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Special Issue Article

Emotion dysregulation as a dynamic process

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Abstract

In this article we adopt the view that emotion dysregulation is characterized by emotion regulation dynamics that are defined as dysfunctional based on contextual criteria. We regard the construct of emotion regulation as valuable because it permits the integration of the classic view of emotions as interfering with human functioning and contemporary views of emotion as adaptive and beneficial. To define patterns that reflect emotion dysregulation, we explain our views of emotion as a dynamic process, and emotion regulation as the bidirectional interplay between emotions and actions/thoughts (extrinsic factors) and the contextual factors that constitute the criteria for that interplay reflecting dysregulation. This conceptualization of emotion regulation and dysregulation leads to methods for studying the intrinsic dynamics of emotion, extrinsic factors that change the intrinsic dynamics of emotion, and how emotion regulation changes over time at multiple time scales. We then apply this thinking to several emotion dysregulation patterns. Emotion regulation is a complex construct, embracing emotion as regulator and as regulated, as self- and other-regulated, and as incorporating both top-down and bottom-up regulatory processes. We highlight an emerging line of research on the development of emotion regulation in early childhood and indicate how this work can inform understanding of emotion dysregulation and the emergence of psychopathology.

Keywords: development, dynamic processes, emotional dysregulation, emotion regulation

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The idea that emotions interfere with human rationality and social propriety harkens back to humankind's earliest known writings. The *Instructions of Shuruppak*, Sumerian tablets dated around 4800 BCE that are regarded as a father's advice to his son about virtuous behavior, warn the son about negative emotion, especially the destructive influences of quarreling and hate (Robson et al., 1998). Understanding that emotions can interfere with rational thought and appropriate behavior also appears in 5th-century BCE Eastern and Western philosophies (Scarantino & de Sousa, 2018; Tuske, 2016). Modern science has given us great appreciation for the necessity of emotions and their critical role in survival. Emotions are the means by which one can evaluate the significance of the environment for well-being, can rapidly organize behavior and ready oneself to do what is necessary to achieve and maintain well-being, and can communicate about those goals in ways that add to the information that language provides (Barrett & Campos, 1987; Izard, 1977; Lazarus, 2006).

Emotion regulation is a concept that integrates both the adaptive nature of emotion and its potential to contribute to maladaptive functioning. Maladaptive functioning is not necessarily characterized by having a negative emotion, or that negative emotion spurs quick action, or that negative emotions are sustained or intense. Rather, the extent to which emotion contributes to maladaptive functioning depends on the context in which the emotion is occurring and how one balances one's goals for well-being with the realities and constraints of the environment (Cole, Michel, & Teti, 1994). Emotion dysregulation is inferred when an individual's emotion regulation dynamics (i.e., patterns of regulation) impair developmental goals in short- and/or long-term time frames (e.g., Beauchaine & Zisner, 2017; Cicchetti, Ganiban, & Barnett, 1991). There are several ways in which such impairment can be articulated (Ramsook, Cole, & Fields-Olivieri, 2018):

1. A pattern of emotion regulation dynamics interferes with achieving short and/or longer term goals for well-being, for example, pattern of angry action when having to share toys with a friend (short-term goal) results in the loss of a friendship (long-term goal);
2. it violates developmental expectations for appropriate behavior, for example, being afraid to separate from a parent and refusing to go to school; or
3. it violates sociocultural standards for emotion-related communication and behavior, for example, laughing after hurting another child.

Moreover, a pattern of emotion dysregulation can be adaptive in the immediate context and yet represent risk for later developmental outcomes; it can also be maladaptive in the immediate context and yet, in the longer term, buffer a person against adversity and support a person achieving later goals (Cole et al., 1994).

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In our view, emotion dysregulation is not the opposite of emotion regulation; emotion dysregulation is a pattern of emotion regulation that is interpreted as dysregulated based on the implications for interfering with healthy, competent development. Capturing these complexities in the study of emotion dysregulation research can provide clinically meaningful evidence that will inform the promotion of competent emotion regulation and preventive and therapeutic programs to address emotion dysregulation.

In contrast to historical views of emotion as irrational and problematic, the concept of emotion regulation, and its offshoot emotion dysregulation, is relatively recent, having appeared in developmental science about 30 years ago. Prior to the 1990s, emotional development was largely understood in terms of infant attachment and childhood temperament; when research focused squarely on emotion, the emphasis was on children's acquisition of emotion understanding. As a result, there was a relative dearth of evidence addressing the role of emotions in the development of psychological dysfunction. At the same time, child clinical research was making a concerted effort to move away from the strict dominance of adult psychiatric models of psychopathology. This effort led to new conceptualizations and descriptions of children's symptoms. Empirical data indicated the presence of two major symptom clusters, each of which included emotion-related symptoms related to children's behavioral control. The undercontrolled or externalizing cluster included angry behavior that led to defiance and disruptive behavior and caused others (e.g., parents and teachers) distress, and the overcontrolled or internalizing cluster included depressed mood, undue fearfulness, and anxiety that limited the flexibility of children's behavior and caused them distress (Achenbach & Edelbrock, 1978; Quay, 1979; Weisz et al., 1989).

In the 1990s, the emergence of the developmental psychopathology framework, coupled with a resurgence of scientific interest in emotion and its adaptive nature, led to a conceptual integration of typical and atypical aspects of emotional development with the concepts of emotion regulation and dysregulation (e.g., Cicchetti et al., 1991; Cole et al., 1994; Dodge, 1989; Garber & Dodge, 1991). Drawing from functional theories of emotion (see Keltner & Gross, 1999, for a concise summary), it was understood that emotions regulate behavior; that is, emotions organize and prepare goal-directed behavior that, when enacted, permits individuals to adapt and interact with the changing environment in pursuit of attaining and maintaining goals for well-being. At the same time, there was appreciation that emotions could be regulated (i.e., amplified or diminished) in ways that enable goal-directed action while accommodating situational constraints and social propriety. In sum, emotion regulation (with emotion as both regulator and regulated) is essential for the development of socioemotional competence in both childhood and adulthood (Halberstadt, Denham, & Dunsmore, 2001; Mayer & Salovey, 1993; Saarni, 1999).

Appreciation of the dual role of emotion as both regulator and regulated continued to move forward in the 2000s. Both functionalist and constructivist views of emotion, which differ in their conceptualizations of how emotions are specified, continued to stimulate debate about how emotions are organized, socialized, and labeled. Furthermore, they spurred appreciation of the complex interplay between emotion, cognition, motivation, and action and how their interplay evolves over situations and with age (see Beauchaine & Haines, 2019). At the same time, advances in neuroscience brought a wealth of empirical evidence from laboratory studies of animals and humans that began to illuminate how the brain functions, including its role in emotion processing and emotion regulation. Although much remains to be determined, advances in neuroscience began to shed light on neural networks that are modulated by emotion-related experimental tasks, highlighting a dynamic interplay among subcortical and cortical regions (Beauchaine & Zisner, 2017). Debate about the nature of emotion and how different emotions are specified (e.g., Barrett, 2006; Panksepp, 2007) and advances in neuroscience largely focused on emotional functioning in adults. In terms of children, during the 2000s developmentally oriented research began highlighting age-related changes in neurobiology, executive functioning, and environmental contexts (including family and peers) contribute to the development of emotional competence, including emotion regulation (Casey et al., 2010; Cole, Martin, & Dennis, 2004; Thompson, 2011). The prevailing view became one assuming that emotion regulation (with emotion as both regulator and regulated) is a complex, continual process (Gross, 2014).

As with any psychological process, things can go awry. That emotion regulates behavior is generally adaptive but can also be maladaptive. Emotion readies an individual for action: for increasing effort toward the environment to regain a goal; for withdrawing, freezing, or fleeing from the environment to protect a goal; or for relinquishing goals (Barrett & Campos, 1987; Frijda, 1986). The action or inaction resulting from emotion as regulator can compromise other goals for well-being or violate developmental expectations or sociocultural standards. In complementary fashion, emotion as regulated can go awry and be problematic. Attempts to regulate emotion may be ineffective or highly effective in a maladaptive way (i.e., overcontrolled), again leading to behavior that violates developmental expectations (e.g., refusal to go to preschool) or resulting in compromised longer term development. Both types of emotion dysregulation (i.e., emotion as regulator or regulated) undergird many forms of psychological distress and psychopathology in children and adults (Beauchaine & Zizner, 2017; Cicchetti et al., 1991; Cole et al., 1994; Garber & Dodge, 1991; Keenan, 2000; Kring & Sloan, 2010).

Emotion Dysregulation as Patterns of Intraindividual Change

Our interest in emotion dysregulation is motivated by observations in clinical practice with children, youth, parents, and adults. We highlight several emotion patterns that we observe in practice, acknowledging that there is insufficient research on their occurrence and etiology in children's typical and atypical development. Each of these emotion patterns can be conceptualized and studied through examination of short-term changes in emotion and behavior that manifest over seconds, minutes, hours, or days. Our focus in this article is on self-regulation, that is, regulation as an intrapersonal process, emergent and situated in context (perceived or actual; Barrett & Campos, 1987; Koole & Veenstra, 2015). Although it is beyond the scope of this article, we share the view that the changing context, the environment in which emotion regulation occurs, should be included in our conceptualizations and study designs, including the important role of the social environment.

In conceptualizing emotion regulation from an intrapersonal perspective, we explicitly consider emotion and emotion regulation as emanating from a dynamic system, wherein the ongoing bidirectional interplay between extrinsic (e.g., regulation strategies) and intrinsic (e.g., prepotent response tendency) factors over time drive short-term changes in emotion and produce different emotion regulation patterns. In our view, the study of

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emotion *dys*regulation requires analysis of how these patterns change over longer term time frames (e.g., with age) in order to determine whether patterns (a) compromise an individual's short- or long-term goals for well-being, (b) violate developmental expectations, and/or (c) violate social/cultural constraints (i.e., local expectations for emotion-related behavior such as expression or communication). The study of emotion patterns (those described in this article and others) will enrich and increase our understanding of emotion dysregulation and its role in psychopathology. We must determine whether and when different emotion patterns are normative, under what conditions they serve goals for well-being with or without associated impairments, and how they develop from emotion patterns to symptoms and/or contribute to the development of psychopathology. Adding this approach to our developmental psychopathology knowledge base will augment the early identification of risk for psychopathology and the tailoring of individualized preventive and therapeutic interventions that address the specific ways emotion dysregulation emerges.

Interindividual Differences in the Intraindividual Dynamics of Emotion Regulation

The literature on emotion dysregulation is dominated by the study of interindividual (between-person) differences, comparing individuals without and with identified psychiatric disorders, with low and high symptom counts, or who have or have not been exposed to specific risk factors, circumstances, or conditions (Beauchaine, 2015). One of the main conclusions from this work is that the target groups (who exhibit or are at risk for psychopathology) are more emotionally negative than the comparison groups. The differences in overall level of negative emotion are interpreted as evidence that the target groups have poor emotion regulation or are emotionally dysregulated. The interpretation is reasonable but makes inferences about individuals' regulation processes without observing those processes (Cole et al., 2004).

A more dynamic, granular analysis of how emotions change and when extrinsic influences alter those changes at the intraindividual (within-person) level can yield new information about different forms and patterns of emotion dysregulation. Observed and felt emotions are indices of changes in a continual psychological process of evaluating one's relationship to the environment in matters of significance for well-being (Barrett & Campos, 1987). This continual psychological process produces *a regulation dynamic* wherein ongoing interplay between the appraisal of significance and preparation to act and environmental or cognitive influences determine subsequent behavior. In this process, emotion functions as regulator and is subject to regulation.

Observation and evaluation of individuals' emotion regulation (and dysregulation) dynamics require collection of intensive repeated measures, tracking changes in emotions, factors influenced by them, and factors that influence them over time. Many studies of emotion already collect continuous, time series data. In laboratory-based studies, for example, recordings of behavior or physiology (or both) are obtained while participants are presented with stimuli or tasks designed to elicit emotional reactions. Similarly, in experience sampling studies, participants are asked to provide self-reports of their emotions and actions every few hours for a series of days as they go about their regular daily lives. Often, these rich time series data are aggregated to obtain sums (e.g., total number of intervals in which child expressed anger) or averages (e.g., heart rate variability averaged over the task or task segments) that are meant to index interindividual differences. Although useful, this general approach prioritizes the study of interindividual differences, rather than studying short-term intraindividual change afforded by the temporal granularity of the data. Collection and analysis of intensive repeated-measures data enables more precise description of the intraindividual change patterns that may eventually give rise to interindividual differences of clinical importance, including emotion regulation dynamics (Cole & Hollenstein, 2018; Diaz & Eisenberg, 2015).

The patterns we describe can occur in any person's day-to-day experience without necessarily causing impairment, but also have potential to interfere with functioning in ways that warrant clinical intervention. Some patterns are characteristic of specific psychiatric disorders (American Psychiatric Association, 2015), such as prolonged sadness in depressive disorders. However, we conceptualize these patterns as transdiagnostic, as mechanisms that underlie and contribute to the etiology of many forms of psychopathology. A focus on intraindividual patterns of emotion regulation dynamics can contribute knowledge about the different ways that a normative regulation process can go awry and the contexts or conditions in which patterns become indicative of emotion *dys*regulation.

Development of intraindividual dynamics of emotion regulation

Emotion regulation is most often studied as a predictor, mediator, or moderator of between-person differences, or as a marker or outcome of between-person differences. As a result, we know little about how emotion (dys)regulation emerges, changes, and/or becomes canalized over a longer developmental time scale. There are surprisingly few long-term longitudinal investigations of emotion regulation itself. Blandon, Calkins, Keane, and O'Brien (2008) found linear growth in mothers' ratings of their children's emotion regulation from ages 4 to 7, though there was also significant interindividual variation in trajectories. Similarly, positive correlations in observed measures of emotion regulation are documented in children from age 1 to 5 (Feldman, 2015; Halligan et al., 2013). These correlations are generally small to modest (*r*s ranging from .25 to .41), suggesting again that there is within-person variation in these early years. This work can be expanded by examining emotion regulation *dynamics* longitudinally, which has the potential to capture multiple aspects in the emotion regulation process that may change across the life span.

There is need for longitudinal studies of change over multiple time scales, including across seconds, hours, or days and across months or years (Cole & Hollenstein, 2018). Nesselroade (1991) suggested that long-term change of short-term dynamic processes be examined using what we now call *multiple time scale designs*, wherein individuals are measured repeatedly at multiple cadences (Ram & Diehl, 2015). Specifically, at the micro-time scale, observations are obtained from one or more individuals at closely spaced intervals (e.g., seconds, minutes, hours, or weeks) constituting a "burst" of measurement. At the macro-time scale, these same individuals are measured again at a wider interval (e.g., months or years), each time providing another burst of information. The embedded nature of the multiple time scale design (micro-time scale nested within macro-time scale) provides opportunities for examining long-term change in intraindividual (regulation) dynamics (see Ram & Gerstorf, 2009). This general

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design is often invoked implicitly in longitudinal studies of children's development where families visit the laboratory or are visited at home on multiple occasions. For example, in the Development of Toddlers Study, children and their mothers were videotaped completing the same (or very similar) tasks during visits to the laboratory at ages 18 months, 24 months, 36 months, 48 months, and 5 years (Cole et al., 2011). As will be discussed later, video recordings made at each visit while children struggled through challenging tasks provide intensive (second-by-second) repeated measures time series data from which the research team can infer the child's intraindividual (regulation) dynamic at that age. The yearly visits provide additional opportunity to study how specific aspects of emotion regulation change with age.

Patterns of emotion dysregulation

The ongoing interplay between an individual's emotions, thoughts, and actions can produce a wide variety of intraindividual (regulation) dynamics, including moment-to-moment or hour-to-hour changes in individuals' emotions. A variety of concepts and metrics are used to describe the resulting patterns of change. We first highlight two patterns of moment-to-moment change that are often viewed as indicative of dysregulation in the intrinsic dynamics of an individual's emotion: *emotional inertia* and *emotional instability*. We then expand our discussion to include purported emotion regulation strategies that may influence an individual's emotion dynamics (emotion as regulated) or may be influenced by the individual's emotion dynamics (emotion as regulator).

Interindividual differences in intraindividual emotion dynamics

As noted, individuals' overall level of negative emotion is often interpreted as indicating emotional dysregulation without consideration of the ways that emotion changes over time (Cole et al., 2004). Taking a more dynamic perspective, clinicians and researchers have identified two types of short-term *change* patterns that appear indicative of emotion dysregulation.

Emotions that are prolonged and resist change

Clinicians often observe that some individuals have prolonged periods of negative emotions. For example, anhedonia is a sustained loss of interest or pleasure during an activity or event that was formerly enjoyable; this has been interpreted as a deficit in the upregulation of positive emotion (Tomarken & Keenan, 1998). Depression involves unrelenting sadness and irritability that resists the soothing by loved ones (e.g., Teasdale, 1988), and disorders involving anxiety involve episodes of prolonged anxiety that are maintained, often by unremitting worry (e.g., Mennin, Heimberg, Turk, & Fresco, 2002). Clinically, the persistence of the negative emotions becomes a target for intervention.

Contemporary research on adult and adolescent psychopathology has incorporated the view of emotions as dynamic (Davidson, 1998; Kuppens, Oravecz, & Tuerlinckx, 2010). Empirical evidence of persistent negative emotions is often derived from experience sampling studies wherein participants periodically (e.g., every few hours) describe their emotional experiences as they go about their usual daily lives (e.g., using ecological momentary assessment methods). The repeated-measures, time series data provide opportunity for intensive study of short-term changes in individuals' emotions (i.e., emotion dynamics). Formally, the persistence of an individual's emotion can be quantified as the extent to which that emotion carries over or recurs from one moment (e.g., hour) to the next (autoregression) and is often referred to as *emotional inertia* (Kuppens, Oravecz, et al., 2010). Across studies, greater inertia of negative emotions is associated with stress (Suls, Green, & Hills, 1998), and with depressive symptoms in both adults and adolescents (Kuppens, Allen, & Sheeber, 2010; Thompson et al., 2012).

These studies interpret the persistence of negative emotions as emotion dysregulation yet have not systematically indicated how environmental context or other extrinsic factors, such as strategies, contribute to these emotion dynamics. Context, for example, may matter; individuals with depressive symptoms experience emotional inertia on an everyday basis, but when they anticipate social stress, they are more prone to emotional variability (Koval & Kuppens, 2012). In addition, individuals with either high inertia or low inertia (i.e., greater variability) are less responsive and more blunted in response to conflict with their intimate partners (Luginbuehl & Schoebi, 2019). In addition, it is not known whether the persistence of negative emotion is due to cognitive influences (e.g., negative self-statements); one study found that cognitive reappraisal had potential to interrupt emotional inertia (Koval, Butler, Hollenstein, Lanteigne, & Kuppens, 2015). Understanding the nuances of context and the role of strategies is important because emotional inertia appears to occur prior to the emergence of depressive disorder and may be an important marker of risk (Kuppens et al., 2012; see also McLaughlin, Hatzenbuehler, Mennin, & Nolen-Hoeksema, 2011, for an interindividual longitudinal approach).

Emotions that change abruptly, intensely, and unexpectedly

Clinicians also observe that some individuals' emotions change quickly and erratically, a pattern that is often characterized as emotional instability or lability. These individuals' daily experiences include sudden, often intense as well as abrupt or unexpected, changes of emotion. Emotional instability has been documented in individuals with borderline personality disorder, bipolar depression, posttraumatic stress disorder, and attention-deficit/hyperactivity disorder (Clarkin, Hull, & Hurt, 1993; Sobanski et al., 2010; Tull, Barrett, McMillan, & Roemer, 2007).

Empirical evidence of variable or inconsistent emotions is also often derived from the time series data obtained in experience sampling studies. Formally, individuals' level of emotional instability (also referred to as lability or inconsistency), defined as sudden, intense can be quantified from time series data using a variety of related metrics that capture the range or extent of moment-to-moment changes, including the intraindividual standard deviation, mean square of successive differences (Woyshville, Lackamp, Eisengart, & Gilliland, 1999), or probability of acute change (Jahng, Wood, & Trull, 2008). Patterns of emotional instability have been found to differentiate adults diagnosed with personality disorder from those diagnosed with depressive disorders (Trull et al., 2008) and levels of behavior problems in school-age children with and without attention-deficit/hyperactivity disorder (Rosen, Walerius, Fogleman, & Factor, 2015). Beyond diagnostic utility, emotional instability predicts suicide attempts among adults with suicidal ideation (Witte, Fitzpatrick, Joiner, & Schmidt, 2005), highlighting its importance for meaningful clinical assessment and intervention.

The evidence from these experience sampling studies of emotional instability highlight another pattern of emotion change—one of rapid and often intense changes—that is related to psychopathology and is interpreted as emotion dysregulation.

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These studies have not systematically indicated how factors that are extrinsic to the emotions, such as the actual and perceived environment or the use of strategies, contribute to emotional instability. Extreme variation in emotion might be due to natural fluctuations in the individual's environment or to an individual's inability to effectively regulate emotions. It is not yet known how a long-term pattern of abrupt, intense, and unexpected changes in emotion is related to emergence and/or canalization of psychopathology. Alternatively, emotional lability may constrain factors extrinsic to the emotions, such as strategy use. One interindividual differences study tested directionality in longitudinal pathways to the development of psychopathology and found that 7-year-olds with greater negative and labile mood had poorer adaptive regulation skills (e.g., empathy) by age 8, which later predicted greater internalizing symptoms by age 9 (Kim-Spoon, Cicchetti, & Rogosch, 2013). This study relied on questionnaires and did not directly examine emotion regulation dynamics, which could be a fruitful for understanding what specific aspects of regulatory skills are related to lability.

Intraindividual emotion regulation dynamics

Thus far, we have discussed two emotion patterns (emotional inertia and emotional instability) that have been shown, using time sampling over hours and days, to distinguish the emotional functioning of individuals with and without symptoms or diagnoses of psychological disorders. Time series data revealed patterns in emotion dynamics, which are then interpreted as indications of emotion dysregulation. To the best of our knowledge, this interesting approach has not yet been used to investigate the role of regulation in these patterns. Next steps in using time series to understand emotion dysregulation can benefit from investigation of atypical patterns of emotion as regulator and as regulated.

Emotion as regulator

Emotion as regulator is clearly described in functional theories of emotion (Keltner & Gross, 1999). In this perspective, different emotions, defined by appraisals and action readiness, prepare an individual to act on the environment in particular ways. This preparation heightens the probability that the individual will interact with and operate on the environment in specific ways to achieve a goal for well-being. Emotion as regulator can be dysfunctional when the emotion leads to action that compromises short- or long-term goals for well-being, violate developmental expectations, or violate sociocultural standards.

Consider situations in which children are referred for anger management. In our workshops, parents and teachers often seek advice on how to control (or teach control of) children's anger. However, not all anger is inherently problematic; the anger itself may be communicative, indicate that a child's goal is unmet or blocked and still seems achievable or justifiable to the child, and that the child is prepared to increase effort to gain/regain the goal. The view of the parents and teachers is that the anger is poorly regulated. However, often, the issue is that the anger led to unacceptable behavior. It may be aggressive, rude, or disruptive, problematic in the immediate sense, and may lead to later impairments in relationships or learning. When anger leads to increased effort to attain a goal, but the resulting effort is problematic for parents and teachers, this is an example of emotion as dysregulator. Clinically, the goal may not be to reduce or eliminate anger but to teach alternative ways to achieve the goal. Often, clients' anger reflects protests of circumstances they cannot control although they may try and try disruptively. This pattern is distinct from deficits in being able to regulate anger. To the layperson the distinction may seem too fine, but to the clinician and to the developmental psychopathologist there is value in distinguishing when emotion dysregulates behavior and when strategies fail to regulate emotion. A time series analysis of the unfolding of such events can clarify the distinction.

Emotion as regulator can be dysfunctional in a second way. In some instances, strategies known to be effective generally are attempted but are overwhelmed by emotion. That is, reasonable strategies are attempted, but emotion nonetheless renders them ineffective. For example, law students coping with the stress of preparing for their bar exams reported that planning, an "effective" coping strategy, was only effective some weeks prior to the exam but not as the exam neared and stress increased (Ilda, Gleason, Green-Rapaport, Bolger, & Shrout, 2017). Clinicians are familiar with therapeutic cognitive strategies being overwhelmed by acute sadness, anxiety, or anger. A time series analysis of the emotion-strategy patterns is needed to understand the reasons why specific emotion appraisals persist in the face of strategy use.

Emotion as regulated

Self-regulation of emotions generally involves the use of strategies (i.e., thoughts or actions) that are considered to, and have been shown to, diminish emotion intensity, shorten emotion duration, or resolve emotion completely. This aspect of emotion as regulated can be dysfunctional when strategy use fails to modulate emotion in ways that compromise goals or violate developmental expectations or sociocultural standards. Moreover, strategy ineffectiveness can take different forms, which can be detected and differentiated by time series analysis of strategy-emotion sequences.

First, the strategy may be generally regarded as ineffective; examples of ineffective strategies include rumination, avoidance, and suppression (Aldao & Nolen-Hoeksema, 2010; Schäfer, Naumann, Holmes, Tuschen-Caffier, & Samson, 2017). Second, strategies that are generally regarded as effective may sometimes sustain and prolong the emotion that one seeks to resolve, or even exacerbate the emotion. For example, therapies that focus on thoughts, such as cognitive or mindfulness interventions, sometimes foster rumination and worry in clients leading to sustained or worsened depression or anxiety. In those instances, therapists may recommend switching to a different therapeutic plan, such as behavioral activation (Boswell, Iles, Gallagher, & Farchione, 2017). A time series analysis of the emotion regulation dynamics is needed to understand the reasons why effective strategies fail on some occasions. One reason may be that they sustain or even worsen the negative emotion that is the target of treatment. In addition, individuals, particularly young children, may perceive ineffective strategies as effective (Dennis & Kelemen, 2009).

It is likely that patterns of dysfunctional emotion such as emotional inertia or instability also involve intervening variables (e.g., strategies) that are dysregulating. Although the research on these emotion patterns implies or refers to emotion regulation, the regulator process itself is not studied directly. Self-talk, rumination, worry, and appraisals that involve attributions and assumptions explain why some negative emotions endure and resist change or even have a negative emotional reaction to a prior emotion (anger-guilt or shame-anger; MacLeod & Bucks, 2011). A time series analysis of both emotions and strategies is needed to identify emotion-strategy-emotion sequences, understand how the

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dynamics manifest, and identify which elements of the dynamic system may be usefully targeted for intervention.

Conceptualizing and Studying Emotion Regulation Dynamics

In conceptualizing the dynamics of how emotion regulation can go awry, at least in terms of the individual, we borrow from the broader theoretical literature on self-regulation, which extends to an individual's attempts to modify emotion. Most models of self-regulation imply engagement of top-down executive processes (cognitive processes) to alter prepotent responses (highly probably, relatively automatic responses; Cole, Ram, & English, 2018). The engagement of executive processes is implicit in many effective strategies (i.e., problem solving, planning, reasoning, verbal self-instruction, distraction) that are thought to be valuable in modulating the emotions that are pulled for by situations. The concept that there are top-down processes that have the potential to regulate emotional processing is also prevalent in neuroscience perspectives. In the neuroscience framework, a complex interplay of bidirectional activity occurs between subcortical regions, largely limbic regions, and cortical regions, largely prefrontal regions (Etkin, Büchel, & Gross, 2015; Lewis & Stieben, 2004). Reappraisal, for example, a strategy shown to be effective in modifying the intensity of negative emotion, involves recruiting higher order cognitive processes in order to think differently about circumstances that have elicited an emotional reaction that one wishes to modify or change. Using reappraisal during an experimental emotion elicitation task is associated with increased prefrontal cortex activation and lowered activation in the amygdala and the insula (Goldin, McRae, Ramel, & Gross, 2008; for a conceptual review, see Ochsner & Gross, 2008). Broadly, evidence indicates less cortical modulation of subcortical regions in individuals with psychopathology (e.g., Shannon, Sauder, Beauchaine, & Gatzke-Kopp, 2009; Tone, Garn, & Pine, 2016), although the exact neurophysiological patterns vary across studies and across specific disorders (Etkin et al., 2015).

In sum, the general conceptualization that executive processes modify prepotent responses also guides research on children's development of emotion regulation. Developing the ability to regulate emotion is thought to involve both the maturation of internal cognitive processes and socialization experiences (Eisenberg, Cumberland, & Spinrad, 1998; Kopp, 1989; Morris, Silk, Steinberg, Myers, & Robinson, 2007). Having begun to learn what is expected of their conduct, young children begin to recruit their maturing cognitive capacities in attempts to regulate their emotions even when adults are not present to monitor and direct them (Kopp, 1982). Thus, in terms of emotion as regulated, it is useful to focus on how extrinsic processes modulate emotion dynamics, including conceptualizing patterns that lead to emotion dysregulation. This model can then be applied to investigating emotion dysregulation. Developmentalists have typically focused on higher order cognitive skills such as inhibitory control or, more broadly, executive functioning as influences on children's ability to engage in emotion regulation (Carlson & Wang, 2007; Zelazo & Cunningham, 2007). This body of research has shown that children's skills in these various executive cognitive processes are associated with more skill at emotion regulation. These cognitive skills are purported to help children reflect on their experience, remember and use rules to guide their behavioral decisions, and stop them from acting in the manner elicited by a situation, inhibiting behavior that is nonetheless undesirable in the situation.

The links between these executive cognitive processes and strategy use is not fully understood. Nonetheless, discussions in the emotion regulation literature often refer to (in)effective strategy use to explain more intense, more unstable, or more enduring negative emotions, and strategies are not often studied. Thus, there is a need to better understand the role of strategies, and the contexts in which they are judged as ineffective. There is evidence that strategy deficits play a role in psychopathology. For example, in the case of persistent depressed mood, ineffective strategies are thought to explain why depressed individuals experience longer duration of negative emotion (Tomarken & Keenan, 1998) and are less able to recover from emotional upset (Kovacs & Devlin, 1998). Children and adolescents with depressive disorders reported using fewer problem-focused and active distraction strategies, and more avoidant, passive, and aggressive strategies, than nondepressed peers (Garber, Braafladt, & Weiss, 1995). These findings underscore the need to understand, more directly, the interplay between extrinsic influence (strategies) and how they change intrinsic emotion dynamics on short time scales.

A few studies of children or youth capitalize on their time series data to demonstrate that young children's strategy use may alter their negative emotion. Tracking changes in emotion across consecutive 10-s intervals, Stifter and Braungart (1995) found that infants' self-soothing was associated with decreasing negative emotion, and infant avoidance was associated with increasing negative emotion. In a study of infants and toddlers, contingency analyses of 10-s intervals revealed that strategy use had no immediate effect on fear, but distraction (shifting attention away from a restricted but desirable object) in one 10-s interval was followed by reduced anger intensity in the next 10-s interval (Buss & Goldsmith, 1998). Similarly, in 3-year-old boys at risk for conduct problems, distraction and information seeking in one 10-s interval was followed by a decrease anger in the next 10-s interval (Gilliom, Shaw, Beck, Schonberg, & Lukon, 2002). Finally, in a study of mothers and their typically developing preschool-age children, maternal attention refocusing (with younger children in this age range), and joint mother–child reframing in one 10-s interval was followed by a reduction in children's disappointment in the subsequent 10-s interval (Morris et al., 2011). In each study, the time series analysis of strategy-emotion sequences facilitated examination of emotion regulation dynamics.

These studies have two important features that are advantageous for obtaining a detailed understanding of emotion regulation. First, they use temporal data to isolate and measure the effectiveness of specific strategies. Second, they use intensive time series derived from continuous video-recorded observations of behavior. This type of data collection affords information that experience sampling methods focused on self-reported experience may not capture. Experience sampling methods can assess elements of emotion regulation that cannot be observed, such as individuals' use of cognitive strategies. However, when trying to relate strategy use to emotion dysregulation, self-report may present some unique problems. For example, adults with bipolar depression reported using appropriate strategies during a video mood induction but observations indicated that their self-reported strategies were not effective at modifying their emotional reactions during the video (Gruber, Harvey, & Gross, 2012). Therefore, some care should be taken when clinicians are drawing conclusions about clients' emotion dysregulation based solely on self-report information, and in some cases, it may be useful to supplement those reports with behavioral observations in selective contexts.

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The contingency analyses afforded by behavioral observation data advance knowledge of strategy effectiveness, indicating that the use of particular strategies had immediate effects on children's negative emotions. There is still more to be known, however, for a full understanding of emotion regulation and when it is indicative of emotion dysregulation. For example, models for analysis of temporal dependencies often assume that all pairs of successive intervals are replicates, no matter whether they occurred at the beginning of a task period or at the end of a task (stationarity assumption). However, it is possible that a strategy that effectively modulates emotion during the early part of the task may become ineffective as the stress of the situation maintains or increases over time. Analysis of successive pairs of intervals also leaves open the clinical question of whether strategy use *resolves* a negative emotion (e.g., dampens and ends a child's frustration or anxiety). Potentially, for young children especially, the effectiveness of their strategy use is transitory. Might frustration recur and accumulate after repeated strategic attempts, leading to subsequent reductions in strategy use or rendering strategy efforts ineffective? Do repeated bouts of negative emotion influence the use of or the effectiveness of strategy attempts? Do repeated efforts at using a strategy take a toll on a person and lead to increased negative emotion? These and other questions can be addressed by investigation of the full time series. Methods that allow for time-varying effects, such as multilevel event history analysis (Dagne, Brown, & Howe, 2003) and state-space models with time-varying parameters (Molenaar, Sinclair, Rovine, Ram, & Corneal, 2009), provide new opportunity to describe how recurrences of emotion, or emotion-strategy or strategy-emotion sequences change during a task and influence task outcomes. In sum, collection of behavioral time series and detailed analysis of emotion-strategy-emotion-strategy sequences can add to our understanding of emotion regulation dynamics.

The Development of Emotion Regulation Dynamics

Knowledge about how strategies develop, when different strategy attempts become effective, and how ineffective strategies develop, persist, and change with age is important for charting and understanding the development of emotion dysregulation. As noted previously, developmental science is beginning to develop this type of knowledge base. We do not yet know, for example, anything about the development of emotion regulation strategies, or how the effectiveness of specific strategies changes with age and as children and youth encounter new experiences in their environments. We do not know about the course of emotion regulation and dysregulation dynamics, including the influences of strategy use, in the contexts characterized by risk and adversity. For example, a strategy that effectively helps a young child cope with family adversity may become a strategy upon which the child continues to rely as he or she gets older, but that becomes ineffective (e.g., avoidance as a way of modulating anxiety caused by family conflict or dissociation as a way of disengaging from awareness and memories of traumatic events).

We are beginning to explore these questions in our research. Articulating a general model of self-regulation as the influence of the engagement of executive processes on prepotent emotions (Cole et al., 2018), we applied dynamic systems models to behavioral time series data to investigate the extent to which 36-month-old children showed desire for and frustration about a restricted gift, and the extent to which their strategic attempts involved engagement of executive processes (Cole, Bendezú, Ram, & Chow, 2017). First, we created an index that ranked the extent to which children's strategies engaged executive processes. Typically developing children are posited to begin to initiate strategies, including those aimed at modulating negative emotion, without direct adult instruction or monitoring (Kopp, 1989). There is a small literature on the development of young children's strategy use (Grolnick, Bridges, & Connell, 1996; Rothbart, Ziaie, & O'Boyle, 1992; Stansbury & Sigman, 2000). Using these studies, we ranked children's strategies by the extent of engagement of executive processes; for example, self-soothing, regarded as a bottom-up, spontaneous strategy, involved little or no executive process engagement; calm bids for parental attention often engaged language verbalized their needs; and distraction involved the engagement of effortful control of attention. Second, we developed a mathematical model (ordinary differential equation) that specifically captured and quantified (a) the intrinsic dynamics of very young children's emotions (fluctuations in desire and frustration), (b) the intrinsic dynamics of their engagement of executive processes (fluctuations in the extent to which strategies engaged executive processes), and (c) how each amplified or diminished the other; and used that model to analyze the strategy and emotion time series (3-s epochs) of 100 children.

These 36-month-olds' engagement of executive processes occurred during intervals when they did not display desire or frustration. However, of importance, there was no evidence that their executive process engagement dampened their desire and frustration over the course of the task. That is, their strategic efforts did not quiet or resolve their emotion, so they could sit patiently and wait to open the restricted gift. This is, to the best of our knowledge, the first evidence of the limitations of 36-month-olds' strategic efforts.

Two additional findings suggested possible ways that 36-month-old children's pattern of emotion regulation in this type of task may be interpreted as emotion dysregulation, one suggesting dysfunction in emotion as regulated and one suggesting dysfunction in emotion as regulator. First, maternal reports of higher temperamental negative affectivity in the children was associated with a pattern in which the 36-month-olds' strategy use was relatively ineffective. That is, for children described as generally reactive to situational changes, strategy use seemed to exacerbate their desire and frustration. Their emotion was not regulated effectively, and led to a violation of a cultural expectation that young children should learn to wait patiently. This pattern of (ineffective) emotion regulation is reminiscent of clinical observations of known useful strategies intensifying clients' emotional distress, a form of emotion dysregulation.

Second, maternal reports of a higher number of externalizing behavior problems in the children associated with a pattern in which 36-month-olds' desire and frustration diminished their engagement of executive processes. That is, for children described as generally prone to being noncompliant and disruptive, increases in desire and frustration actively diminished engagement of executive processes. Emotion as regulator did not motivate the socially desirable action in this situation, but instead overwhelmed and dampened children's use of the optimal strategy. This pattern of (ineffective) emotion regulation is reminiscent of client reports of their emotions making it harder to use the strategies they are learning, a second form of emotion dysregulation.

These findings compel us to proceed with examining how emotion regulation dynamics change with age, work that is in progress. We are testing whether there are changes in these dynamics as children transition from age 24 months to age 5

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years, the age at which they are expected to be school ready emotionally. Using multiple time scale study designs, it is possible to determine if strategy attempts become more effective as children get older (emotion as self-regulated) of how young children process, at the neural level, the sound of anger in their mother's voice, if emotion motivates better strategy engagement as children get older (emotion as regulator), whether in typically developing samples the patterns indicative of emotion dysregulation diminish with age, and whether children who are vulnerable due to biological conditions or who are exposed to adversity have different emotion regulation dynamics and/or their emotion regulation dynamics develop in a different way.

In one recent study we tested age differences in emotion regulation dynamics of young children exposed to a fear-inducing situation in the laboratory (Morales et al., 2018). We again used ordinary differential equation modeling, this time investigating how the interplay between emotion and strategy use differed when the children encountered a novel character (e.g., clown) at age 2 and at age 5 years. The resulting patterns indicated a decrease in prepotent emotions from age 2 to age 5, and evidence that fearfulness was regulated more quickly and efficiently at age 5 years that at age 2 years (i.e., developmental improvement in emotion regulation).

Future Directions for Studying the Development of Patterns of Emotion Dysregulation

We have offered a view of emotion dysregulation as patterns of emotion regulation dynamics that are deemed dysregulated based on the context in which they occur and the implications that the pattern compromises other goals for well-being or violates developmental expectations or sociocultural standards. We identified several patterns of emotion and emotion regulation that are often depicted as evidence of emotion dysregulation. Each of these observed patterns can be conceptualized in terms of emotion regulation dynamics that are best captured and understood when studied using time series methods. They are patterns of emotion dysregulation that are both atypical in frequency, duration, or intensity of emotion as regulator or as regulated, and are associated with impaired functioning or risk for impairment in the short and/or long term. From the vantage point of developmental psychopathology, we not only want to be able to conceptualize and measure these sequences but also understand how they develop and how they can change once established as emotion dysregulation. We have observed these various emotion regulation patterns in young children and recognize that if those patterns of regulation become dominant, they can impair children's functioning and lead to emergence of psychopathology. We suggest that a dynamic approach to conceptualizing emotion and emotion regulation can advance this knowledge. We can better understand how risk influences emotion regulation and how the patterns of emotion regulation in one situation may help a child cope with adversity even as they pose risk for longer term developmental goals. A more nuanced, granular analysis of emotion regulation patterns can inform how emotion regulation becomes effective, how emotion dysregulation observed at one age may arise and even disappear, and when and how such patterns recur and become dominant characteristics of impaired intra- and interpersonal functioning.

We should note that there is a compelling argument that emotion and emotion regulation are, at least at certain levels of analysis, and especially in regard to the systemic nature of autonomic and central nervous system activity, impossible to disentangle (Campos, Frankel, & Camras, 2004; Hollenstein, 2015; Lewis & Stieben, 2004). Our perspective is not intended to contradict that view. As clinicians we observe emotion dysregulation and we believe that studying emotion regulation using dynamic systems models and time series data offers additional information about how the ongoing interplay between emotions and strategies may produce patterns indicative of emotion dysregulation.

In sum, emotion dysregulation *is* a form of emotion regulation (temporal dynamics that compromise other goals for well-being or violates developmental expectations or sociocultural standards). Conceptualizing emotion as a dynamic process and its regulation as the relation between extrinsic influences and emotion requires analysis of how emotion regulates and is regulated by those influences over time. Multiple time scale designs provide opportunity for examining long-term change in intraindividual (regulation) dynamics and can shed light on when and how clinically significant forms of emotion dysregulation emerge and potentially canalize into psychopathology and the interindividual differences therein.

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References

Achenbach, T. M., & Edelbrock, C. S. (1978). The classification of child psychopathology: A review and analysis of empirical efforts. *Psychological Bulletin*, *85*, 1275–1301. doi:10.1037/0033-2909.85.6.1275

Aldao, A., & Nolen-Hoeksema, S. (2010). Specificity of cognitive emotion regulation strategies: A transdiagnostic examination. *Behaviour Research and Therapy*, *48*, 974–983. doi:10.1016/j.brat.2010.06.002

American Psychiatric Association. (2015). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: Author.

Barrett, K. C., & Campos, J. J. (1987). Perspectives on emotional development: II. A functionalist approach to emotions. In J. D. Osofsky (Ed.), *Handbook on infant development* (pp. 555–578). New York: Wiley.

Barrett, L. F. (2006). Are emotions natural kinds? *Perspectives on Psychological Science*, *1*, 28–58. doi:10.1111/j.1745-6916.2006.00003.x

Beauchaine, T. P. (2015). Future directions in emotion dysregulation and youth psychopathology. *Journal of Clinical Child and Adolescent Psychology*, *44*, 875–896. doi:10.1080/15374416.2015.1038827

Beauchaine, T. P., & Haines, N. (2019). Functionalist and constructionist perspectives on emotion dysregulation. In T. P. Beauchaine & S. E. Crowell (Eds.), *The Oxford handbook of emotion dysregulation*. New York: Oxford University Press.

Beauchaine, T. P., & Zisner, A. (2017). Motivation, emotion regulation, and the latent structure of psychopathology: An integrative and convergent historical perspective. *International Journal of Psychophysiology*, *119*, 108–118. doi:10.1016/j.ijpsycho.2016.12.014

Blandon, A. Y., Calkins, S. D., Keane, S. P., & O'Brien, M. (2008). Individual differences in trajectories of emotion regulation processes: The effects of maternal depressive symptomatology and children's physiological regulation. *Developmental Psychology*, *41*, 1110–1123. doi:10.1037/0012-1649.44.4.1110

https://doi.org/10.1017/S0954579419000695 Published online by Cambridge University Press

Boswell, J. F., Iles, B. R., Gallagher, M. W., & Farchione, T. J. (2017). Behavioral activation strategies in cognitive-behavioral therapy for anxiety disorders. *Psychotherapy*, *54*, 231–236. doi:10.1037/pst0000119

Buss, K. A., & Goldsmith, H. H. (1998). Fear and anger regulation in infancy: Effects on the temporal dynamics of affective expression. *Child Development*, *69*, 359–374. doi:10.1111/j.1467-8624.1998.tb06195.x

Campos, J. J., Frankel, C. B., & Camras, L. (2004). On the nature of emotion regulation. *Child Development*, *75*, 377–394. doi:10.1111/j.1467-8624.2004.00681.x

Carlson, S. M., & Wang, T. S. (2007). Inhibitory control and emotion regulation in preschool children. *Cognitive Development*, *22*, 489–510. doi:10.1016/j.cogdev.2007.08.002

Casey, B. J., Jones, R. M., Levita, L., Libby, V., Pattwell, S. S., Ruberry, E. J., … Somerville, L. H. (2010). The storm and stress of adolescence: Insights from human imaging and mouse genetics. *Developmental Psychobiology*, *52*, 225–235. doi:10.1002/dev.20447

Cicchetti, D., Ganiban, J., & Barnett, D. (1991). Contributions from the study of high-risk populations to understanding the development of emotion regulation. In J. Garber & K. Dodge (Eds.), *The development of emotion regulation* (pp. 15–48). New York: Cambridge University Press.

Clarkin, J. F., Hull, J. W., & Hurt, S. W. (1993). Factor structure of borderline personality disorder criteria. *Journal of Personality Disorders*, *7*, 137–143. doi:10.1521/pedi.1993.7.2.137

Cole, P. M., Bendezú, J. J., Ram, N., & Chow, S. M. (2017). Dynamical systems modeling of early childhood self-regulation. *Emotion*, *17*, 684–699. doi:10.1037/emo0000268

Cole, P. M., & Hollenstein, T. (Eds.) (2018). *Emotion regulation: A matter of time*. New York: Routledge.

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. doi:10.1111/j.1467-8624.2004.00673.x

Cole, P. M., Michel, M. K., & Teti, L. O. D. (1994). The development of emotion regulation and dysregulation: A clinical perspective. *Monographs of the Society for Research in Child Development*, *59*, 73–102. doi:10.2307/1166139

Cole, P. M., Ram, N., & English, M. S. (2018). Toward a unifying model of self-regulation: A developmental approach. *Child Development Perspectives*. Advance online publication. doi:10.1111/cdep.12316

Cole, P. M., Tan, P. Z., Hall, S. E., Zhang, Y., Crnic, K. A., Blair, C. B., & Li, R. (2011). Developmental changes in anger expression and attention focus: Learning to wait. *Developmental Psychology*, *47*, 1078–1089. doi:10.1037/a0023813

Dagne, G. A., Brown, C. H., & Howe, G. W. (2003). Bayesian hierarchical modeling of heterogeneity in multiple contingency tables: An application to behavioral observation data. *Journal of Educational and Behavioral Statistics*, *28*, 339–352. doi:10.3102/10769986028004339

Davidson, R. J. (1998). Affective style and affective disorders: Perspectives from affective neuroscience. *Cognition and Emotion*, *12*, 307–330. doi:10.1080/026999398379628

Dennis, T. A., & Kelemen, D. A. (2009). Preschool children's views on emotion regulation: Functional associations and implications for social-emotional adjustment. *International Journal of Behavioral Development*, *33*, 243–252. doi:10.1177/0165025408098024

Diaz, A., & Eisenberg, N. (2015). The process of emotion regulation is different from individual differences in emotion regulation: Conceptual arguments and a focus on individual differences. *Psychological Inquiry*, *26*, 37–47. doi:10.1080/1047840X.2015.959094

Dodge, K. A. (1989). Coordinating responses to aversive stimuli: Introduction to a special section on the development of emotion regulation. *Developmental Psychology*, *25*, 339–342. doi:10.1037/0012-1649.25.3.339

Eisenberg, N., Cumberland, A., & Spinrad, T. L. (1998). Parental socialization of emotion. *Psychological Inquiry*, *9*, 241–273. doi:10.1207/s15327965pli0904_1

Etkin, A., Büchel, C., & Gross, J. J. (2015). The neural basis of emotion regulation: *Nature Reviews Neuroscience*, *16*, 693–700. doi:10.1038/nrn4044

Feldman, R. (2015). Mutual influences between child emotion regulation and parent–child reciprocity support development across the first 10 years of life: Implications for developmental psychopathology. *Development and Psychopathology*, *27*, 1007–1023. doi:10.1017/S0954579415000656

Frijda, N. (1986). *The emotions*. New York: Cambridge University Press.

Garber, J., Braafladt, N., & Weiss, B. (1995). Affect regulation in depressed and nondepressed children and young adolescents. *Development and Psychopathology*, *7*, 93–115. doi:10.1017/S0954579400006362

Garber, J., & Dodge, K. A. (Eds.) (1991). *The development of emotion regulation and dysregulation*. New York: Cambridge University Press.

Gilliom, M., Shaw, D. S., Beck, J. E., Schonberg, M. A., & Lukon, J. L. (2002). Anger regulation in disadvantaged preschool boys: Strategies, antecedents, and the development of self-control. *Developmental Psychology*, *38*, 222–235. doi:10.1037/0012-1649.38.2.222

Goldin, P. R., McRae, K., Ramel, W., & Gross, J. J. (2008). The neural bases of emotion regulation: Reappraisal and suppression of negative emotion. *Biological Psychiatry*, *63*, 577–586. doi:10.1016/j.biopsych.2007.05.031

Grolnick, W. S., Bridges, L. J., & Connell, J. P. (1996). Emotion regulation in two-year-olds: Strategies and emotional expression in four contexts. *Child Development*, *67*, 928–941. doi:10.2307/1131871

Gross, J. J. (2014). Emotion regulation: Conceptual and empirical foundations. In J. J. Gross (Ed.), *Handbook of emotion regulation* (pp. 3–20). New York: Guilford Press.

Gruber, J., Harvey, A. G., & Gross, J. J. (2012). When trying is not enough: Emotion regulation and the effort–success gap in bipolar disorder. *Emotion*, *12*, 997–1003. doi:10.1037/a0026822

Halberstadt, A. G., Denham, S. A., & Dunsmore, J. C. (2001). Affective social competence. *Social Development*, *10*, 79–119. doi:10.1111/1467-9507.00150

Halligan, S. L., Cooper, P. J., Fearon, P., Wheeler, S. L., Crosby, M., & Murray, L. (2013). The longitudinal development of emotion regulation capacities in children at risk for externalizing disorders. *Development and Psychopathology*, *25*, 391–406. doi:10.1017/S0954579412001137

Hollenstein, T. (2015). This time, it's real: Affective flexibility, time scales, feedback loops, and the regulation of emotion. *Emotion Review*, *7*, 308–315. doi:10.1177/1754073915590621

Ilda, M., Gleason, M., Green-Rapaport, A. S., Bolger, N., & Shrout, P. E. (2017). The influence of daily coping on anxiety under examination stress: A model of interindividual differences in intraindividual change. *Personality and Social Psychology Bulletin*, *43*, 907–923. doi:10.1177/0146167217700605

Izard, C. E. (1977). *Human emotions*. New York: Springer.

Jahng, S., Wood, P. K., & Trull, T. J. (2008). Analysis of affective instability in ecological momentary assessment: Indices using successive difference and group comparison via multilevel modeling. *Psychological Methods*, *13*, 354–375. doi:10.1037/a0014173

Keenan, K. (2000). Emotion dysregulation as a risk factor for child psychopathology. *Clinical Psychology: Science and Practice*, *7*, 418–434. doi:10.1093/clipsy/7.4.418

Keltner, D., & Gross, J. J. (1999). Functional accounts of emotion. *Cognition and Emotion*, *13*, 467–480. doi:10.1080/026999399379140

Kim-Spoon, J., Cicchetti, D., & Rogosch, F. A. (2013). A longitudinal study of emotion regulation, emotion lability-negativity, and internalizing symptomatology in maltreated and nonmaltreated children. *Child Development*, *84*, 512–527. doi:10.1111/j.1467-8624.2012.01857.x

Koole, S. L., & Veenstra, L. (2015). Does emotion regulation occur only inside people's heads? Toward a situated cognition analysis of emotion-regulatory dynamics. *Psychological Inquiry*, *26*, 61–68. doi:10.1080/1047840X.2015.964657

Kopp, C. B. (1982). Antecedents of self-regulation: A developmental perspective. *Developmental Psychology*, *18*, 199–214. doi:10.1037/0012-1649. 18.2.199

Kopp, C. B. (1989). Regulation of distress and negative emotions: A developmental view. *Developmental Psychology*, *25*, 343–354. doi:10.1037/0012-1649.25.3.343

Kovacs, M., & Devlin, B. (1998). Internalizing disorders in childhood. *Journal of Child Psychology and Psychiatry and Allied Disciplines*, *39*, 47–63. doi:10.1111/1469-7610.00303

Koval, P., Butler, E. A., Hollenstein, T., Lanteigne, D., & Kuppens, P. (2015). Emotion regulation and the temporal dynamics of emotions: Effects of cognitive reappraisal and expressive suppression on emotional inertia. *Cognition and Emotion*, *29*, 831–851. doi:10.1080/02699931.2014.948388

Koval, P., & Kuppens, P. (2012). Changing emotion dynamics: Individual differences in the effects of anticipatory social stress on emotional inertia. *Emotion*, *12*, 256–267. doi:10.1037/a0024756

https://doi.org/10.1017/S0954579419000695 Published online by Cambridge University Press

Kring, A. M., & Sloan, D. M. (Eds.) (2010). *Emotion regulation and psychopathology: A transdiagnostic approach to etiology and treatment*. New York: Guilford Press.

Kuppens, P., Allen, N. B., & Sheeber, L. B. (2010a). Emotional inertia and psychological maladjustment. *Psychological Science*, *21*, 984–991. doi:10.1177/0956797610372634

Kuppens, P., Oravecz, Z., & Tuerlinckx, F. (2010b). Feelings change: Accounting for individual differences in the temporal dynamics of affect. *Journal of Personality and Social Psychology*, *99*, 1042–1060. doi:10.1037/a0020962

Kuppens, P., Sheeber, L. B., Yap, M. B. H., Whittle, S., Simmons, J. G., & Allen, N. B. (2012). Emotional inertia prospectively predicts the onset of depressive disorder in adolescence. *Emotion*, *12*, 283–289. doi:10.1037/a0025046

Lazarus, R. S. (2006). *Stress and emotion: A new synthesis*. New York: Springer.

Lewis, M. D., & Stieben, J. (2004). Emotion regulation in the brain: Conceptual issues and directions for developmental research. *Child Development*, *75*, 371–376. doi:10.1111/j.1467-8624.2004.00680.x

Luginbuehl, T., & Schoebi, D. (2019). Emotion dynamics and responsiveness in intimate relationships. *Emotion*. Advance online publication. doi:10.1037/emo0000540

MacLeod, C., & Bucks, R. S. (2011). Emotion regulation and the cognitive-experimental approach to emotional dysfunction. *Emotion Review*, *3*, 62–73. doi:10.1177/1754073910380970

Mayer, J. D., & Salovey, P. (1993). The intelligence of emotional intelligence. *Intelligence*, *17*, 433–442. doi:10.1016/0160-2896(93)90010-3

McLaughlin, K. A., Hatzenbuehler, M. L., Mennin, D. S., & Nolen-Hoeksema, S. (2011). Emotion dysregulation and adolescent psychopathology: A prospective study. *Behaviour Research and Therapy*, *49*, 544–554. doi:10.1016/j.brat.2011.06.003

Mennin, D. S., Heimberg, R. G., Turk, C. L., & Fresco, D. M. (2002). Applying an emotion regulation framework to integrative approaches to generalized anxiety disorder. *Clinical Psychology: Science and Practice*, *9*, 85–90. doi:10.1016/j.brat.2004.08.008

Molenaar, P. C. M., Sinclair, K. O., Rovine, M. J., Ram, N., & Corneal, S. E. (2009). Analyzing developmental processes on an individual level using nonstationary time series modeling. *Developmental Psychology*, *45*, 260–271. doi:10.1037/A0014170

Morales, S., Ram, N., Buss, K. A., Cole, P. M., Helm, J. L., & Chow, S. M. (2018). Age-related changes in the dynamics of fear-related regulation in early childhood. *Developmental Science*. Advance online publication. doi:10.1111/desc.12633

Morris, A. S., Silk, J. S., Morris, M. D. S., Steinberg, L., Aucoin, K. J., & Keyes, A. W. (2011). The influence of mother–child emotion regulation strategies on children's expression of anger and sadness. *Developmental Psychology*, *47*, 213–225. doi:10.1037/a0021021

Morris, A. S., Silk, J. S., Steinberg, L., Myers, S. S., & Robinson, L. R. (2007). The role of the family context in the development of emotion regulation. *Social Development*, *16*, 361–388. doi:10.1111/j.1467-9507.2007.00389.x

Nesselroade, J. R. (1991). The warp and the woof of the developmental fabric. In R. M. Downs, L. S. Liben, & D. S. Palermo (Eds.), *Visions of aesthetics, the environment & development: The legacy of Joachim F. Wohlwill* (pp. 213–240). Hillsdale, NJ: Erlbaum.

Ochsner, K. N., & Gross, J. J. (2008). Cognitive emotion regulation: Insights from social cognitive and affective neuroscience. *Current Directions in Psychological Science*, *17*, 153–158. doi:10.1111/j.1467-8721.2008.00566.x

Panksepp, J. (2007). Neurologizing the psychology of affects: How appraisal-based constructivism and basic emotion theory can coexist. *Perspectives on Psychological Science*, *2*, 281–296. doi:10.1111/j.1745-6916.2007.00045.x

Quay, H. C. (1979). Classification. In H. C. Quay & J. S. Werry (Eds.), *Psychopathological disorders of childhood* (2nd ed.). New York: Wiley.

Ram, N., & Diehl, M. (2015). Multiple time-scale design and analysis: Pushing towards real-time modeling of complex developmental processes. In M. Diehl, K. Hooker, & M. Sliwinski (Eds.), *Handbook of intraindividual variability across the lifespan* (pp. 308–323). New York: Routledge.

Ram, N., & Gerstorf, D. (2009). Time-structured and net intraindividual variability: Tools for examining the development of dynamic characteristics and processes. *Psychology and Aging*, *24*, 778–791. doi:10.1037/A0017915

Ramsook, K. A., Cole, P. M., & Fields-Olivieri, M. F. (2018). What emotion dysregulation looks like: Inferences from behavioral observations. In T. P. Beauchaine & S. E. Crowell (Eds.), *The Oxford Handbook of emotion dysregulation*. New York: Oxford University Press.

Robson, E., Cunningham, G., Ebeling, J., Flückiger-Hawker, E., Black, J. A., Taylor, J., & Zólyomi, G. (1998). *The electronic text corpus of Sumerian literature*. [Digital scholarly resource]. Retrieved from http://etscl.orinst.ox.ac.uk/

Rosen, P. J., Walerius, D. M., Fogleman, N. D., & Factor, P. I. (2015). The association of emotional lability and emotional and behavioral difficulties among children with and without ADHD. *ADHD Attention Deficit and Hyperactivity Disorders*, *4*, 281–294. doi:10.1007/s12402-015-0175-0

Rothbart, M. K., Ziaie, H., & O'Boyle, C. G. (1992). Self-regulation and emotion in infancy. In N. Eisenberg & R. A. Fabes (Eds.), *New directions for child development, No. 55: The Jossey-Bass education series. Emotion and its regulation in early development* (pp. 7–23). San Francisco, CA: Jossey–Bass.

Saarni, C. (1999). *The Guilford series on social and emotional development. The development of emotional competence*. New York: Guilford Press.

Scarantino, A., & de Sousa, R. (2018). Emotion. In E. N. Zalta (Ed.), *The Stanford encyclopedia of philosophy*. Stanford, CA: Stanford University Press.

Schäfer, J. Ö., Naumann, E., Holmes, E. A., Tuschen-Caffier, B., & Samson, A. C. (2017). Emotion regulation strategies in depressive and anxiety symptoms in youth: A meta-analytic review. *Journal of Youth and Adolescence*, *46*, 261–276. doi:10.1007/s10964-016-0585-0

Shannon, K. E., Sauder, C., Beauchaine, T. P., & Gatzke-Kopp, L. (2009). Disrupted effective connectivity between the medial frontal cortex and the caudate in adolescent boys with externalizing behavior disorders. *Criminal Justice and Behavior*, *36*, 1141–1157. doi:10.1177/0093854809342856

Sobanski, E., Banaschewski, T., Asherson, P., Buitelaar, J., Chen, W., Franke, B., … Stringaris, A. (2010). Emotional lability in children and adolescents with attention deficit/hyperactivity disorder (ADHD): Clinical correlates and familial prevalence. *Journal of Child Psychology and Psychiatry*, *51*, 915–923. doi:10.1111/j.1469-7610.2010.02217.x

Stansbury, K., & Sigman, M. (2000). Responses of preschoolers in two frustrating episodes: Emergence of complex strategies for emotion regulation. *Journal of Genetic Psychology: Research and Theory on Human Development*, *161*, 182–202. doi:10.1080/00221320009596705

Stifter, C. A., & Braungart, J. (1995). The regulation of negative reactivity in infancy: Function and development. *Developmental Psychology*, *31*, 448–455. doi:10.1037/0012-1649.31.3.448

Suls, J., Green, P., & Hills, S. (1998). Emotional reactivity to everyday problems, affective inertia, and neuroticism. *Personality and Social Psychology Bulletin*, *24*, 127–136. doi:10.1177/0146167298242002

Teasdale, J. D. (1988). Cognitive vulnerability to persistent depression. *Cognition and Emotion*, *2*, 247–274. doi:10.1080/02699938808410927

Thompson, R. A. (2011). Emotion and emotion regulation: Two sides of the developing coin. *Emotion Review*, *3*, 53–61. doi:10.1177/1754073910380969

Thompson, R. J., Mata, J., Jaeggi, S. M., Buschkuehl, M., Jonides, J., & Gotlib, I. H. (2012). The everyday emotional experience of adults with major depressive disorder: Examining emotional instability, inertia, and reactivity. *Journal of Abnormal Psychology*, *121*, 819–829. doi:10.1037/a0027978

Tomarken, A. J., & Keenan, A. D. (1998). Frontal brain asymmetry and depression: A self-regulatory perspective. *Cognition and Emotion*, *12*, 387–420. doi:10.1080/026999398379655

Tone, E. B., Garn, C. L., & Pine, D. S. (2016). Anxiety regulation: A developmental psychopathology perspective. In D. Cicchetti (Ed.), *Developmental psychopathology: Vol. 2. Developmental neuroscience* (3rd ed., pp. 523–556). Hoboken, NJ: Wiley.

Trull, T. J., Solhan, M. B., Tragesser, S. L., Jahng, S., Wood, P. K., Piasecki, T. M., & Watson, D. (2008). Affective instability: Measuring a core feature of borderline personality disorder with ecological momentary assessment. *Journal of Abnormal Psychology*, *117*, 647–661. doi:10.1037/a0012532

Tull, M. T., Barrett, H. M., McMillan, E. S., & Roemer, L. (2007). A preliminary investigation of the relationship between emotion regulation difficulties and posttraumatic stress symptoms. *Behavior Therapy*, *38*, 303–313. doi:10.1016/j.beth.2006.10.001

https://doi.org/10.1017/S0954579419000695 Published online by Cambridge University Press

Tuske, J. (2016). The concept of emotion in classical Indian philosophy. In E. N. Zalta (Ed.), *The Stanford encyclopedia of philosophy*. Stanford, CA: Stanford University Press.

Weisz, J. R., Suwanlert, S., Chaiyasit, W., Weiss, B., Achenbach, T. M., & Trevathan, D. (1989). Epidemiology of behavioral and emotional problems among Thai and American children: Teacher reports for ages 6–11. *Journal of Child Psychology and Psychiatry*, *30*, 471–484. doi:10.1111/j.1469-7610.1989.tb00260.x

Witte, T. K., Fitzpatrick, K. K., Joiner, T. E.Jr., & Schmidt, N. B. (2005). Variability in suicidal ideation: A better predictor of suicide attempts than intensity or duration of ideation? *Journal of Affective Disorders*, *88*, 131–136. doi:10.1016/j.jad.2005.05.019

Woyshville, M. J., Lackamp, J. M., Eisengart, J. A., & Gilliland, J. A. M. (1999). On the meaning and measurement of affective instability: Clues from chaos theory. *Biological Psychiatry*, *45*, 261–269. doi:10.1016/S0006-3223(98)00152-8

Zelazo, P. D., & Cunningham, W. A. (2007). Executive function: Mechanisms underlying emotion regulation. In J. J. Gross (Ed.), *Handbook of emotion regulation* (pp. 135–158). New York: Guilford Press.

https://doi.org/10.1017/S0954579419000695 Published online by Cambridge University Press