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Temperament

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Table of content

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Synthesis

How important is it?

Temperament refers to individual characteristics that are assumed to have a biological 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 disposition refers to distinctive patterns of feelings and behaviours that originate in the child's biology and appear early in development. 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.

One of the basic dimensions of temperament is effortful control. 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. These abilities underlie the emergence of self-regulation. The skills involved in effortful control are likely quite important for learning and children's emerging adjustment and social competence. Also, children who are not well regulated are likely to elicit negative reactions from both peers and adults.

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?

The current list of temperament dimensions includes three broad basic dimensions: Extraversion/Surgency, which is related to positive emotionality, 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 factors have been linked to emotional and attentional brain systems in humans and in non-humans.

Temperament 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 behavioural inhibition to novel or intense stimuli. It is also late in the first year of life that children begin to develop effortful control. This ability develops rapidly in the first four years of life, with marked improvements occurring in the third year. Considering the rapid pace of development during the first years of life, it is not surprising that 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. However, temperament does not appear to become more stable during the elementary-school years and adolescence. In other words, 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.

There is good evidence that children's temperament traits make some life outcomes more or less likely to occur. For example, it is clear that effortful control is linked to positive development, even in the first five years of life, since it has been associated with lower levels of problem behaviours and has been found to correlate with and predict low levels of negative emotion, highly committed compliance, high levels of social competence, and conscience. Links have also been identified between temperament and the development of psychopathology.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. Negative emotional reactivity has been found to predict both internalizing problems (e.g., anxiety, depression) and externalizing problems (e.g., aggression, rule-breaking).

Yet it is important to remember that temperament is not destiny. Even if they have a basis in genetic and other biological processes, temperamental traits are shaped by a combination of genetic and environmental factors both early in development and across the childhood years. For example, four-month-olds who show high levels of motor activity and distress, called high-reactive, are likely to become inhibited to the unfamiliar at 1-2 years old and report more unrealistic worries and more frequent bouts of depression at age 18, whereas low-reactive infants are likely to become uninhibited to the unfamiliar in the second year and are at a slightly higher risk for asocial behaviour at age 18. However, most of the children in both groups will not develop any mental symptoms or psychiatric condition. Seriously negative outcomes require very specific rearing conditions. In other words, children's experiences play a part in whether a trait leads to

positive or negative outcomes, and the history of a child's experiences with a given situation or another person becomes increasingly important in the child's life.

Among these experiences, parenting may play an especially important role in moderating the outcomes of children's traits. First, child's temperament and parenting influence each other. For example, child positive emotional reactivity, fearfulness, and self-regulation elicit warmth from parents, whereas child negative emotional reactivity results in more negative parental control. Second, child's temperament and parenting also interact to predict outcomes. For example, children who have high levels of fearfulness are less likely to have internalizing and externalizing problems if their parents are high in warmth and in gentle discipline strategies. Genetically informed studies also help understanding these interactions. For example, children at genetic risk for behavioural difficulties characterized by poor physiological regulation were shown to be less vulnerable to such difficulties when exposed to sensitive caregiving early in development.

What can be done?

Parents should appreciate that each temperamental quality has advantages and disadvantages in contemporary society. Also, 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 solely the 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. The caregivers can thus become more accepting and valuing of each individual child.

Children's traits and the outcomes of those traits can be modified directly through prevention and intervention efforts. Intervention programs have been designed to modify children's typical patterns of behaviour, including their self-regulation abilities, emotional competence, and coping skills. Training in attentional control has been successfully used with four-year-old children, and can be adapted to preschool settings.

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. 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. Children who are aggressive and difficult to manage seem to benefit from a parenting style involving more restrictive control and lower parental negativity. Firm, consistent parental discipline appears to be particularly

important for children who have difficulties with self-regulation. Since children who have high levels of negative emotionality or self-regulatory problems present greater challenges to parents than other children, it may be especially difficult to provide optimal care for them. Their parents appear likely to use less firm control over time,but they are also the very children who especially need calmly-persistent caregiver efforts. Fearful children tend to develop greater early conscience and do best under parental warmth and gentle 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 caregivers because of their temperaments. In such cases, caregivers are likely to benefit from additional support and education. They can be helped to avoid negative responses that might naturally be evoked by children with more difficult temperaments. For example, parents have been successfully taught how to manage irritable, hard-to-soothe infants so that such children can develop positive coping strategies and secure attachments with their caregivers.

Early Temperament and Psychosocial Development

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Introduction

Temperament refers to individual differences that can be seen early in life, shaping our reaction to events in the social and physical environment, and the environment’s reaction to us. Temperament includes the child's dispositions toward emotionality, activity and orienting, along with their attention based effortful control. The study of temperament is a rapidly growing research area, and the influence of temperament on developmental pathways and outcomes has now been recognized even in areas that have traditionally been seen almost exclusively the result of socialization, such as conduct problems, school performance, empathy and the development of conscience.[1,2,3]

Subject

Temperament can be observed before many of the more cognitive aspects of personality have developed. The parent can observe temperament in the patterns of the child's behaviour and emotions in different situations. How does the child respond to new situations? How does the child respond to frustration? Can the child control his behaviour and emotions? How soothable is the child when s/he has become upset? To date temperament includes variability in positive affect and approach, fear, frustration, sadness and discomfort as well as attentional reactivity and attention controls on behaviour, thought and emotion.[1,2]

Children’s temperamental dispositions are reflected in orientations toward or away from objects, people and events[1,4,5] and other forms of reactivity. Influences of the child's experiences, which in turn are shaped by the child’s temperament, are critical to the development of coping, understanding of the meaning of things, competence and motivation.[1,2,5,6]

Problems

Research on temperament in childhood is based on multiple methods, including questionnaires, laboratory and home observations with each approach demonstrating both advantages and disadvantages.[1,2,5] On the positive side, caregiver-report questionnaires are inexpensive to administer and they are based on a wide range of behaviours observed by parents or teachers. Questionnaires also allow measurement of many temperament variables at the same time, so that the underlying structure of temperament can be explored. 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 coder objectivity while seeing children in their natural habitat.[1,2]

There are also problems with each of these methods. Caregiver reports in questionnaires 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 another. 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.[1,2] New methods are now being developed in studies of the brain and nervous system. We are finding brain networks that are linked to behaviour and arousability, and we are able to study how these networks change and develop.[7,8]

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. Some of these dimensions referred to general threshold for responses and general intensity of responses, which has not been supported. Thresholds and intensity vary with the system being studied, e.g., positive reactivity and negative reactivity. Also some of their dimensions pit one dimension against another, so we have positive mood versus negative mood, whereas children can be high in one mood and also in the other. Thus revisions to the Thomas and Chess list have been indicated;[1,2] 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

Dimensions of Temperament

Factor analyses of children's temperament as measured by questionnaires have led to a revised list of temperament dimensions in infancy and early childhood that began with the dimension identified by Thomas, Chess and colleagues[4]: activity level, approach, withdrawal, distractability, attention span, persistence, adaptability, rhythmicity and mood. The revised list includes 1) positive emotionality; 2) activity level; 3) fearfulness; 4) anger/frustration; 5) attentional orienting; 6) sadness, and later in childhood 7) effortful control, i.e. the capacity to inhibit a dominant response in order to perform a subdominant response.[1,2]

During early and middle childhood, three broad factors have consistently been found in parent reports of temperament: Surgency or Extraversion, related to positive emotionality and activity; Negative Affectivity, related to the negative emotions and soothability. Effortful Control is related to attentional, inhibitory and activational control. These factors have been linked to emotional and attentional brain systems in humans and in non-humans.[1,2]

Development of Temperament

Temperament also develops. During the first few months of life, individual differences in orienting, distress proneness, positive affect, approach, fear, sadness and frustration can be observed.[1,2] By six months of age, when infants are presented with objects, some infants will also show rapid approach by reaching and touching them, while others will approach more slowly.[9] Infant approach tendencies and smiling and laughter in the laboratory predict parent-reported extraversion at seven years.[10]

Late in the first year and beyond, individual differences in fearful inhibition to novel or intense stimuli can be observed.[11,12] 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.[4,12] Fearful children tend to develop greater early conscience[3] 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 patterns in conscience development.

We continue to learn about how children's emotion and behaviour is regulated. In infancy, children's orienting appears to be the major regulator, including looking away or the presentation of distractors by the caregiver, but late in the first year of life, effortful control begins to develop, allowing the child to inhibit a dominant response and allowing better pursuit of a coherent plan of action. The brain network underlying effort control is called the executive attention network.[7] 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.[13,14] 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 their control over negative affect.[1,2] Effortful control is strongly related to children's social compliance, and to the development of empathy and guilt or shame in children.[11,12,14]

Temperament and the Brain

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.[7,15] Recently, networks of brain areas have been shown to be correlated during the resting allowing researchers to study the development of brain networks in infants.[16] Where possible, laboratory tasks have been used in the study of the development of orienting and effortful control. Performance on these tasks is positively related to parents' reports about children's ability to control attention and emotion.[17,18] In adults, performance on these tasks has been linked to the action of specific genes, and developing evidence supports the heritability of temperament.[19,20] Increasingly, studies have also found that effects of parenting depend on the temperament and genotype of the child, with negative emotionality and surgency/sensation seeking influencing outcomes in both positive and negative directions.[20]

Temperament and the development of behaviour problems

Temperament has also been linked to the development of psychopathology.[1,2,21] Temperament may heighten responses to stressful events or buffer their 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 borderline personality disorder, substance abuse and other externalizing behaviour.[8]

Conclusions

The list of temperament dimensions identified by Thomas and Chess4 has been revised to reflect subsequent research: broad basic dimensions with their subcomponents 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.[22] Positive links have been found between negative affectivity and extraversion and behaviour problems,[1,2] whereas effortful control is related to adaptation and low behaviour problems.[1,2] Both fearfulness and effortful control have predicted the development of conscience.[3] Links are also increasingly being made between temperament and genetic variations[19,20] and between questionnaire measures and measures of brain processes.[1,7,21]

Implications

It is important for adults to realize that children's behaviour and emotions are not solely the 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.[1,2] Knowing this means that differences among developing children do not mean that there are good children or bad children. Each person acts with what they bring to a situation, and we can embrace the differences rather than condemning the child for not being what we wanted or expected. Training in attentional control has been proven useful for children with ADHD[23] and has been shown to sometimes have general effects on children's cognitive processing.[24,25]

For those who wish to study any of the temperament dimensions such as fear, anger, positive affect, and effortful control, discussed in more detail, the Handbook of Temperament is a rewarding source book.[26] There you can also find applications of temperament non-human animals, peer relationships, personality traits, psychopathology and applications in school and psychotherapy. Each article reflects the progress we have made and the prospects for the future.

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Temperament

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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 distinctive patterns of feelings and behaviours that originate in the child’s biology and appear early in development.[1]

Subject and Problems

The biological foundation of a temperamental bias is usually, but not always, genetic. In some cases it is the result of prenatal stress or infection to the pregnant mother which affects the fetus. An important source of the biological foundation of a temperamental bias is variation in the concentration of neurotransmitters and the density and location of the varied receptors for the large number of molecules that can affect brain function, including glutamate, GABA, dopamine, norepinephrine, serotonin, opioids, acetylcholine, corticotropin-releasing hormone, the sex hormones, vasopressin and oxytocin.[2]

This claim implies a very large number of temperamental biases, most of which are unknown. Because it is not yet possible to measure the neurochemistry that is the basis of a temperamental bias, scientists rely primarily on specific behavioural profiles. The behaviours in infants and young children that are most often attributed to a temperamental bias are unusually high or low levels of irritability, motor activity, smiling, ease of regulating these responses, and a consistent tendency to approach or to avoid unfamiliar people, objects, and places.

Because the likelihood of a behaviour being expressed is controlled, in part, by the local setting and it is difficult for scientists to observe children in a number of settings, some psychologists administer questionnaires to parents asking them to describe the behaviours of their children and assume that these descriptions are, by and large, accurate. This assumption is not always valid because some parents are not sensitive observers of their children. The correlations between parental descriptions and direct behavioural observations of the comparable behaviours are low to

modest.[3,4] Therefore, it is better practice to combine parental reports with behavioural observations but award priority to the behaviours.

A temperamental bias does not determine a behaviour because life experiences create an envelope of possible traits in children with the same temperament. By the second year a blend of the child's temperamental biases with the products of experience has produced a seamless tapestry making it difficult to detect the early temperamental biases of most children. The same behaviour could be the partial result of a temperamental bias or the product of experience alone. Not all shy children inherit a temperamental bias favouring that kind of response. Therefore, studies of adult temperaments, often based on questionnaire data, are open to criticism.

Research Context

Two of the many temperamental biases that have been studied most extensively refer to the typical behaviours of one- and two-year-olds to unfamiliar people, objects, and situations. About 10 to 20% of middle-class American children are consistently shy with strangers and avoidant of unfamiliar objects and situations. These children are called behaviorally inhibited. This group is contrasted with the 30 to 40% who show the complementary traits of approaching most unfamiliar events. These children are called uninhibited.[5] Both kinds of behaviours appear to be partly heritable. These proportions of inhibited and uninhibited vary in different class, ethnic, and national groups. Although some members of mammalian species display actions that resemble inhibited and uninhibited children, we do not know if the biological bases for these groups resemble the bases in humans.

Independent studies by Kagan and Fox[2,5,6] have revealed that these two styles of behaviour can be predicted by variation in vigorous motor behaviour and crying to unfamiliar visual, auditory and olfactory stimuli in four-month-old middle-class white infants. 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. High and low reactive are two infant temperaments that are presumed to be due, in part, to different thresholds of excitability in the amygdala. This assumption is supported by the fact that older children who had been high reactive infants are more likely than low reactive infants to have higher and less variable heart rates.

Research Results

Continued study of these two groups through age 18 has revealed several interesting facts. American adolescents who had been high reactive infants report more unrealistic worries than most adolescents, including visiting new places, meeting strangers, entering crowds, and brooding over possible harm to the self or a parent, and more frequent bouts of depression.[7] These properties are rare in adolescents who had been low reactive infants. Second, measurements of the brain anatomy and function revealed that the 18 year old high reactives had a thicker cortex in an area of the prefrontal region of the right hemisphere that projects to sites that mediate defensive postures to threat as well as an amygdala that was more reactive to the unexpected appearance of pictures of unfamiliar scenes.[8] This evidence supports the belief that high and low reactive infants were born with different neurochemical profiles in the amygdala.

Although adolescents who had been high-reactive infants are at a slightly higher risk than most for developing social anxiety or depression, they are not at a higher risk for phobias to animals or blood. Low-reactives are at a slightly higher risk for asocial behaviour. These outcomes require specific rearing conditions and local circumstances. Most children in both groups will not develop any mental symptoms or psychiatric illness.

A temperamental bias restricts the acquisition of a particular personality trait, rather than determine a certain profile. The probability that a high-reactive infant will not become an extremely sociable, spontaneous, relaxed adolescent, free of unrealistic worries is very high. However, the probability that this category of child will be a quiet, anxious introvert is low. Thus, the biology that is the foundation of a temperamental bias functions as a constraint on what is possible rather than as a determining force.

Conclusion and Implications

Parents should appreciate that each of these two temperamental types has advantages and disadvantages in contemporary society. A technological economy requires many adults who like to work alone, including computer programmers, historians, bench scientists, and mathematicians. These vocations allow adults to work in environments where they can control the level of uncertainty and keep unanticipated interactions with strangers to a minimum. High-reactives tend to avoid risk and, therefore, are less likely to drive at high speeds, experiment with drugs, engage in sex at an early age, or cheat on examinations.

Low-reactive, uninhibited children enjoy their 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.

As children develop, their temperament makes a more substantial contribution to their private feeling tone than to the public personality they display to others. The chronic possession of a relaxed or tense feeling tone requires a more substantial contribution from temperamental biases than does a sociable or shy posture with others.

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Temperamental Effortful Control (Self-Regulation)

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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.”[1,2] 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 or class, 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.[2,3]

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 over time 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) and prefrontal cortex.[3] 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.[1,3,4]

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.[2,3] 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 and molecular geneticists have also attempted to identify the degree to which heredity contributes to effortful control and interacts with environmental influences when predicting self-regulation. 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 age[9] 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 Rothbart[4] 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 sensitivity, and negatively related to a directive and controlling caregiving style.[15,16,17] Moreover, children's heredity and quality of their attachment interact to predict their self-regulation; children with certain *serotonin*-related *polymorphisms* are more susceptible to the low self-regulation if they have an insecure (but not secure) attachment.[18]

Finally, it is clear that effortful control is linked to optimal development, even in the first five years of life. For example, laboratory or parent-report measures of toddlers', preschoolers' and children's effortful control have been associated with lower levels of problem behaviours, concurrently and at older ages.[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,[7,19,20,22,23] conscience,[19,24,25] high levels of social competence,[5,7,26] andhighly committed compliance.[26,27]

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 influence the emergence of children's effortful control; moreover, genes and the social environment interact in their effects on regulation. 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 relation between parenting style and a range of developmental outcomes is likely due in part to the effects of parenting on children's self-regulation.[28] 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, Parenting and Implications for Development

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Introduction

Children's temperament is often defined as biologically-based differences in reactivity and self-regulation.[1] Research has focused most on temperament dimensions of self-regulation or effortful control, general positive emotional reactivity, general negative emotional reactivity, and more specific aspects of negative emotionality reflecting fearfulness and inhibition on the one hand, and anger and irritability on the other hand. Much research has also considered whether temperament dimensions predict subsequent child adjustment outcomes. Some research has considered how temperament and parenting combine to predict child outcomes. Parental warmth (support, affection) and firm control (discipline) have been identified as particularly important.[2]

Subject

According to current systems theories of child social development,[3] temperament-related behaviour and parenting behaviour influence one another, and are independently associated with child socio-emotional development. In addition, some temperament characteristics lead to better or worse outcomes depending on parenting, and vice versa – some parenting behaviours lead to better or worse outcomes depending on temperament.[1]

Problems

One challenge in examining the influences of parenting and temperament on one another is that cross-sectional studies, which measure temperament and parenting at only one point in time, do not clarify the direction of influence between temperament and parenting. To clarify directionality, longitudinal studies or experimental methods are needed. However, factors like participant attrition and the problem of replicating real life experience in a lab context present considerable challenges for longitudinal studies and experiments, respectively. Thus, many studies have relied on cross-sectional, correlational methods which prevent inferences regarding the direction of

influence.

Research Context

Certain dimensions of temperament have been found to predict subsequent child outcomes. Specifically, negative emotional reactivity has been found to predict both internalizing problems (e.g., anxiety, depression) and externalizing problems (e.g., aggression, rule-breaking).[1] Fearfulness predicts internalizing problems, and self-regulation difficulties predict externalizing problems.[1] The large literature on parenting[2] generally shows that high levels of warm and firm parenting are associated with positive child development.[4]

Key Research Questions

1. Which temperament dimensions influence which parenting dimensions?
2. Which parenting dimensions influence which temperament characteristics?
3. How do temperament and parenting interact to influence developmental outcomes?

Although temperament and parenting each independently predict outcomes, the associations are only moderate in strength,[5] allowing the possibility that parenting may increase the risk of problem outcomes in children whose temperament predisposes them to adjustment problems.

Recent Research Results

Temperament -- Parenting: There is some, but not much, evidence that child positive emotional reactivity may elicit higher levels of parental warmth.[6,7] There is also a little evidence of the opposite direction of effects, suggesting that parental warmth gives rise to more child positive emotionality.[8,9] We do not yet have enough evidence to know whether child positivity and parental control influence one another.

More studies have examined associations between child negative emotional reactivity and parenting. With contradictions possibly related to child age, some studies suggest that child negative emotionality elicits more parental warmth,[10] whereas other studies suggest it has mixed associations with parental warmth.[11] However, there is more consistent evidence that high levels of parental sensitivity/responsivity lead to less child negative reactivity.[8,12] There is also some evidence that child negative emotionality predicts more negative parental control,[7] and a little evidence that negative parental control predicts more negative emotionality.[13] In terms of more

specific aspects of negative emotionality, child fearfulness predicts more parental warmth and more positive control.[14] Similarly, low levels of parental warmth predict increases in fearfulness.[12]

Studies have also examined associations between child self-regulation and parenting. Higher levels of child self-regulation consistently predict more parental warmth[14,15] and less parental control.[16] Similarly, parental warmth predicts better child self-regulation,[17] and more negative parental control predicts poorer child self-regulation.[13]

Temperament X Parenting Interactions: In the study of interaction effects of temperament and parenting on developmental outcomes, one replicated pattern of associations involves child self-regulation and parental control. Children's self-regulatory difficulties are more likely to lead to externalizing problems when parents use inconsistent discipline strategies or are low in firm discipline.[18,19] Another replicated finding involves temperament-related fearfulness. Children who have high levels of fearfulness are less likely to have internalizing and externalizing problems if their parents are high in warmth and in gentle discipline strategies.[20,21]

Research Gaps

To clarify the developmental relationship between children's temperament and parenting, more longitudinal studies are needed, especially ones that include statistical controls for parenting and temperament at earlier time points, allowing tests of temperament as predictors of change in parenting and tests of parenting as predictors of change in temperament. Such studies are particularly needed in the developmental era of adolescence. Further, much more investigation of basic mechanisms underlying these associations is needed. Neuropsychological processing is one example. Although children who have been maltreated show different brain activity in response to facial emotion than nonmaltreated children,[22] we know little about children's neural processing of a wide variety of parenting behaviours, and we know even less about temperament-related differences in such neural processing.

Conclusions

Based on studies conducted so far, findings suggest that child positive emotional reactivity, fearfulness, and self-regulation elicit warmth from parents, whereas child negative emotional reactivity results in more negative parental control. Conversely, parental warmth and positive control appear to contribute to children's development of less negative emotional reactivity and more positive emotional reactivity and self-regulation.

Firm, consistent parental discipline appears to be particularly important for children who have difficulties with self-regulation. Parents' use of firm control may lead, over time, to the development of better self-regulation for children who are initially low in self-regulation. In addition, parental warmth and gentle control appears to be particularly important for children who are highly fearful. One possible explanation is that harsh parenting is too emotionally arousing for highly fearful children to absorb socialization lessons. Findings, thus, are beginning to suggest ways to increase the "goodness-of-fit" between the parenting strategies and the child's temperament.

Implications for Parents, Services and Policy

Some children especially need firm, consistent parenting, and other children especially need gentle parenting, according to recent studies. Studies showing the influence of child temperament upon parenting suggest that children who have high levels of negative emotionality or self-regulatory difficulties are more difficult to parent than other children. In addition, behavior genetic studies suggest genetic factors contribute to temperamental differences among children and influence the association between temperament and child outcomes.[23] Children with tendencies toward negative emotionality and poor self-regulation may be especially difficult to provide optimal care for, and their parents appear particularly likely to use less firm control over time,[24] but they are also the very children who especially need calmly-persistent caregiver efforts. Recognizing interplay between temperament and parenting offers potentially useful ways of specifying the challenges involved in parenting, caring for, and educating an individual child and devising care that is a good fit to the child and the family.

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

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Introduction

As noted by Rothbart, Kagan, Eisenberg, and Schermerhorn and Bates, 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 five 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. This research also reveals which dimensions of parenting, or socialization more broadly, may interact with which child tendencies to influence behavioural trajectories and outcomes.

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 20 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.

Schermerhorn and Bates address the complex transactions that occur between children and parents as a function of both children's temperament and parenting behaviour. The most consistent findings suggest that both child negative reactivity and self-regulation are predictive of, and predicted by, specific dimensions of parenting behaviour. These findings support the notion that child temperament is part of a dynamic system of dyadic interactions that modifies both caregivers and offspring over time. Not surprisingly, child temperament and parenting behaviour also interact to predict subsequent behaviour and functioning. Again, the research findings identify specific dimensions of temperament, notably fearfulness and self-regulation, that are implicated in these interactional pathways, suggesting that some temperament dimensions are more modifiable, or predictive of particular outcomes, than others.

The four perspectives on temperament and temperament research presented here highlight a number of areas of agreement that are critical to ongoing research and application of temperament theory. Temperament is manifest early in development, modifies and is modified by the environment, and is influential in behavioural adaptation. The notion that it is biologically-based, an early tenet of temperament theory, continues to generate much empirical work, particularly, and as several of the authors note, as the fields of genetics and neuroscience have become integrated into mainstream developmental psychology.

The field of temperament has further come to recognize that co-action, transaction, and interaction characterize development in any biologically informed model of child functioning.[22] By incorporating biological indicators of temperament and functioning, temperament researchers are able to shift the focus of the research from the observation that an interaction between parent

and child has occurred and leads to a specific behavioural outcome, to how and why that interaction leads to behavioural change. In fact, recent temperament work has adopted an empirical approach that measures functioning across multiple biological levels of analysis, and that examines how the environment may modify these biological processes. So, for example, in one recent study that assessed the genetic and physiological basis for self-regulation, the researchers found that children at genetic risk for behavioural difficulties characterized by poor physiological regulation were less vulnerable to such difficulties when exposed to sensitive caregiving early in development. Thus, the presumed mechanism for successful behavioural adaptation is a physiological system that supports the regulation of behaviour. [23] Importantly, that physiological system is highly responsive to sensitive caregiving early in development. Understanding the genetic, neural, physiological and behavioural mechanisms responsible for developmental adaptation will be the focus of much future temperament research.

Implications for the Policy and Service Perspectives

Rothbart, Kagan, Eisenberg, and Schermerhorn and Bates 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 temperamental reactivity 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,[24] 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.[25] 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.[26] The next generation of temperament research will focus a great deal on the complex biological processes involved in these developmental pathways and the way these processes may be modified by the environment.

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.[27,28,29,30] 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, Eisenberg, Kagan, and Schermerhorn and Bates

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Introduction

The articles on temperament present four lucid reviews of contemporary temperament research, including one review of the field of temperament as a whole (Rothbart), two reviews of particular temperament traits (Kagan on inhibition and Eisenberg on effortful control), and one review of research on the interplay of temperament and parenting in development (Schermerhorn & Bates). These four pieces 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 four especially important findings: 1) temperament consists of individual differences in extraversion, negative affectivity, and effortful control and is shaped by both genetic and environmental factors, 2) temperament influences children's experience of the environment, 3) temperament interacts with experiences to shape important life outcomes, and 4) although temperament shows stability, it can change both naturally and through intervention. The following sections review these four major themes and highlight additional research addressing each topic.

Research and Conclusions

The nature of temperament

Temperament researchers have hotly debated the very definition of temperament for decades. In more recent years, however, there is increasing consensus about the basic nature of temperament,[1,2] and those shared views are reflected in the reviews. All the authors agree that temperament involves individual differences in emotional and behavioural processes that emerge early in development and are shaped by biological processes. Three overarching traits that meet

this definition are described by Rothbart. Extraversion or Surgency taps children's tendencies toward sociability, positive emotions, and eagerness in approaching potentially pleasurable activities. Negative Affectivity measures children's general tendencies toward a wide range of negative emotions, including both fearfulness and irritability/frustration. The tendency described by Kagan as inhibition is most likely a blend of low extraversion and high negative affectivity, especially fear.[3] Effortful Control reflects children's emerging behavioural constraint and regulation. Another potential temperament trait involves differences in affiliation, empathy, kindness, and nurturance versus antagonism (a trait mentioned briefly by Rothbart); these tendencies show some stability in early childhood and are influenced in part by genetic influences like other temperament traits.[4]

As Rothbart notes, temperament traits emerge in more rudimentary form in infancy, but they expand to include more complex traits over time. For example, Eisenberg describes how children's capacities for self-regulation broaden from more limited skills in deploying attention in infancy to more complex repertoires for behavioural control in the preschool years. Although temperament has a basis in genetic and other biological processes, it is important to recognize that temperament is shaped by experience as well. At birth, infants' temperament traits have already been influenced by prenatal experiences,[5] and experiences continue to shape gene expression after birth.[6,7,8,9] In addition, new genetic influences on temperament traits arise later in development.[10] Thus, children's temperamental traits are shaped by a combination of genetic and environmental factors both early in development and across the childhood years.

Temperament influences children's experience of the environment

One of the most profound ways that temperament shapes development is that it causes children to have different experiences of the environment.[1,11] First, children's temperaments shape the responses typically evoked from other people. As Schermerhorn and Bates describe, children who are more extraverted, fearful, and self-controlled tend to evoke more parental warmth, whereas children with higher levels of other negative emotions tend to evoke more negative attempts from parents to exert control. Children's temperaments likewise affect the responses they evoke in other caregivers, teachers and peers.[12] Second, 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.[13]

Temperament interacts with experiences to shape important life outcomes

Although temperament is certainly not destiny, there is good evidence that children's temperament traits make some life outcomes more or less likely to occur. For example, as Kagan notes, more inhibited children have a slightly greater chance than other children of developing social anxiety or depression. In contrast, Eisenberg summarizes research indicating that high effortful control is associated with a number of positive outcomes, such as fewer behaviour problems and stronger social competence. However, in many cases, children's experiences play a part in whether a trait leads to positive or negative outcomes. As Schermerhorn and Bates suggest, parenting may play an especially important role in moderating the outcomes of children's traits. 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.[14] More recent work has demonstrated several replicable instances of "goodness-of-fit."[1,15,16] 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.[12]

Although temperament shows stability, it can change naturally and through intervention

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 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.[17] 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. New research has also demonstrated that children's traits and the outcomes of those traits

can be modified more directly through prevention and intervention efforts. Intervention programs have been designed to modify children's typical patterns of behaviour, including their self-regulation abilities, emotional competence, and coping skills.[18,19,20]

Implications

All of the target pieces 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. 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. In contrast, children's early tendencies toward extraversion versus shyness and toward fearfulness versus fearlessness confer both risks and possible benefits.

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.[21] 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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