, and there may be multiple goals (some immediate, some long-term) competing in the determination of these efforts, applying a functionalist analysis to the study of emotion regulation is a complex but important challenge. This is especially so when considering individuals at risk for affective psychopathology, for whom accomplishing these goals may involve psychological costs as well as benefits.

A functionalist analysis of emotion regulation is important to developmental inquiry because it requires observers to comprehend a child's goals in an emotionally-evocative situation to determine whether emotions are being managed competently or not. Misunderstanding children's goals for emotion management can cause adults to perceive children as emotionally dysregulated in situations where they are functioning adaptively as emotional tacticians (e.g., a toddler fussing for candy; an adolescent becoming moody to elicit sympathy from friends). When emotion regulatory efforts lead to socially inappropriate conduct, this does not necessarily mean that children are dysregulated, but perhaps that children's goals are different from those assumed by observers in these circumstances. Moreover, children's goals for emotion regulation may be very different in peer contexts than with adults, where different feeling rules prevail and peers respond differently than parents to the child's emotional displays (Thompson & Waters, *in press*).

Furthermore, emotion regulatory efforts can be governed by multiple goals, and these goals can vary in many ways, including whether they are immediate or long-term. A child who has been threatened by a peer, for example, may have to choose between managing emotion to enlist the assistance of others (by controlling anger and manifesting intense distress), defending oneself and deterring aggression (by managing fear and distress and intensifying anger), avoiding further conflict and/or reconciling with the aggressor (by reducing negative feelings of any kind), or to accomplish other goals. There may be different (and potentially inconsistent) immediate and long-term consequences of each strategy, based on the child's power relative to that of the bully, the values of the adults to whom the child might turn, the behavior of other children in the setting, and the overarching values of the sociocultural milieu (see Miller & Sperry, 1987). Determining which strategy is most adaptive for which immediate and longer-term purposes is part of a functionalist analysis. The same is true in considering emotion regulation in adults: emotion regulation can accomplish immediate goals that may be inconsistent with long-term social functioning. A medical professional's skilled self-regulation of distressed emotion in emergency situations, for example, may blunt empathic sensitivity in other contexts.

Furthermore, understanding the goal orientation of emotion regulation can broaden awareness of the diverse ways that emotions are managed. Considerable emotion regulation occurs prior to an emotional response in the attentional processes, anticipatory appraisals (or preappraisals), situation selection, and other strategies intended to avert anticipated emotional reactions before

they occur (Gross & Thompson, 2007). Understanding these initiatives as emotion regulatory is important, especially because it is contrary to the view that emotion is activation and antecedent to emotion regulation.

The potential conflict between the multiple goals underlying emotion regulation is especially apparent in studies of children at risk for affective disorders. For children living in a family climate of expressed emotion, for example, emotion regulatory efforts may be devoted to managing the emotional effects of parental criticism, hostility, and overinvolvement, even at a cost of developing more adaptive emotion regulatory strategies (Hirshfeld, Biederman, Brody, Faraone, & Rosenbaum, 1997). Young children at risk for anxiety disorders show hypervigilance in situations associated with fearful events, attentional orienting to anxiety-provoking stimuli, and a tendency to construe benign situations as disproportionately negative or threatening, and these appraisal and preappraisal processes develop to accomplish the immediate goal of avoiding anxiety-provoking events despite their dysfunctional broader consequences (Fox, Henderson, Marshall, Nichols, & Ghera, 2005; Thompson, 2001).

Research on child maltreatment also illustrates the troubled calculus of immediate and long-term goals for emotion regulation in challenging circumstances. Children with a history of abuse become hypersensitive to adult expressions of anger, even to the extent of misperceiving anger in facial expressions that other children perceive as benign (Pollak, 2002; Pollak & Kistler, 2002). They also exhibit a lower attentional threshold for detecting anger in the vocal expressions of their mothers (but not of an unfamiliar woman), and have more difficulty attentionally disengaging from perceived angry cues (Pollak & Tolley-Schell, 2003; Shackman & Pollak, 2005). In a study using event-related brain potential (ERP) technology, maltreated children showed higher ERP responses to pictures of angry facial expressions compared to nonmaltreated children, but there were no differences in their responses to pictures of happy or fearful expressions (Pollak, Klorman, Thatcher, & Cicchetti, 2001).

These and other findings suggest that, if children cannot avert the emotionally overwhelming attack of an abusive adult, it may be adaptive to be able to anticipate it and flee, avoid, or otherwise prepare for it. But outside the home, their hypersensitivity to cues of anger and threat undermines competent emotion management and is more socially dysfunctional. Maltreated children are more physically and verbally aggressive toward their peers and are more likely to respond with aggression or withdrawal to peer distress (Cicchetti & Toth, 1995; Klimes-Dougan & Kistner, 1990). In this respect, the hypersensitivity to potential threat that is a protective factor at home is a liability with peers when the social cues of other children are more likely to be misinterpreted and imbued with hostile intent (Thompson & Goodman, 2010).

In circumstances like these, children's emotion self-regulatory strategies involve inherent trade-offs that purchase immediate coping at the cost of long-term difficulty, and which may ultimately increase rather than diminish their emotional problems. These challenges emerge not only in response to the

extremity of child abuse, but in more typical conditions as well, such as when children are exposed to marital conflict (Davies & Woitach, 2008; Sturge-Apple, Davies, Winter, Cummings, & Schermerhorn, 2008). Emotion regulation is for these children a double-edged sword: the strategies that are most adaptive for accomplishing immediate emotional goals often render individuals more vulnerable to longer-term problems (Thompson & Calkins, 1996). Emotion regulation is especially challenging when experiences of chronic stress or genetic vulnerability have also enhanced aspects of emotion activation—such as heightened neuroendocrine reactivity (Boyce & Ellis, 2005)—that increment the difficulties of managing emotion to accomplish immediate or longer-term goals. For children at risk in these ways, there may be no optimal means of managing emotion. Their challenges are best characterized not merely as problems of emotion dysregulation except in a broadly descriptive sense. From a functionalist perspective, their problems derive from the inherently conflicting goals underlying emotional regulatory efforts in emotionally overwhelming circumstances.

Conclusion

The developmental systems view that has guided this discussion offers several conclusions about the association between emotion and emotion regulation that can stimulate new thinking about the developmental construction of emotional experience. In this view, multiple components of emotion are continuously and mutually influential in emotional responding, and become progressively interrelated over the course of emotional development. Neurobiologically, this involves widely distributed emotion-related brain areas, with regions that are higher and lower on the neuroaxis mutually involved in emotional activation and emotion regulation. This also involves the interaction of multiple behavioral systems related to emotion appraisals, goals, cognitions, and other processes that also assume activational and regulatory functions in emotional responding.

As a consequence, regulatory influences are incorporated into emotional development in both neurobiological and behavioral systems. Unregulated emotion does not exist at any developmental period because emotion itself incorporates regulatory processes. Moreover, context is crucial to understanding how emotion regulatory systems function to manage the course of emotional behavior.

Context is important neurobiologically because of how regulatory processes are affected by other components of emotional responding (such as the reactivity of the HPA axis). Context is behaviorally important because of how cultural values, social expectations, and situational demands shape the goals, strategies, and outcomes of emotion regulatory efforts.

In a practical sense, this developmental systems view of emotion and emotion regulation is consistent with the impetus of contemporary research into emotion regulation (cf. Campos, Frankel, & Camras, 2004). Because the contextual requirements of emotion regulation tasks in research settings are usually highly

structured and well defined, researchers' inquiry into the effects of alternative explicit strategies of emotion management and developmental changes in these strategies is useful, although of uncertain generalizability. To be sure, the study of emotion regulation is not for the faint-hearted (see Cole, Martin, and Dennis, 2004, for a survey of these challenges). But in this respect the study of emotion regulation is not markedly different from the study of other forms of behavioral or neurobiological regulation, in which researchers have studied identifiable, distinctive regulatory influences in response to specific circumstances and organismic conditions.

In two other ways, however, a developmental systems view offers something new and important. First, it contributes a new perspective to understanding the emotion regulatory challenges of children at risk for affective psychopathology, for whom the overwhelming and sometimes unpredictable contextual demands of emotion management alter emotion goals and the efficacy of self-regulatory strategies in ways that make the description of these children as emotionally dysregulated seem inadequate. Comprehending the benefit-cost calculus of their efforts at emotion regulation, especially in light of the neurobiological effects of stress, seems a much more fruitful approach that is consistent with both the functionalism of contemporary emotion theory and this developmental systems perspective. Second, this perspective also offers an alternative to the view of emotion regulation as self-regulation to promote behavioral competence, even though it has contributed to current enthusiasm for research in this area. In providing a view of emotion regulation that is broader and more inclusive, this developmental systems perspective portrays emotion regulation as more contextually-grounded, situationally dynamic, and individualistic in ways that invite further exploration.

References

- Barrett, K. F. (2009). Variety is the spice of life: A psychological construction approach to understanding variability in emotion. *Cognition & Emotion*, 23, 1284–1306.
- Barrett, L. F., & Bar, M. (2009). See it with feeling: Affective predictions during object perception. *Philosophical Transactions of the Royal Society B (Biological Sciences)*, 364, 1325–1334.
- Boyce, W. T., & Ellis, B. J. (2005). Biological sensitivity to context: I. An evolutionary-developmental theory of the origins and functions of stress reactivity. *Development and Psychopathology*, 17, 271–301.
- Calkins, S. D., & Hill, A. (2007). Caregiver influences on emerging emotion regulation: Biological and environmental transactions in early development. In J. Gross (Ed.), *Handbook of emotion regulation* (pp. 229–248). New York, NY: Guilford.
- Campos, J. J., Frankel, C. B., & Camras, L. (2004). On the nature of emotion regulation. *Child Development*, 75, 377–394.
- Cardinal, R. N., Parkinson, J. A., Hall, J., & Everitt, B. J. (2002). Emotion and motivation: The role of the amygdala, ventral striatum, and prefrontal cortex. *Neuroscience and Biobehavioral Reviews*, 26, 321–352.
- Cicchetti, D., & Toth, S. L. (1995). A developmental psychopathology perspective on child abuse and neglect. *Journal of the American Academy of Child and Adolescent Psychiatry*, 34, 541–565.
- Cole, P. M., Bruschi, C. J., & Tamang, B. L. (2002). Cultural differences in children's emotional reactions to difficult situations. *Child Development*, 73, 983–996.

- Cole, P. M., Martin, S. E., & Dennis, T. A. (2004). Emotion regulation as a scientific construct: Methodological challenges and directions for child development research. *Child Development*, 75, 317–333.
- Davies, P. T., & Woitach, M. J. (2008). Children's emotional security in the interparental relationship. *Current Directions in Psychological Science*, 17, 269–274.
- Fox, N. A., Henderson, H. A., Marshall, P. J., Nichols, K. E., & Ghera, M. M. (2005). Behavioral inhibition: Linking biology and behavior within a developmental framework. *Annual Review of Psychology*, 56, 235–262.
- Frijda, N. H. (1987). *The emotions*. New York, NY: Cambridge University Press.
- Goldsmith, H. H., Pollak, S. D., & Davidson, R. J. (2008). Developmental neuroscience perspectives on emotion regulation. *Child Development Perspectives*, 2, 132–140.
- Gottlieb, G., Wahlsten, D., & Lickliter, R. (2006). The significance of biology for human development: A developmental psychobiological systems view. In W. Damon & R. M. Lerner (Eds.), & R. M. Lerner (Vol. Ed.), *Handbook of child psychology: Vol. 1. Theoretical models of human development* (6th ed., pp. 210–257). New York, NY: Wiley.
- Gottman, J. M., Katz, L. F., & Hooven, C. (1997). *Meta-emotion: How families communicate emotionally*. Mahwah, NJ: Erlbaum.
- Gross, J., & Thompson, R. A. (2007). Conceptual foundations for the field. In J. J. Gross (Ed.), *Handbook of emotion regulation* (pp. 3–24). New York, NY: Guilford.
- Gunnar, M. R., & Donzella, B. (2002). Social regulation of the cortisol levels in early human development. *Psychoneuroendocrinology*, 27, 199–220.
- Gunnar, M., & Vazquez, D. (2006). Stress neurobiology and developmental psychopathology. In D. Cicchetti & D. Cohen (Eds.), *Developmental psychopathology: Vol. III. Risk, disorder, and adaptation* (2nd ed., pp. 533–577). New York, NY: Wiley.
- Hirshfeld, D. R., Biederman, J., Brody, L., Faraone, S. V., & Rosenbaum, J. F. (1997). Associations between expressed emotion and child behavioral inhibition and psychopathology: A pilot study. *Journal of the American Academy of Child and Adolescent Psychiatry*, 36, 205–213.
- Izard, C. E. (2007). Basic emotions, natural kinds, emotion schemas, and a new paradigm. *Perspectives on Psychological Science*, 2, 260–280.
- Izard, C. E. (2009). Emotion theory and research: Highlights, unanswered questions, and emerging issues. *Annual Review of Psychology*, 60, 1–25.
- Johnstone, T., van Reekum, C. M., Urry, H. L., Kalin, N. H., & Davidson, R. J. (2007). Failure to regulate: Counterproductive recruitment of top-down prefrontal-subcortical circuitry in major depression. *The Journal of Neuroscience*, 27, 8877–8884.
- Klimes-Dougan, B., & Kistner, J. (1990). Physically abused preschoolers' responses to peers' distress. *Developmental Psychology*, 26, 599–602.
- Kober, H., Barrett, L. F., Joseph, J., Bliss-Moreau, E., Lindquist, K., & Wager, T. D. (2008). Functional grouping and cortical-subcortical interactions in emotion: A meta-analysis of neuroimaging studies. *NeuroImage*, 42, 998–1031.
- Lewis, M. D., Granic, I., Lamm, C., Zelazo, P. D., Stieben, J., Todd, R. M., ... Pepler, D. (2008). Changes in the neural bases of emotion regulation associated with clinical improvement in children with behavior problems. *Development and Psychopathology*, 20, 913–939.
- Lewis, M. D., & Todd, R. M. (2007). The self-regulating brain: Cortical-subcortical feedback and the development of intelligent action. *Cognitive Development*, 22, 406–430.
- Luby, J. L., & Belden, A. C. (2006). Mood disorders: Phenomenology and a developmental emotional reactivity model. In J. L. Luby (Ed.), *Handbook of preschool mental health* (pp. 209–230). New York, NY: Guilford.
- Miller, P., & Sperry, L. L. (1987). The socialization of anger and aggression. *Merrill-Palmer Quarterly*, 33, 1–31.
- Nitschke, J. B., Sarinopoulos, I., Oathes, D. J., Johnstone, T., Whalen, P. J., Davidson, R. J., & Kalin, N. H. (2009). Anticipatory activation in the amygdala and anterior cingulate in generalized anxiety disorder and prediction of treatment response. *American Journal of Psychiatry*, 166, 302–310.
- Ochsner, K. N., Ray, R. R., Hughes, B., McRae, K., Cooper, J. C., Weber, J., ... Gross, J. J. (2009). Bottom-up and top-down processes in emotion generation: Common and distinct neural mechanisms. *Psychological Science*, 20, 1322–1331.
- Pollak, S. D. (2002). Effects of early experience on children's recognition of facial displays of emotion. *Developmental Psychology*, 38, 784–791.
- Pollak, S. D., & Kistler, D. J. (2002). Early experience is associated with the development of categorical representations for facial expressions of emotion. *Proceedings of the National Academy Sciences*, 99, 9072–9076.
- Pollak, S. D., Klorman, R., Thatcher, J. E., & Cicchetti, D. (2001). P3b reflects maltreated children's reactions to facial displays of emotion. *Psychophysiology*, 38, 267–274.
- Pollak, S. D., & Tolley-Schell, S. A. (2003). Selective attention to facial emotion of physically abused children. *Journal of Abnormal Psychology*, 113, 323–338.
- Posner, M. I., & Rothbart, M. K. (2000). Developing mechanisms of self-regulation. *Development and Psychopathology*, 12, 427–441.
- Propper, C., & Moore, G. A. (2006). The influence of parenting on infant emotionality: A multi-level psychobiological perspective. *Developmental Review*, 26, 427–460.
- Quirk, G. J. (2007). Prefrontal-amygdala interactions in the regulation of fear. In J. J. Gross (Ed.), *Handbook of emotion regulation* (pp. 27–46). New York, NY: Guilford.
- Raikes, H. A., & Thompson, R. A. (2008). Conversations about emotion in high-risk dyads. *Attachment & Human Development*, 10, 359–377.
- Raver, C. C. (2004). Placing emotional self-regulation in sociocultural and socioeconomic contexts. *Child Development*, 75, 346–353.
- Russell, J. A. (2003). Core affect and the psychological construction of emotion. *Psychological Review*, 110, 145–172.
- Saarni, C., Campos, J. J., Camras, L., & Witherington, D. (2006). Emotional development: Action, communication, and understanding. In W. Damon, & R. M. Lerner (Eds.), & N. Eisenberg (Vol. Ed.), *Handbook of child psychology: Vol. 3. Social, emotional and personality development* (6th ed., pp. 226–299). New York, NY: Wiley.
- Schwartz, C., Wright, C., Shin, L., Kagan, J., & Rauch, S. (2003). Inhibited and uninhibited infants "grown up": Adult amygdalar response to novelty. *Science*, 300, 1952–1953.
- Shackman, J. E., & Pollak, S. D. (2005). Experiential influences on multimodal perception of emotion. *Child Development*, 76, 1116–1126.
- Sturge-Apple, M. L., Davies, P. T., Winter, M. A., Cummings, E. M., & Schermerhorn, A. (2008). Interparental conflict and children's school adjustment: The explanatory role of children's internal representations of interparental and parent-child relationships. *Developmental Psychology*, 44, 1678–1690.
- Surguladze, S. A., Brammer, M. J., Young, A. W., Andrew, C., Travis, M. J., Williams, S. C. R., & Phillips, M. L. (2003). A preferential increase in the extrastriate response to signals of danger. *NeuroImage*, 19, 1317–1328.
- Thompson, R. A. (1990). Emotion and self-regulation. In R. A. Thompson (Ed.), *Socioemotional development. Nebraska symposium on motivation* (Vol. 36, pp. 383–483). Lincoln, NE: University of Nebraska Press.
- Thompson, R. A. (1994). Emotion regulation: A theme in search of definition. In N. A. Fox (Ed.), *The development of emotion regulation and dysregulation: Biological and behavioral aspects. Monographs of the Society for Research in Child Development*, 59, 25–52 (Serial no. 240).
- Thompson, R. A. (2001). Childhood anxiety disorders from the perspective of emotion regulation and attachment. In M. W. Vasey & M. R. Dadds

- (Eds.), *The developmental psychopathology of anxiety* (pp. 160–182). Oxford, UK: Oxford University Press.
- Thompson, R. A. (2006). Conversation and developing understanding: Introduction to the special issue. *Merrill-Palmer Quarterly*, 52, 1–16.
- Thompson, R. A. (in press). The emotionate child. In D. Cicchetti & G. I. Roissman (Eds.), *The origins and organization of adaptation and maladaptation. Minnesota symposium on child psychology* (Vol. 36). New York, NY: Wiley.
- Thompson, R. A., & Calkins, S. (1996). The double-edged sword: Emotional regulation for children at risk. *Development and Psychopathology*, 8, 163–182.
- Thompson, R. A., Flood, M. F., & Lundquist, L. (1995). Emotional regulation and developmental psychopathology. In D. Cicchetti & S. Toth (Eds.), *Rochester symposium on developmental psychopathology. Emotion, cognition, and representation* (Vol. 6, pp. 261–299). Rochester, NY: University of Rochester Press.
- Thompson, R. A., & Goodman, M. (2010). Development of emotion regulation: More than meets the eye. In A. Kring, & D. Sloan (Eds.), *Emotion regulation and psychopathology* (pp. 38–58). New York, NY: Guilford.
- Thompson, R. A., & Goodvin, R. (2007). Taming the tempest in the teapot: Emotion regulation in toddlers. In C. A. Brownell & C. B. Kopp (Eds.), *Transitions in early socioemotional development: The toddler years* (pp. 320–341). New York, NY: Guilford.
- Thompson, R. A., & Lagattuta, K. (2006). Feeling and understanding: Early emotional development. In K. McCartney & D. Phillips (Eds.), *The Blackwell handbook of early childhood development* (pp. 317–337). Oxford, UK: Blackwell.
- Thompson, R. A., Lewis, M., & Calkins, S. D. (2008). Reassessing emotion regulation. *Child Development Perspectives*, 2, 124–131.
- Thompson, R. A., & Waters, S. F. (in press). The development of emotion regulation: Parent and peer influences. In R. Sanchez-Aragon (Ed.), *Emotion regulation*. Mexico City, Mexico: Miguel Angel Porrua.
- Waters, S., Virmani, E., Thompson, R. A., Meyer, S., Raikes, A., & Jochem, R. (2010). Emotion regulation and attachment: Unpacking two constructs and their association. *Journal of Psychopathology and Behavioral Assessment*, 32, 37–47.
- Wolterling, S., & Lewis, M. D. (2009). Developmental pathways of emotion regulation in childhood: A neuropsychological perspective. *Mind, Brain, and Education*, 3, 160–169.