

Temperament and Emotion

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Early occurring individual differences play a large role in shaping developmental trajectories over the course of childhood and adolescence. Traditionally, developmental psychology has been heavily oriented toward nomothetic laws of human development, which argue for understanding typical patterns of fairly universal human behavior that hold true across individuals and contexts (Pérez-Edgar & Hastings, 2018). More recently, there has been a greater emphasis on an idiographic focus, which aims to study variations within the population, or behaviors that are unique to individual children. To illustrate this approach, the current review focuses specifically on the role of temperament in emotional development. Temperament can be conceptualized as biologically rooted and relatively stable individual differences in emotion expression, experience, and regulation. Temperament researchers are particularly interested in how these components of emotion develop over time in relation to the emergence of increasingly complex socioemotional behaviors. Examining the link between early temperament and later patterns of behavior will help us better understand both normative and nonnormative trajectories.

Temperament researchers differ when characterizing the strength of the temperament-to-emotion link across development. However, nearly all would argue that emotion-related behaviors are at least partially tethered to temperament profiles. This entry first discusses temperament theories as well as the working definitions of temperament that have emerged from them. Next, it demonstrates the relations between temperament and emotion in the study of child development. Finally, it discusses contemporary research focusing on intrinsic (i.e., biological and cognitive) and extrinsic (i.e., contextual) processes that play a role in the links between temperament and socioemotional behaviors and outcomes.

1 Theories and Working Definitions of Temperament Concepts

Temperament is defined as a child's fairly consistent disposition that contributes to their emotionality/affectivity, effortful control, activity level, and attention across time

and contexts (Shiner et al., 2012). Temperamental differences are grounded in biology, are present early in life, and influence later development. For instance, negative affect in infancy is a developmentally sensitive marker for fearful and inhibited temperament (Fox, Henderson, Rubin, Calkins, & Schmidt, 2001). Distinct patterns of attention biases to emotional cues in infancy emerge alongside the attention-orienting systems that rapidly develop in the first year (Morales, Fu, & Pérez-Edgar, 2016). These early temperamental behaviors are reactive or unconscious on the part of the infant and likely driven by genetics or neural maturation at these early stages.

A core tenet of temperament theory argues that a trait will show relative stability over time. However, researchers have debated the extent of this stability, including whether children continue to hold their relative ranked positions over time. The empirical evidence suggests that the stability is moderate at best and increases after age 2 (Fox et al., 2001). Even with relative rank stability, the phenotypic expression of a temperament trait may change over time and may partially reflect the context of expression. Thus, temperament traits are not immune to individual and environmental forces that typically influence development. For example, behavioral inhibition (BI) is an early appearing temperament marked by sensitivity to novelty in the environment (see the section below on theories). BI is moderately stable from toddlerhood to early childhood ($r = 0.52$; Kagan, Reznick, & Snidman, 1987). Infants who demonstrate higher levels of motor reactivity and negative affect when exposed to new auditory and visual stimuli are more likely to display BI in toddlerhood and preschool (Fox et al., 2001). Toddlers identified as behaviorally inhibited are more likely to be inhibited at 7 years of age, and BI is stable in 30–40% of children through middle childhood (Fox, Henderson, Pérez-Edgar, & White, 2008).

Multiple approaches to child temperament have significantly contributed to our understanding of how individual differences influence emotion development trajectories. The five most prominent temperament theories have been proposed by Rothbart, Buss and Plomin, Goldsmith, Thomas and Chess, and Kagan.

Temperament Theories

Rothbart

Rothbart's model of temperament argues that reactivity and regulation are orthogonal factors that contribute to longitudinal patterns of temperament styles (Rothbart & Derryberry, 1981). Reactivity captures the physiological and behavioral indicators of arousal, excitation, and responsiveness. Regulation is the control mechanism for reactivity, such that neural, physiological, and behavioral processes alter one's initial reactivity. According to Rothbart, regulatory processes emerge after initial reactivity, within both the macro time frame of development and the microprocesses of dealing with salient events in the environment. A combination of high dispositional reactivity and low levels of self-regulation is associated with child behavior problems. For example, individuals with externalizing problems (e.g., conduct problems, hyperactivity) tend to underregulate their expressions and feelings of anger. Alternatively, individuals with internalizing difficulties (e.g., depressive and anxious symptoms) show difficulties appropriately regulating their attention away from negative stimuli in their environment.

Buss and Plomin

Buss and Plomin's (1984) theory of temperament encompasses individual constructs of emotionality, activity, and sociability. Emotionality refers to a child's general level of distress, including the ease, frequency, and intensity of their response. Activity is composed of tempo and vigor, while sociability is a child's preference to engage with and be around others. Buss and Plomin's theory is largely based on a behavioral genetics model, examining the contributions of both genetics and the environment in the development of temperamental traits. In their study of twins, Buss and Plomin (1984) found that emotionality, activity, and sociability were more highly correlated in monozygotic twins than dizygotic twins, which suggests genetic effects for individual differences in temperament. They also posited that, while children's rank orders on these traits remain stable over time, their mean levels are likely to change as behaviors become more nuanced with age.

Goldsmith

This approach examines temperament as individual differences in tendencies to experience and express discrete emotions (e.g., joy, sadness, anger, fear, surprise). The emphasis on discrete emotions contrasts with other approaches that place individuals on a continuum of broad emotionality. Differences in the experience and expression of discrete emotions are evident in temporal variations in behavior as coded by a child's vocal, facial, and motor expressions. This approach is unique in that (1) motivation is a key component of emotion experience and expression and (2) understanding biological processes is not critical to the definition of temperament, such that temperament can have genetic influences without being heritable (Goldsmith et al., 1987).

Thomas and Chess

Thomas and Chess's (1977) pivotal New York Longitudinal Study assessed temperament behaviorally across nine dimensions: activity level, regularity, approach-withdrawal, adaptability, threshold of responsiveness, intensity of reaction, quality of mood, attention span or persistence, and distractibility. Using these dimensions, children were grouped into easy, difficult, or slow-to-warm temperament types. Chess and Thomas (1991) introduced the concept of *goodness of fit*, which describes the compatibility between the child's temperament and the requirements and opportunities of the environment for fostering healthy development. A "good" fit would indicate that the parent is sensitive and responsive to the needs of their particular child. These needs are, in part, shaped by how the child varies across the nine temperament dimensions.

Kagan

Kagan's approach to temperament is unique in that it focuses on the discrete temperamental category of BI (Kagan et al., 1987). Rather than examine how children fall across one or more continuous dimensions, Kagan focuses on qualitatively unique groupings of children that display discrete temperament types. BI is the most studied of the potential temperament types. BI is characterized by increased sensitivity to unfamiliarity or novelty, social withdrawal, and anxious behaviors. As such, BI is often considered a precursor of anxiety disorders (Pérez-Edgar & Guyer, 2014). To cope with novel situations, behaviorally inhibited children typically rely on freezing or avoidance strategies, which momentarily decrease their fear. Over time, the links between children's physiological

responses to novelty and avoidance behaviors are reinforced, perpetuating behaviorally inhibited tendencies that can lead to social wariness (Pérez-Edgar & Guyer, 2014).

Working Definitions

Despite variations in temperament theory, there is an emerging consensus among researchers that temperament is early appearing and biologically rooted and that relative positions on temperament measures are moderately stable over time. Additionally, researchers consider temperament to involve individual differences in emotionality/affectivity, effortful control, activity level, and attention (Shiner et al., 2012). Most temperament theorists, with the exception of Kagan and colleagues (1987), examine temperament dimensionally, with individuals varying along a continuum (Shiner et al., 2012).

Emotionality/affectivity as a temperament dimension captures individual differences in the intensity, speed, quality, and changeability of emotions. Negative emotionality can be composed of frustration and irritability along with feelings of fear and sadness. More covert, inhibitory forms of negative emotionality, such as fear and sadness, are better predictive of internalizing issues. Patterns of overt, negative emotions, such as anger, are more predictive of externalizing problems. Positive emotionality, in contrast, is the propensity to have positive moods, to be interested in engaging socially with others, and to demonstrate adaptability. Although comparatively less research has examined positive emotionality, researchers argue that positivity reflects a unique construct and is not simply the far end of the negative emotionality spectrum.

Effortful control is conceptualized as the ability to willfully activate, inhibit, or modulate one's attention and subsequent behavior, falling within Rothbart's regulatory component of temperament. Reactive control, on the other hand, describes the process whereby an individual displays reflexive, non-planful control, which can result in anxious, inhibitory strategies (Eisenberg, Spinrad, & Smith, 2004). Activity level reflects the amount, tempo, and vigor of a child's movement (Buss & Plomin, 1984) and is linked to positive emotionality. Lastly, attention processes operate as "gatekeepers," filtering in information from the environment that will be processed to influence the child's social engagement (Pérez-Edgar & Hastings, 2018; see section below on cognitive processes).

Measuring Individual Differences

Researchers have chiefly relied on laboratory assessments, parent reports, and physiological measures to study temperament. Laboratory observations can help to control the intensity and novelty of presented stimuli so that researchers can more easily compare responses across children. Further, they facilitate the use of attentional tasks that capture attention patterns too subtle to measure in naturalistic contexts. Laboratory measures also lessen the chance of shared rater variance (i.e., variance attributed to the method of the collection, such as using the same informant, rather than to the constructs of interest).

The age-adapted Laboratory Temperament Assessment Battery (Lab-TAB) is a well-validated laboratory-based assessment intended to capture temperament dimensions in emotionally salient situations using standardized behavioral tasks. In the fear-eliciting episode, for example, a stranger wears a scary mask. This encounter will

scare some children, but not others, and researchers can capture individual differences in fear from the children's responses. Parent reports are also useful for examining children's behavior, serving as a comprehensive assessment of parents' observations over a wide variety of situations. Lastly, we can measure physiological correlates of temperament behaviors in children through noninvasive electrophysiology and neuroimaging technology.

2 Temperament–Emotion Relations

Temperament can help to explain individual differences in observed emotion. Emotions influence people's perceptions and experiences of the world. Emotions drive individuals to appraise their experiences and determine courses of action (Cole, Martin, & Dennis, 2004). The nature of emotion, however, continues to be a widely debated topic. Despite the multiple definitions of emotion, most researchers agree that emotions are tools used to appraise and experience situations that motivate subsequent behavior. Further, the dynamic nature of children's emotions draws upon a child's given situation, as different situations may offer distinct appraisal and action-readiness tendencies (Cole et al., 2004).

The basic emotions, such as fear, sadness, happiness, surprise, and anger, can be expressed as early as 6 months of age. In preschool and kindergarten, a time when children experience social interactions in and outside the family context, self-conscious emotions such as guilt, shame, pride, and embarrassment emerge. These new emotions involve self-evaluations, as the child begins to see how their emotions influence others in their social world (see MEASUREMENT OF EMOTION).

Emotion regulation is the dynamic interplay of behavioral, psychophysiological, affective, and attentional processes used to manage emotional experience and expression. Emotion regulation contributes to the formation and maintenance of adaptive social relationships and is considered a crucial normative developmental process (Cole et al., 2004). Emotion regulation may explain how and why initial emotions may differentially influence psychological processes, such as engaging in prosocial relationships, decision making, and attention (Cole et al., 2004; see also ASSESSMENT OF EMOTION REGULATION AND DYSREGULATION).

A child's temperament is associated with individual differences in both emotion reactivity and regulation, which are conceptualized as independent processes that come together to form an individual's observed pattern of behavior. These behaviors, in turn, influence children's socioemotional adjustment. This dynamic interplay between temperament traits and emotion is evident in early infancy. For example, in one study, easily frustrated 6-month-olds were less attentive, were more active, and demonstrated poorer physiological regulation than their less frustrated counterparts (Calkins, Dedmon, Gill, Lomax, & Johnson, 2002). For preschoolers, the relations between temperament and children's internalizing and externalizing problems are dependent upon the combined influence of children's emotionality and regulatory ability. More specifically, when children high in negative emotionality face problems head on, they have fewer adjustment problems than children who use passive coping strategies.

The current entry proposes that temperament and emotion reactivity and regulation are interwoven constructs that can, and should, be examined together to predict later socioemotional behaviors. How temperament and emotion influence later adjustment,

however, can be moderated or mediated through intrinsic (i.e., biological and cognitive) and extrinsic (i.e., parenting) factors. The cross-sectional literature illustrates that intrinsic and extrinsic factors act as markers, or correlates, of socioemotional profiles. Recent longitudinal work proposes that these factors may also act as mechanisms of change. The following sections delineate the current research on intrinsic and extrinsic factors that relate temperament-linked development to children's socioemotional adjustment.

3 Biological and Cognitive Processes

Factors that are individual to the child, such as biology and cognition, contribute to the development of temperament–emotion relations over time. They also influence how these relations predict later behavior. Behavioral and molecular genetics studies have been used to test the assumptions that temperamental behaviors are biological in origin. Researchers largely emphasize the roles of both the central and autonomic nervous systems in driving emotion-related behavior based on temperament profiles (e.g., Kagan et al., 1987). Cognitive processes, specifically attentional control, are also intrinsic to the child and contribute to regulating the child's responses to salient emotional stimuli in their environment.

Biological Processes

Genetic Markers

Individual genetic profiles and early environmental experiences interact to predict behavior. For example, variations in fearful temperament are associated with the 5HTTLPR gene, such that individuals who are homozygous for the short allele (i.e., have two copies), and who are additionally exposed to greater environmental stress, are at a higher risk for maladjustment than equally fearful children with two long alleles (Fox, Hane, & Pine, 2007). 5-HT neurons are wired with broadly distributed brain networks and alter circuitry involved in processing dangerous stimuli. This circuit includes the ventral prefrontal cortex (vPFC), associated with decision making, and the amygdala, implicated in detecting novel and threatening events. Extrinsic processes, such as parenting, are likely to influence the expression of a child's 5HTT gene and, in turn, the vPFC–amygdala circuitry. Fox et al.'s (2007) model suggests a critical gene-by-environment interaction shaping the developmental trajectories of fearful children.

The Central Nervous System

Patterns of central nervous system activity influence infants' early affective dispositions and how they respond to sensory and social stimuli (Fox et al., 2008). The behavioral activation system (BAS) and behavioral inhibition system (BIS) are neural systems that help to explain pathways to temperamental dimensions, such as surgency and negative affect (Gray, 1991). The BAS processes events that may involve rewards, potentiating an approach motor response, along with excitement, happiness, and interest. The BIS, in contrast, processes events that may indicate dangers, generating inhibited motor responses and fearful and anxious emotional responses. Thus, the BAS and BIS act as motivational systems that provoke an individual to approach (BAS) or withdraw from (BIS) an emotionally driven situation.

Empirical research on the BAS and BIS has indicated that the amygdala is associated with conditioned fear responses and learning stimulus–threat patterns. Dual-process models, which link top-down neural processes in cortical regions to the regulation of bottom-up subcortical regions, may help to explain the emergence of fearful behaviors in children and link temperamental fearfulness to anxiety. For example, both BI and anxiety are related to an overactive amygdala and fear responses to novelty (Fox et al., 2008).

The Autonomic Nervous System

Autonomic nervous system activity impacts temperament and socioemotional behavior via patterns of sympathetic and parasympathetic activation throughout the body. Through the functioning of the parasympathetic nervous system, the vagal system facilitates flexibility in responding to environmental challenges by varying heart rate, or respiratory sinus arrhythmia (RSA; Porges, 2007), so that the child may interact with the environment in adaptive ways. Children who show decreases in RSA from baseline to task demonstrate greater emotion regulation. Lower levels of RSA suppression during an attention task are related to higher levels of observed frustration (Calkins et al., 2002).

Cognitive Processes

Cognitive processes of attention may be particularly important for understanding how temperament predicts socioemotional adjustment because infants and children regulate their distress by invoking emerging attentional mechanisms (for a review see Bell & Wolfe, 2004). First, preferential attention to emotion appears very early on in life and tends to increase with age. Second, children use attention to selectively process the environment and regulate their emotions, especially in situations that evoke negative affect. The ability to selectively sustain attention typically increases as children get older, and children learn to filter out some contextual cues to attend to salient or goal-directed cues. Lastly, individual differences in attention can be associated with individual differences in both temperament and emotion (Pérez-Edgar & Hastings, 2018).

Affect-biased attention is the predisposition to attend to specific types of emotional stimuli in one's environment while ignoring other types of stimuli (Morales et al., 2016). One form of affect-biased attention, attention bias to threat, is a within-person factor that contributes to the individual variation in reactivity and regulation in behaviorally inhibited children. Indeed, attention bias to threat in childhood moderates the link between BI in toddlerhood and social withdrawal later in life, such that BI is positively related to social withdrawal only for children with an attention bias to threat. Alternatively, toddler temperamental exuberance, characterized by high levels of approach and positive affect, positively predicts child attention biases to rewarding stimuli, which are then associated with child externalizing problems (for a review see Morales et al., 2016). Understanding attention processes can help us to elucidate how children come to subjectively experience and process their environments.

In sum, there is a substantial body of literature outlining biological and cognitive pathways of temperament-linked development. Neuroscience research is beginning to apply sensitive analytical techniques to better understand the dynamic interactions between emotional reactivity and regulation processes that underlie temperament profiles (see NEUROPHYSIOLOGICAL THEORY AND FOUNDATIONS OF EMOTIONS). Further, the brain structures implicated in temperament–emotion relations are

inextricably linked to cognitive processes of attention, such that testing the role of attention in the regulation of emotion at the behavioral and biological levels helps to explain individual differences in temperament (see BIASED COGNITIVE PROCESSING OF EMOTIONAL INFORMATION IN CHILD ANXIETY AND DEPRESSION).

Temperament, however, does not develop in a vacuum. Children are active participants in their environment, and their temperament significantly shapes the environment they experience. For example, Fox and colleagues' (2007) model of plasticity for affective neurocircuitry argues that early temperament impacts the quality of the caregiving environment, which in turn influences children's attention bias to threatening stimuli and mediates the link between temperament and later adjustment. The following section discusses how context shapes children's temperament and subsequent socioemotional adjustment.

4 Parenting as a Process

Because the family is the young child's most proximal environment, parents can help to explain the link between temperamental risk factors and maladaptive outcomes for children. Some parenting strategies may buffer the effects of temperament on socioemotional adjustment, whereas other parenting strategies may canalize early tendencies. The mediating or moderating effects of parenting in the relation between child temperament and adjustment can be parent driven, while other effects may be child driven, such that the child's temperament influences parenting (Belsky & Pluess, 2009). For example, a parent with an anxiety disorder may reinforce inhibited behaviors in their temperamentally fearful child by displaying their own anxious behaviors. By the same token, a behaviorally inhibited child may elicit overprotecting behaviors from the parent that in turn reinforce the child's anxious behaviors. The current entry focuses on the parent, but it is important to note that the broader family, peers, neighborhood, and culture are other important contexts that impact the links between temperament and later behavior.

When children are very young, their reactive tendencies can disproportionately control their behavior, and it is normative for them to primarily rely on their caregivers to help them regulate (Pérez-Edgar & Hastings, 2018). Adults can engage and disengage the infant's attention, thereby modulating the infant's arousal. When an infant's attention is engaged by a positive parental cue, such as smiling, the infant may experience greater positive affect and arousal. Sensitive parenting includes the ability to pace activity levels in response to the infant's behavior, such as when the infant disengages from the parent or displays negative affect (Eisenberg et al., 2004). When parents engage in sensitive parenting interactions with their children, they inadvertently teach their infant attentional control so that the infant may move from parent-assisted regulation to self-regulation as they age. This parental socialization of emotion regulation (see EMOTION SOCIALIZATION IN THE FAMILY) is particularly important for children with difficult temperaments, or children higher in negative affectivity, who are more reactive to environmental input.

Parental personality traits, such as neuroticism and negative affect, can influence the parenting behaviors available to scaffold a child's regulation. For example, maternal neuroticism and negativity have been linked to more stable BI in children. After controlling for early child temperament, higher levels of parents' neuroticism predict

higher levels of child negative affect. Maternal negative affect also mediates the relation between preschoolers' effortful control and family functioning, such that, when controlling for mothers' negative affect, the correlation between effortful control and family functioning disappears. Mothers with anxiety symptomatology, or reactive personality traits, may reinforce children's inhibited temperament by modeling poor coping strategies. Alternatively, mothers who rely on positivity and have extraverted tendencies may help to teach children more adaptive regulatory skills when they are faced with negative emotions.

The specific behaviors associated with adaptive parenting will differ for children with different temperaments. As such, sensitive parenting of a more exuberant child may look different from sensitive parenting of a child with a fearful temperament. For example, researchers have pointed to overcontrol as a negative form of parenting for children with fearful temperaments. Overcontrol involves demonstrations of warmth, intrusiveness, and restrictiveness in situations that do not warrant this type of behavior. More parental control during a free-play task is associated with more peer reticence for dysregulated children. Lack of parental control during a teaching task is associated with more peer reticence for these same children, highlighting the need for flexibility across contexts and tasks.

Children with specific temperament traits also may be more vulnerable to later psychopathology depending on the family context, including parenting and the emotional climate of the home. For example, children with emotion regulation difficulties, such as undercontrol, are likely to develop externalizing problems when their mothers are more negative (e.g., Rubin, Burgess, Dwyer, & Hastings, 2003). On the other hand, children who have the tendency to overcontrol their behavior, or employ reactive control as opposed to effortful control, are likely to develop internalizing issues, particularly in homes characterized by parental intrusiveness and overcontrol.

Further, children with difficult temperaments may be more vulnerable to environmental influences than children with easier temperaments. The differential susceptibility hypothesis contends that the relation between the environment and childhood disorders is influenced by dispositional traits that reflect openness to environmental influence. In other words, children who have difficulties regulating their emotions may benefit more from positive socialization strategies than their peers but are at risk for worse adjustment relative to their peers if exposed to maladaptive socialization. These individuals are more susceptible to rearing experiences, for better or for worse (Belsky & Pluess, 2009). Children with difficult temperaments show more externalizing problems when parents have lower levels of sensitive parenting, but they have the lowest levels of externalizing problems when their parents are high in sensitivity. In sum, the environment provided by the family can shape the developmental impact of children's temperament, placing them at risk for, or protecting them against, maladaptive socioemotional functioning and later psychopathology.

5 Conclusions

The current entry has reviewed the role of temperament in the development of children's emotional reactivity and regulation, as well as the intrinsic and extrinsic processes that drive temperament–emotion relations over time. Although specific

temperaments are associated with particular developmental trajectories, temperament should not be viewed as a determinant of invariant emotional and behavioral outcomes. Rather, biological, cognitive, and contextual processes play significant roles in canalizing temperamental behaviors over the lifespan or altering these pathways, leading to more or less adaptive behaviors. Temperament is a critical field of study for better understanding how emotion regulation abilities in childhood augment or protect against the development of psychopathology later in life. Because temperament is early emerging and biologically rooted, we can assess biomarkers and contextual factors that may influence behavioral trajectories in the first months of life. Moreover, the impact of later regulatory abilities on subsequent functioning is also dependent upon biology, cognition, and contextual change over time. Researchers have made great strides toward elucidating temperament–emotion relations and their potentiating mechanisms. Moving forward, future work should strive to empirically test models bridging biology, behavior, and context to better understand mechanisms that contribute to resilience processes and adaptive outcomes for children.

SEE ALSO: Assessment of Emotion Regulation and Dysregulation; Attention in Infancy and Childhood: A Focus on Developmental Dynamics; Biased Cognitive Processing of Emotional Information in Child Anxiety and Depression; Development of Emotional Competence; Emotion Perception and Recognition; Emotion Socialization in the Family; Emotion in Toddlers and Young Children; Measurement of Emotion; Neurophysiological Theory and Foundations of Emotions

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