

Temperament

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Synthesis on temperament

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How important is it?

[Temperament](#) refers to individual characteristics that are assumed to have a biological or genetic basis and that determine the individual's affective, attentional and motor responses in various situations. For example, temperament can affect young children's mood and emotions, how they approach and react to situations, their level of fear, frustration, sadness and discomfort, etc. These responses also play a role in subsequent social interactions and social functioning. A [temperamental bias](#) refers to a distinctive profile of feelings and behaviours that originate in the child's biology and appear early in development.

An important dimension of temperament is [effortful control](#), defined by Rothbart as "the ability to inhibit a dominant response to perform a subdominant response." Effortful control includes the abilities to voluntarily manage attention and inhibit or activate behaviour as needed to adapt to the environment, especially when the child does not particularly want to do so.

Temperament's influence on [developmental pathways](#) and outcomes has now been recognized, even in areas that have traditionally been seen as almost exclusively the result of socialization, such as conduct problems, empathy and the development of conscience.

What do we know?

Thomas, Chess and colleagues identified nine [temperament dimensions](#): activity level, rhythmicity, approach-withdrawal, adaptability, threshold, intensity, mood, distractibility and attention span-persistence. A revised list reflecting subsequent research includes extraversion or surgency, which is related to positive affect, activity level, impulsivity and risk-taking; negative affectivity, which is related to fear, anger, sadness and discomfort; and effortful control, which is related to attention shifting and focusing, perceptual sensitivity, and inhibitory and activational control. These last three dimensions have been found consistently in parent reports of temperament in early and middle childhood.

Temperament also develops over time. During the first few months of life, individual differences can be observed in attentional orienting, distress proneness, positive affect and approach, and frustration. Late in the first year and beyond, there may be individual differences in [fearful inhibition](#) to novel or intense stimuli. Some infants who previously responded rapidly to new objects or people may now approach more slowly, or not approach at all. It is also late in the first year of life that children begin to develop effortful control.

Children's temperaments shape their outcomes, in part by forming the ways that children engage and evoke responses from their environments. Children interpret their environmental experiences differently depending on their temperaments. For

example, anxious and irritable children tend to perceive negative events as more threatening than do children with a lower level of negative emotions.

It is clear that effortful control is linked to [positive development](#), even in the first five years of life. For example, laboratory or parent-report measures of toddlers' and preschoolers' effortful control have been associated with lower levels of problem behaviours. In addition, young children's effortful control has been found to correlate with and predict low levels of negative emotion, highly committed compliance, high levels of social competence, and conscience. Effortful control also plays a role in the responses evoked. As children grow, they are increasingly held responsible for their own behaviour; children who are not well regulated are therefore likely to elicit negative reactions from both peers and adults.

Links have also been identified between temperament and the development of [psychopathology](#). Temperament may heighten responses to stressful events or buffer against risk. Relationships have been found between temperamental fearful inhibition and later anxiety, negative affectivity and depression. Extraversion/surgency and low effortful control have also been associated with the development of behaviour problems.

Yet while there is consensus that temperament is shaped by biological processes, recent research with infant twin pairs has made it clear that children's [individual differences](#) are shaped by environmental experiences as well, even during infancy. Different parenting strategies may help to augment or diminish certain aspects of a child's temperament. Beyond the family environment, children's school environment, peer relationships and neighbourhoods can also have a major impact on whether children's early temperaments remain stable and on whether their temperaments lead to good or poor outcomes.

What can be done?

Research on temperament suggests the [importance of education](#) to help child-care workers, teachers and parents realize that children's behaviour and emotions are not the sole result of social learning. Instead, children differ from an early age in their reactivity and self-regulation and may follow different pathways to developmental outcomes. Temperament also suggests specific interventions, such as training in attentional control that has been successfully used with four-year-olds and can be adapted to preschool settings. Such training has proven useful for children with ADHD as well, and appears to have general positive effects on children's cognitive processing.

[Different parenting strategies](#) appear to work better for children with certain temperaments. This can be explained by the "goodness of fit" theory, as suggested by Thomas and Chess. Children who are aggressive and difficult to manage seem to benefit from a parenting style involving more restrictive control and lower parental negativity. Shy children appear to benefit from being encouraged by parents to explore novel situations and are more likely to remain shy and inhibited if parents are overprotective.

Fearful children tend to develop greater early conscience and do best under gentle [parental discipline](#) that promotes internalized conscience. More fearless children appear to benefit more from maternal responsiveness and their own security of attachment in conscience development.

Individual differences in effortful control, although partly due to heredity, are also associated with the quality of [parent-child interactions](#). Warm, supportive parenting, rather than cold, directive parenting, appears to predict higher levels of effortful control. It is therefore important that parents and other caregivers be encouraged to interact with children in ways that foster the development of effortful control.

Finally, some children pose greater challenges in certain contexts to parents, teachers and other caregivers because of their temperaments. In such cases, caregivers are likely to benefit from additional support and education. For example, caregivers can be helped to avoid negative responses that might naturally be evoked by children with more difficult temperaments.



Early Temperament and Psychosocial Development

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Topic

Temperament

Introduction

Temperament, defined as individual differences in constitutionally based reactivity and self-regulation, and observed in children's emotionality, activity and attention, has an ancient history. It has also recently become a rapidly growing research area in child development. Temperament's influence on developmental pathways and outcomes has now been recognized, even in areas that have traditionally been seen as almost exclusively the result of socialization, such as conduct problems, empathy and the development of conscience.¹

Subject

Temperament refers to individual differences in the infant and young child that exist before many of the more cognitive aspects of personality have developed. Temperament includes variability in positive affect and approach, fear, frustration, sadness and discomfort, as well as attentional reactivity and controls on behaviour, thought and emotion.¹ Temperamental dispositions, which are reflected in orientations toward or away from objects, people and events,² are critical to the development of competence and motivation.³

Problems

Research on temperament in childhood is based on multiple methods of questionnaires and observations, with each approach demonstrating both advantages and disadvantages.¹ On the positive side, caregiver-report questionnaires are inexpensive to administer and based on a wide range of behaviours observed by parents or teachers. Laboratory observations allow researchers to control and manipulate the environment and to precisely measure the reaction time, intensity and duration of the children's behaviour, whereas naturalistic home or school observations allow both coder objectivity and ecological validity.¹

There are also problems with each of these methods. Caregiver reports may be biased by the respondent's desire to portray the child in a desirable way. Laboratory observations are likely to be limited in the range and frequency of behaviours that can be elicited, and there are often carry-over effects from one episode to others. Natural observations are often expensive and time-consuming, requiring multiple visits to elicit a reliable sample

of children's behaviour. While no one method is completely error-free, each provides tools to improve our understanding of temperament and its relation to developmental outcomes.¹

Research Context

Research on temperament in childhood has been greatly influenced by the New York Longitudinal Study (NYLS).⁴ Thomas, Chess and colleagues interviewed parents about the behaviours of their two- to six-month-old infants, and through content analysis, identified nine temperament dimensions: activity level, rhythmicity, approach-withdrawal, adaptability, threshold, intensity, mood, distractibility and attention span-persistence. More recently, however, revisions to the Thomas and Chess list have been indicated;¹ these will be listed below under Recent Research Results.

Key Research Questions

1. What are the major dimensions of temperament in infancy and childhood?
2. How does temperament develop?
3. What psychosocial outcomes are associated with temperament?
4. What are the neural, genetic and experiential contributions to temperament?

Recent Research Results

Factor analyses of children's temperament have led to a revised list of temperament dimensions in infancy and early childhood.^{1,5,6} These include 1) positive affectivity; 2) activity level; 3) fearfulness; 4) anger/frustration; 5) attentional orienting; and later, in early childhood, 6) effortful control, i.e. the capacity to inhibit a dominant response in order to perform a subdominant response. During early and middle childhood, three broad factors have consistently been found in parent reports of temperament: Surgency or Extraversion, related to positive affect and activity; Negative Affectivity, related to negative emotions; and Effortful Control, related to attentional, inhibitory and activational control. These factors have been linked to emotional and attentional brain systems in humans and in non-humans.¹

Temperament also develops. During the first few months of life, individual differences in attentional orienting, distress proneness, positive affect and approach, and frustration can be observed. By six months of age, when infants are presented with objects, some infants will also show rapid approach by reaching and contacting them, while others will approach more slowly.⁷ Infant approach tendencies and smiling and laughter in the laboratory predict parent-reported extraversion at seven years.⁸

Late in the first year and beyond, individual differences in fearful inhibition to novel or intense stimuli can be observed.² Fearful inhibition opposes approach tendencies, so that some infants who previously responded rapidly to new objects or people may now approach more slowly, or not approach at all. Fearful inhibition shows considerable stability and is related to the later development of empathy, guilt and shame in childhood.^{2,9} Fearful children tend to develop greater early conscience¹⁰ and benefit from gentle parental discipline in promoting internalized conscience. More fearless children

appear to benefit more from maternal responsiveness and their own security of attachment in conscience development.

Late in the first year of life, effortful control begins to develop, providing additional means of regulating reactive tendencies. We call the brain system underlying effortful control the executive attention system.^{11,12} As executive attention develops, so does the ability to maintain focused attention for longer periods of time. Sustained attention and ability to refrain from touching a prohibited toy in infancy significantly predict effortful control at 22 months.¹³ There is also long-term stability in children's ability to delay gratification, with preschoolers' ability to delay predicting adolescent parent-reported attentiveness, ability to concentrate and control over negative affect.¹⁴ Effortful control is strongly related to children's compliance, and to the development of empathy and guilt or shame in children.

Neuroimaging studies allow researchers to identify tasks that activate brain networks underlying temperament, and these tasks have been adapted to children of different ages to study the development of temperamental systems.¹⁵ These tasks have been used in the study of the development of attentional orienting and effortful control, but it is likely that other dimensions can be similarly measured. Performance on these tasks in the laboratory is positively related to parents' reports about children's ability to control attention and emotion.^{15,16} In adults, performance on these tasks has been linked to the action of specific genes, and considerable evidence supports the heritability of temperament.

Temperament and the development of psychopathology have also been linked.^{1,11} Temperament may heighten responses to stressful events or buffer against risk, and relationships have been found between temperamental fearful inhibition and later anxiety, negative affectivity and depression. Extraversion/surgency and low effortful control have also been linked to the development of behaviour problems.

Conclusions

The list of nine temperament dimensions identified by Thomas and Chess⁴ has been revised to reflect subsequent research: broad basic dimensions include Extraversion/Surgency (positive affect, activity level, impulsivity, risk-taking); Negative Affectivity (fear, anger, sadness, discomfort); and Effortful Control (attention-shifting and focusing, perceptual sensitivity, inhibitory and activational control). Affiliation has also recently been measured.¹⁷ Links have been found between negative affectivity and extraversion and behaviour problems, whereas effortful control is related to adaptation and low behaviour problems. Both fearfulness and effortful control have predicted the development of conscience. Links are also increasingly being made between temperament and genetic and brain processes.

Implications

Research on temperament suggests the importance of educating child-care workers, teachers and parents to realize that children's behaviour and emotions are not the sole result of social learning. Instead, children differ from an early age in their reactivity and

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self-regulation, and may follow different pathways to developmental outcomes. Temperament also suggests specific interventions, such as training in attentional control that has been successfully used with four-year-old children,¹² and can be adapted to preschool settings. Such training has proven useful for children with ADHD as well,¹⁸ and appears to have quite general effects on children's cognitive processing.

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Temperament

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Topic

Temperament

Introduction

Although the term “temperament” does not have a consensual definition, most scientists would agree on the following sense meaning: A temperamental bias refers to a distinctive profile of feelings and behaviours that originate in the child’s biology and appear early in development.¹

Subject and Problems

The biological foundation is usually genetic, but may be the result of prenatal events. An important source of the biological foundation of a temperamental bias is variation in the concentration of, and density of receptors for, the large number of molecules that can affect brain function, including dopamine, norepinephrine, serotonin, opioids, acetylcholine, corticotropin-releasing hormone, vasopressin and oxytocin.²

This hypothesis implies that there will be a very large number of temperamental biases. Because it is not currently feasible to quantify the neurochemistry that is the basis for the temperamental bias, scientists measure specific behavioural profiles. The behaviours most often attributed to a temperamental bias in infancy and early childhood include high (compared with low) irritability, activity, frequency of smiling, and an approach or avoidant posture to unfamiliar events.

There is some controversy over the validity of parental descriptions of these and other behaviours because the correlation between the parental descriptions, usually based on questionnaires, and direct behavioural observations of comparable features is usually low (i.e. the correlations are less than 0.3).^{3,4}

Therefore, it is good practice to combine parental reports with behavioural observations. A temperamental quality should be regarded as a bias, and not as determining a particular profile, because experience affects the developing phenotype in a serious way. By school entrance, it is difficult to detect the early temperamental biases of most children and a profile of behaviours could be the result of a temperamental bias or the product of experience alone. Not all shy children inherit the temperamental bias favouring that quality. Hence, discussions of temperaments in adults, most often based on questionnaire data, are open to criticism.

Research Context

Two temperamental biases that have been studied more extensively than most refer to the typical behaviours of one- and two-year-olds to unfamiliar people, objects and situations. The 10 to 20% of children who are usually subdued and shy with strangers or avoidant with unfamiliar objects or situations, called “inhibited to the unfamiliar,” are contrasted with the 30 to 40% of children who show the complementary traits of approaching the unfamiliar and are called “uninhibited.”⁵

Independent studies by Kagan^{2,5,6} have discovered that variation in motor behaviour and crying to unfamiliar visual, auditory and olfactory stimuli in four-month-old infants predict these two profiles in the second year of life. Four-month-olds who show high levels of motor activity and distress, called high-reactive, are likely to become inhibited. Infants who show low levels of motor activity and crying, called “low-reactive,” are likely to become uninhibited in the second year.

Research Results

Biological information gathered on these children during early adolescence implied that high- and low-reactive infants differ in level of excitability in the amygdala and its projections when unfamiliar events occur.⁷ At age 11, the children were evaluated for a number of physiological measures that are indirect indexes of limbic excitability. They include right, rather than left, hemisphere activation in the EEG; sympathetic rather than vagal tone in the cardiovascular system; a large Wave 5 from the inferior colliculus in the brain stem auditory-evoked response; and a larger event-related potential at 400 msec to discrepant scenes. Each of these variables was more characteristic of 11-year-olds who had been high-reactive compared with low-reactive. The former showed greater activation of the right rather than the left hemisphere, a large evoked potential from the inferior colliculus to a series of click sounds, greater sympathetic tone in the cardiovascular system, and a larger negative waveform in the event-related potential to discrepant scenes. This variation could be due to any one of a number of neurochemical profiles, including opioids, corticotropin-releasing hormone, dopamine, norepinephrine or GABA.

Although children who were high-reactive infants are at slightly higher risk than most of developing social anxiety, but not at higher risk for phobias to animals or blood, and the low-reactives had slightly higher risk for asocial profiles, these outcomes require very specific rearing conditions. Most of these children will not develop any psychiatric condition.

It is important to appreciate that the power of a temperamental bias lies in its ability to limit or restrain the acquisition of a particular personality, rather than determine a particular profile. The probability that a high-reactive infant will not become an adolescent who is extremely sociable, spontaneous, relaxed, free of worry, and possessing low levels of autonomic and cortical arousal is very high. However, the probability that this class of child will be a quiet introvert with high levels of autonomic and cortical arousal is quite low (probably less than 0.2). Thus, the biology that is the foundation of a temperamental bias functions as a constraint rather than as a determining force.

Conclusion and Implications

Parents should appreciate that each of these temperamental types has advantages and disadvantages in contemporary society. A technological economy requires a college education. Students with higher grade point averages in high school are more likely to be accepted at better colleges and therefore have a higher probability of attaining a gratifying, economically productive career. High-reactive children being raised in middle-class homes are more concerned with academic failure and therefore more likely to have an academic record that will gain them admission to an excellent college. Adolescents who were high-reactive infants often choose locations that allow them to work in environments where they can control the level of uncertainty. Such work allows some control over each day's settings and events, keeping unanticipated interactions with strangers to a minimum. In addition, high-reactives tend to avoid risk and are therefore less likely to drive at high speeds, experiment with drugs, engage in sex at an early age, or cheat on examinations.

The low-reactive, uninhibited child enjoys a share of advantages. Sociability and a willingness to take career and economic risks are adaptive in contemporary American society. The adolescent who is willing to leave home to attend a better college or accept a more interesting job is likely to gain a more challenging position than one who stays close to home because of a reluctance to confront the uncertainties of a distant place. Finally, it appears that during adolescence and adulthood, temperament makes a more substantial contribution to an individual's private feeling tone than to the public personality displayed to others. The developmental journal that leads to a relaxed or a tense feeling tone requires a more substantial contribution from temperament than does a sociable or shy posture with others.

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Temperamental Effortful Control (Self-Regulation)

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Topic

Temperament

Introduction

An important dimension of temperament is effortful control, which has been defined by Rothbart as "the ability to inhibit a dominant response to perform a subdominant response" (p. 137)¹ or the "efficiency of executive attention, including the ability to inhibit a dominant response and/or to activate a subdominant response, to plan, and to detect errors."² Effortful control includes the abilities to voluntarily manage attention (attentional regulation) and inhibit (inhibitory control) or activate (activational control) behaviour as needed to adapt, especially when the child does not particularly want to do so. For example, the abilities to focus attention when there are distractions, to not interrupt others and sit still in church, and to force oneself to do an unpleasant task are aspects of effortful control. These abilities underlie the emergence of self-regulation, a major milestone in children's development.³

Although nearly all children improve greatly in their effortful control (and hence self-regulation) across the first five years of life, there are large individual differences in effortful control. As is true for other aspects of temperament, individual differences in effortful control are believed to be due to both biological factors (hereditary and constitutional factors, such as the prenatal environment) and environmental influences (e.g. on prenatal care), and to be affected by environmental influences during early childhood. Effortful control is believed to involve executive attention abilities and to be linked to activity in the anterior cingulate gyrus (part of the brain). Effortful control, as part of executive attention, has been shown to be involved in the voluntary control of thoughts and feelings, in resolving conflict in regard to discrepant information, correcting errors and planning new actions.⁴

Subject

The emergence of temperamentally based self-regulation and individual differences therein is important for multiple reasons. As children age, they are increasingly held responsible for their own behaviour by their socializers.³ Children who are not well regulated are likely to elicit negative reactions from both peers and adults. In addition, the attentional skills involved in effortful control are likely quite important for learning.^{5,6} Finally, the skills involved in effortful control have an obvious relevance to children's emerging adjustment and social competence.⁷

Problem

For the aforementioned reasons, it is important to identify both the normative pattern for the emergence of effortful control and the antecedents of individual differences in effortful control. Researchers in the developmental sciences have examined both of these issues.

Research Context

Effortful control has been studied using a variety of methods. Investigators examining effortful control typically have used parents' or other caregivers' reports of children's effortful control and behavioural measures. These behavioural measures typically include tasks that assess children's focused attention and persistence on tasks, attentional control on Stroop tests or other measures of executive attention, the ability to delay gratification (e.g. hold an M & M on their tongue), and the abilities to inhibit or activate behaviour (e.g. follow an instruction in response to one cue but not another or move faster and slower in accordance with instructions).⁸ Such research has been conducted in both laboratory settings (sometimes in preschools) and in the home environment.

Key Research Questions

Important research questions are the age at which attentional and behavioural control (i.e. inhibitory and activational control) emerge in the early years of life and when they become relatively well developed. Investigators have also been interested in aspects of children's social interactions – especially parent-child interactions – that are associated with individual differences in effortful control. Behavioural geneticists have also attempted to identify the degree to which heredity contributes to effortful control. Finally, researchers have assessed the relationships between effortful control and young children's adjustment and moral development.

Recent Research Results

Young infants exhibit very little effortful control. Attention becomes somewhat more voluntary (but still quite limited) between nine and 18 months of age⁹ as infants learn to resolve conflicts (e.g. when processing information), correct errors and plan new actions.⁴ Using a Stroop-like task that requires toddlers to switch attention and inhibit behaviour accordingly, Posner and Rothbart⁴ reported that children showed significant improvement in performance by 30 months of age and performed with high accuracy by 36 to 38 months of age.^{10,11}

Infants are very limited in the behavioural component of voluntary behavioural control (e.g. the ability to inhibit behaviour upon command), but these skills improve considerably in the third year of life.^{4,8} The ability to effortfully inhibit behaviour on tasks such as "Simon Says" emerges at approximately 44 months of age and is fairly good by four years of age,^{4,12} although improvements in effortful control continue into childhood.¹³

Twin studies confirm that there is a genetic basis to effortful control.¹⁴ However, parenting has also been associated with individual differences in effortful control. In general, young children's self-regulation (including behaviours that reflect effortful control) has been positively associated with maternal support and negatively related to a

directive and controlling caregiving style.^{15,16,17} Similarly, a secure attachment at 13 months¹⁷ and maternal sensitivity at 22 months⁸ predicted effortful control at a later assessment.⁷

Finally, it is clear that effortful control is linked to positive development, even in the first five years of life. For example, laboratory or parent-report measures of toddlers' and preschoolers' effortful control have been associated with lower levels of problem behaviours, concurrently and at older ages.^{18,19,20,21} In addition, young children's effortful control has been found to correlate with, and predict over time, low levels of negative emotion,^{5,22,23} highly committed compliance,^{24,25} high levels of social competence,^{5,6,19,26} and conscience.^{20,24}

Conclusions

Although effortful control has a hereditary basis, it develops rapidly in the first four years of life, with marked improvements occurring in the third year. Individual differences in effortful control, although due partly to heredity, are also associated with the quality of mother-child interactions. Warm, supportive parenting, rather than cold, directive parenting, appears to predict higher levels of effortful control. Individual differences in effortful control that emerge during the first five years of life have been linked to higher levels of adjustment, social competence, committed compliance and conscience, concurrently and in the future.

Implications

The toddler and preschool years are a time in which temperamentally based effortful control emerges rapidly and provides the basis for the emergence of self-regulation. Self-regulation is critical because it affects the quality of children's social interactions and their capacity for learning. Because adults increasingly expect children to self-regulate as they mature, adults are likely to respond negatively to children who do not develop at least normative levels of self-regulation.

Although individual differences are due partly to heredity, it is likely that socializers can influence the emergence of children's effortful control. Because the quality of parenting is associated with higher levels of effortful control, it is important that parents and other caregivers be encouraged to interact with children in ways that foster the development of effortful control. Indeed, the relationship between parenting style and a range of developmental outcomes is likely due in part to the effects of parenting on children's self-regulation.²⁷ Because of the relation between effortful control and healthy psychological and socio-emotional development, service-providers and policy-makers are well advised to implement procedures that promote supportive parenting and teacher-child interactions.

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Temperament and Its Impact on Child Development: Comments on Rothbart, Kagan, and Eisenberg

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Topic

Temperament

Introduction

As noted by Rothbart, Kagan, and Eisenberg, the construct of temperament has been the focus of considerable developmental and clinical psychology research because it has the potential to capture the child's contribution to early developmental processes. Temperament refers to individual characteristics that are assumed to have a biological or genetic basis, that determine the individual's affective, attentional and motor responses cross-situationally, and that play a role in subsequent social interactions and social functioning. Early temperament research focused on establishing taxonomies of temperament dimensions, addressing measurement issues and examining stability of temperament across time. The three authors have conducted important longitudinal research that examines the extent to which temperament affects normative development, positive adjustment and the development of psychopathology. This work has considerable translational potential, as it may facilitate the development of appropriate interventions targeted toward children with different temperamental tendencies who may be vulnerable to learning and social difficulties.

Research and Conclusions

Current theory and research on infant and child temperament and its role in emotional functioning and behavioural adjustment has its roots in the work of Thomas and Chess.^{1,2,3} Their work stimulated a number of researchers interested in early socio-emotional development to explore the notion that inborn characteristics of the child contributed substantively to later behaviour, and to attempt to develop measurement strategies to capture these characteristics. Subsequent theories of temperament have varied in the numbers of temperament dimensions proposed, the emphasis on emotion versus behaviour and the extent to which the environment influences these initial tendencies.^{4,5,6}

Rothbart and colleagues^{6,7,8,9} articulated one of the most influential and comprehensive theories of early temperament, one that has generated a great deal of research on infant development over the last 10 years.^{10,11,12,13,14} This theory defines temperament along two

broad dimensions of reactivity and self-regulation, which then subsume multiple subscales that place a greater emphasis on basic emotion, attention and motor processes.

With respect to the reactive dimension of temperament, Rothbart notes that researchers may characterize an infant's initial responses by his physiological and behavioural reactions to sensory stimuli of different qualities and intensities. This reactivity is believed to be present at birth and reflects a relatively stable characteristic of the infant.⁹ The second dimension proposed by Rothbart, self-regulation, has been described largely in terms of attentional and motor control mechanisms that emerge across early development. For example, the development of attention and its use in the control of emotional reactivity begin to emerge in the first year of life and continue throughout the preschool and school years.^{6,15,16} Individual differences in the ability to voluntarily sustain focus or shift attention are critical components of self-control of attention. Attentional orienting skills, in particular, have been identified as a critical component of the regulatory process, since orienting has the direct effect of amplifying, at a neural level, the stimuli toward which attention is directed, changing the affective experience of the individual.¹⁷ Thus, orienting skills assist in the management of both negative and positive emotions, and consequently in the development of adaptive control of emotion and behaviour. Rothbart views the very young infant as a highly reactive organism whose behaviour becomes, with development, increasingly controlled by regulatory processes. It is these regulatory processes that may ultimately determine the young child's degree of success at mastering developmental achievements.^{18,19}

Eisenberg notes the importance of studying individual differences as well as normative development of one key dimension of temperament, effortful control. This term refers to a special class of self-regulatory processes that develop with the maturation of attentional mechanisms, particularly the anterior attention system.¹⁶ Although it is believed that effortful control begins to emerge at the end of the first year of life, its development continues at least through the preschool years, and again, is a likely candidate process in the development of childhood psychopathology. Eisenberg argues for the value of studying these effortful control processes across the first several years of life, since they likely play an important role in adaptive behaviour, and factors that affect the development of effortful control, including caregiving, may exert their effect prior to the emergence of the actual skills.

Kagan^{20,21} focuses his temperament theory on two extreme types of children — inhibited and uninhibited — that he argues represent distinct bio-behavioural profiles leading to patterns of approach versus withdrawal tendencies across childhood. In his view, the biological disposition toward inhibition functions as a foundation, rather than a constraint. Not all inhibited children, he notes, become shy, anxious adults. Presumably, some children who display inhibited tendencies early in development because of their biological disposition may develop strategies for coping with this early bias so that, over time, they engage in adaptive and appropriate behaviour.

The research cited by the three authors points to the value of understanding how and why early temperament affects child development. Although acknowledged, important child-environment interactions are minimized in much of this work. Greater emphasis on the

role of parents, teachers and peers in altering early tendencies and facilitating the development of appropriate self-regulation is needed.

Implications for the Policy and Service Perspectives

Rothbart, Kagan, and Eisenberg all highlight various ways in which early temperament may influence child development. One hypothesis that follows directly from Rothbart's theory of temperament is that temperament exerts its effects on child behaviour via the developing self-regulatory system. Recent developmental neuroscience work suggests that because of its dependence on the maturation of prefrontal-limbic connections, the development of self-regulatory processes is relatively protracted,²² from the development of basic and automatic regulation of physiology in infancy and toddlerhood to the more self-conscious and intentional regulation of cognition emerging in middle childhood.²³ From a developmental perspective, then, opportunities for success and failure of self-regulation are numerous over the course of childhood, particularly given the potential of environmental factors such as parenting to facilitate or disrupt development in these domains.²⁴

Normative achievements in self-regulation are the hallmark of positive adjustment, and failures of self-regulation characterize adjustment problems of childhood. Indeed, many consider the development of emotional self-regulation in particular to be one of the key processes in childhood behaviour problems.^{25,26,27,28} For example, in characterizing the behaviour of children with early externalizing behaviour problems, there is often reference to a lack of control, under-control, or poor regulation.^{29,30} In characterizing the behaviour of children with internalizing disorders, there is often a discussion of over-control.¹² Understanding the role of temperament in child development may be facilitated by examining the possible mediational effects of emerging self and emotion regulation, and may provide a more proximal mechanism for the development of different forms of behavioural adjustment difficulties characteristic of childhood.

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The Impact of Temperament on Child Development: Comments on Rothbart, Kagan, and Eisenberg

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Topic

Temperament

Introduction

The articles on temperament present three lucid reviews of contemporary temperament research, including one review of the field of temperament as a whole (Rothbart) and two reviews of particular temperament traits (Kagan on inhibition and Eisenberg on effortful control). These reviews convey the vibrancy of this burgeoning field of research. Although parents throughout history have undoubtedly recognized that their children show distinctive behavioural patterns from early in life, recent research has probed the nature of these behavioural patterns in greater depth. Specifically, over the last several decades, researchers have documented what temperament traits exist in young children, how stable such traits are, and how children's temperament shapes important outcomes such as social competence and psychopathology.

Research and Conclusions

Temperament researchers have hotly debated the very definition of *temperament*. The pieces on temperament, in fact, differ in the ways temperament is conceptualized. All three authors agree that temperament involves individual differences in emotional and behavioural processes, which emerge early in development and are shaped by biological processes. Kagan appears to equate temperament with the biological processes underlying early behavioural differences in positive and negative emotions and approach and avoidance. Rothbart adds that temperament is also shaped by context and life experiences, emphasizing that temperament itself develops over time. Rothbart sees temperament as including a broader array of traits, including the positive and negative emotion traits noted by Kagan, as well as early traits indicating self-control (attention, effortful control and persistence). Most contemporary researchers accept the broader definition offered by Rothbart,^{1,2} and there is great interest in early temperament traits reflecting self-regulation, as described by Eisenberg. Further, recent research with infant twin pairs has made it clear that children's individual differences arise from both genetic factors and environmental experiences, even during infancy.³ Thus, children's temperamental traits are shaped by a combination of genetic and environmental factors, both early in development and across childhood.¹

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The three pieces provide excellent and accurate reviews of temperament in terms of its measurement, development over time and biological and environmental underpinnings. To these reviews, four further points about recent research can be added.

First, the array of temperament traits may be even broader than the lists provided by Rothbart. Rothbart notes a number of temperamental traits that can be measured in young children: positive emotions and approach, activity level, fearfulness, anger/frustration, attention and effortful control. By around age three, children also appear to differ in two other traits: 1) Agreeableness — affiliation, kindness and nurturance versus antagonism toward others (a trait noted briefly by Rothbart); and 2) Intellect/imagination — curiosity, creativity and cleverness.¹ Agreeableness and Intellect/imagination shared several features with the temperamental traits included in Rothbart's list: a) Comparable traits have been observed in more rudimentary forms in a number of animal species;⁴ b) Parents from many countries use all of these traits to describe the most important characteristics of their children;⁵ c) All of these traits can be observed in older children, adolescents, and adults;^{1,6} and d) All of these traits are moderately heritable in late adolescence and adulthood.^{1,6}

Second, there are now good data on the extent to which children's early traits exhibit continuity. After the first few months of life, is there convincing evidence for continuity in children's temperaments? According to a recent comprehensive synopsis of data addressing this question, children's temperamental traits show only modest stability during infancy and toddlerhood and then show a rather large increase in stability by around age three.⁷ Surprisingly, temperament does not appear to become more stable during the elementary-school years and adolescence, but remains moderately stable, comparable to the level of stability seen in the preschool years. In short, preschool-age children's temperamental traits meaningfully predict their later personalities, but there is also good evidence that children do still change across the childhood and adolescent years.

Third, it is now clear that children's temperaments shape their outcomes, in part by forming the ways that children engage and evoke responses from their environments.¹ Children interpret their environmental experiences differently depending on their temperaments. For example, anxious and irritable children tend to perceive negative events in their lives as more threatening than do children with lower levels of negative emotions.⁸ Children's temperaments also shape the responses typically evoked from other people. For example, mothers of infants who are irritable and hard-to-soothe experience lower confidence and greater depression than do mothers of more temperamentally easy infants;⁹ similarly, more emotionally negative children evoke more negative parental responses than less emotionally negative children in the same family.¹⁰ Children's temperaments likewise affect the responses they evoke in other caregivers, teachers and peers.¹

Fourth, different parenting strategies appear to work better for children with certain temperaments. Thomas and Chess introduced the idea of "goodness-of-fit" many years ago in some of the earliest contemporary work on temperament. According to this model,

the outcome of a child's temperament will vary, depending on how well the parents can adapt their parenting style to the child's temperament.¹¹ Although this notion is intuitively appealing, for many years it proved difficult to substantiate with data. More recent work, however, has demonstrated several replicable instances of "goodness-of-fit."^{12,13,14} For example, children who are aggressive and difficult to manage appear to receive particular benefit from a parenting style involving more restrictive control and lower parental negativity. Shy children appear to benefit from being encouraged by parents to explore novel situations and are more likely to remain shy and inhibited if parents are overprotective. Beyond the family environment, children's school environments, peer relationships and neighbourhoods can have additional important impacts on whether children's early temperaments remain stable and on whether their temperaments lead to good or poor outcomes.¹⁵

Implications

Rothbart, Kagan, and Eisenberg note several crucial implications of current temperament research. Children's behavioural differences stem in part from influences beyond social learning; rather, there are important hereditary influences on children's temperaments (Rothbart, Kagan, and Eisenberg). Early effortful control and attention confer a variety of benefits for children, and caregivers and teachers should make every effort to help children cultivate these positive traits (Rothbart and Eisenberg). In contrast, children's early tendencies toward extraversion versus shyness and toward fearfulness versus fearlessness confer both risks and possible benefits (Rothbart and Kagan; Kagan's description of the specific risks and benefits of inhibition is speculative at this juncture).

A final implication should be emphasized. Some children pose greater challenges to parents, teachers and other caregivers because of their temperaments. In particular, several temperament traits may be particularly challenging for some caregivers: irritability/frustration, fearfulness, high activity level and low effortful control. In such situations, caregivers are likely to benefit from additional support and education; in particular, caregivers can be helped to avoid negative responses that might be naturally evoked by children's temperaments. For example, parents have been successfully taught how to manage irritable, hard-to-soothe infants so that such children can develop a secure attachment.¹⁶ By providing support and education to caregivers, it may be possible to help children achieve better "goodness-of-fit" in the worlds in which they grow up.

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