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Temperament and Its Role in Developmental Psychopathology

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Abstract

Temperament refers to early-appearing variation in emotional reactivity. The core dimensions of temperament and optimal method for assessment continue to be sources of considerable discussion. Nevertheless, the moderate stability of most temperamental traits and the strong influence of genetic and unique environmental factors have been well established, along with temperament's association with childhood psychiatric disorders. Both a temperamental predisposition toward experiencing negative emotions and low inhibitory control are linked to many psychiatric conditions, while other dimensions, such as levels of extraversion, vary by, and likely even within, disorders. Accumulating research directed at understanding the mechanism of these links between temperament and psychopathology indicate that, at least for most disorders, the two constructs cannot be viewed as simply different points along a shared continuum. The effect of temperament upon psychopathology has been found to be mediated and moderated by a number of both internal and external factors. Additional research is needed to help further define the core dimensions of temperament and the complex mechanisms through which temperamental traits interact with other influences in affecting developmental trajectories.

Keywords

anxiety; attention-deficit/hyperactivity disorder; children; personality; psychopathology; temperament

The study of temperament and its relation to psychopathology has experienced a surge of interest and stands poised to alter our fundamental understanding of psychiatric disorders. Research in temperament and personality lay dormant for many years as psychodynamic and learning-based theories dominated the field.¹ When it rewoke, the literature of temperament (considered as part of normal human development) grew outside the purview of most clinical scientists. Since the landmark work of Thomas and Chess,² however, there has been a steady effort to bring these previously parallel lines of work together in mutually informative designs.

This article will first briefly review some of the core concepts relating to temperament and its research, including the measurement of temperament and what is currently known about its origins and development. We will then turn to studies of the association between temperament and childhood psychiatric disorders, and also consider the possible mechanisms that may be involved. Finally, directions for future research will be addressed.

DEFINITION AND RELATIONS TO PERSONALITY

The concept of temperament dates back to ancient Greek philosophers, including Hippocrates and Galen, who postulated the cause of a person's usual behavior to be due to varying concentrations of humors.³ Derived from the Latin *temperare*, which means "to mix," the word itself suggests a relation between behavioral predispositions and basic biological substrates. Despite the long history of investigation, however, the precise definition of temperament continues to be a subject of much debate and discussion.⁴ General consensus does exist around some key components of temperamental traits, including their manifestation early in life, genetic influence, and at least moderate stability across time.^{2,3,5}

There is less agreement, however, as to the boundaries between temperament and personality.⁶ Indeed, some prominent personality researchers have argued that both temperament *and* personality refer to endogenous basic tendencies of thoughts, emotions, and behavior, and that the distinction between these constructs is largely artificial.⁶⁻⁸ Indeed, finding separate dimensions between temperament and personality has been difficult, at least in cross-sectional studies. One study of undergraduates tested the degree of association between the Big Five factors of personality (neuroticism, extraversion, openness, agreeableness, and conscientiousness) and four dimensions of temperament (negative affectivity, extraversion, effortful attention, and orienting sensitivity) as assessed by the Adult Temperament Questionnaire.⁶ Not surprisingly, many strong relations were found. Effortful attention was positively correlated with conscientiousness, and orienting sensitivity was related to openness. The expected strong associations were also found between the two extraversion scales and between neuroticism and negative affectivity. A negative correlation was found between effortful attention and neuroticism. Similarly, studies that have examined the association between the Big Five and the four temperament dimensions of the Temperament and Character Inventory⁹ have found overlap between dimensions, particularly (1) harm avoidance and neuroticism (positive) and extraversion (negative), (2) novelty seeking and conscientiousness (negative), (3) reward dependence and extraversion/agreeableness (positive), and (4) persistence and conscientiousness (positive).^{10,11} Molecular genetic studies have similarly converged on the same candidate genes despite using various personality or temperament scales almost interchangeably.¹²

Another viewpoint holds that temperament is a lifelong, yet distinct, component of personality. Cloninger's psychobiological theory,¹³ for example, describes personality as comprising temperament and character, with temperament referring to emotional predispositions and character relating to more intentional goals and values that develop from social learning.¹⁴ Rothbart and Ahadi¹⁵ clarify that "the personality domain contains much more than temperament ... including patterns of habitual behavior skills, and the content of individual thought, values, needs, and goals. It also includes the perception of self, others, and events." Since these components may modify each other, however, disentangling these two constructs can be very difficult at the phenotypic level. Digman and Shmelyov¹⁶ found that the five-factor personality model, with the possible exception of neuroticism, was well replicated in Russian school-age children, leading the researchers to conclude that temperament is the major basis of personality.

Others view the relation more sequentially, with temperament being the early building blocks or substrates that develop into more complex personality traits over time.¹⁷ As Kagan¹ writes, "[T]he environment acts on that temperament to produce personality." Consequently, temperament has traditionally been used to describe children and infants, whereas personality is generally applied to adults and adolescents, even if the specific dimensions being measured sound remarkably similar.

Longitudinal studies have supported strong associations between early temperamental traits and later personality dimensions. Comparison between temperament assessed in preschool and personality assessed at age 8 in one study showed many significant correlations, including extraversion with earlier levels of activity, sociability, and shyness (negative), and neuroticism with both emotionality and impulsivity.¹⁸ In perhaps the longest and largest study of its kind, with over a thousand subjects whose temperament was assessed at age 3 and personality assessed at age 26, researchers from the Dunedin Study found that, when compared to toddlers rated as well adjusted or confident, temperamentally undercontrolled toddlers showed higher levels of negative emotionality as adults, while inhibited toddlers had less positive emotionality.¹⁹ These studies cannot confirm, however, the separateness of personality from temperament.

In summary, there remains a good deal of confusion regarding the relations between temperament and personality. There is a high amount of overlap between these constructs, especially when considering older children and adults—which has led many to conclude that any distinction is more historical than substantive. Those attempting to specify more of a developmental process, however, have tended to reserve temperament for early-appearing and more constitutionally based predispositions onto which personality traits are built and modified as additional experiences and cognitive abilities build throughout the lifespan. For the purposes of this review, we will largely confine our comments to studies that purport to measure child and adolescent temperament rather than personality or character, with the understanding that there may be substantial overlap that has yet to be fully delineated in the literature.

DIMENSIONS OF TEMPERAMENT

One of the major challenges in temperament research is the existence of multiple systems of organization, each with partially overlapping dimensions that are given different names and load onto slightly different factors. The original work of Thomas and Chess in their New York Longitudinal Study^{20,21} postulated nine continuous dimensions of temperament in addition to three higher-order categories of “difficult,” “easy,” and “slow to warm up.” Around the same time, Eysenck²² described a personality structure of three main factors of neuroticism, extraversion, and psychoticism (actually more related to antisocial behavior than true psychotic processes) in the development of the Eysenck Personality Questionnaire. While a number of changes have been proposed and supported through additional studies and statistical analyses,^{23,24} many, if not most, of the modern temperament-assessment systems bear resemblance to one or both of these early forms of organization.

Currently, there are a number of different taxonomies used in modern temperament research.^{25–28} Some of the most popular ones are shown in Table 1. Many of these systems are organized hierarchically, with more specific traits being summed to form higher-order structures. One of these higher-order dimensions common to most temperament-organization schemes refers to the degree of sensitivity to signals of punishment and the propensity of an individual to experience negative emotions. This dimension, variably known as negative affectivity,⁶ neuroticism,²⁹ harm avoidance,⁹ or the behavioral inhibition system,^{30,31} often encompasses parameters relating to threshold, intensity, and duration of several emotions, including anger and fear. Some researchers have found evidence to distinguish between general negative affectivity and that which is related specifically to new situations or people.³² Kagan’s definition of behavioral inhibition³³ refers to children who display high amounts of fearfulness and reticence in novel situations that may or may not have a social component.³

The other broad dimension that is frequently found in temperament-organization schemes relates to a tendency toward novelty or sensation seeking, high energy and positive emotions, extraversion, and impulsivity. Various scales that incorporate at least some of these aspects have been labeled novelty seeking,⁹ surgency,²⁸ extraversion,²⁹ sensation seeking,³⁴ or the behavioral activation system.³⁵ Many of these scales break down the dimension into component parts.

In contrast to the above dimensions, which refer to emotional reactivity or overall hedonic valence, many temperament theorists include a measure of emotional regulation that encompasses an ability to persist, pay attention, delay gratification, plan, and modulate emotional responses.³⁶ This trait can serve to modify or override the outward expression of the first two broad dimensions. Some of these “executive” functions have been variably referred to as effortful control²¹ or persistence.¹⁶ This dimension is also sometimes assessed as the inverse of the novelty-seeking or extraversion dimension.

Sociability²⁷ or other measures of affiliation toward others⁹ are also occasionally labeled as higher-order dimensions, whereas in other cases they are conceptualized as a component of either the negative- or positive-affect dimensions. Overall activity level is also included on some temperament scales,^{27,37} as it was in the original Thomas and Chess formulations.

Most classification structures are organized quantitatively so that an individual receives a “score” for a particular dimension (which can vary anywhere from 0 to some maximum value), and a profile is then generated across a series of dimensions. A few systems, however, are organized categorically in a manner similar to DSM diagnoses—most notably, the categories developed by Thomas and Chess mentioned previously and the categorical definition of behavioral inhibition.

TEMPERAMENT ASSESSMENT

There are a number of methods through which temperament is assessed. By far the most widely used method of temperament assessment is the questionnaire in which either parents rate their children or individuals rate themselves. Proponents of this system point to several advantages over observational or laboratory procedures, including (1) the ability of the informant to rate a child’s “usual” temperamental style across time, (2) ease of administration, and (3) good psychometric properties of the technique.³⁸ Some questionnaires use a true/false format for items,⁹ whereas others employ a Likert scale in which informants rate their degree of agreement with each statement.²⁸

Another system of assessment utilizes standardized observation or laboratory measures in which children are guided through different procedures and their behavior is coded by trained observers. The assessment of behavioral inhibition, for example, involves children being exposed to a number of small, developmentally appropriate tasks (vocabulary test, pulse and blood pressure checks) by a friendly research assistant. The number of spontaneous comments, smiles, and fear reactions are recorded and factored into an overall yes/no rating of behavioral inhibition.³ Proponents of observation-based measures point to a reduction of potential bias by relying on standardized procedures and trained observers with no attachments to the subject.

Unfortunately, there have been few efforts to incorporate multiple assessment procedures into a single system. Rothbart and colleagues^{6,39} have found some convergence of temperament dimensions in infants assessed in the laboratory and through parent report. An approach that could potentially serve as a model for the incorporation of multiple informants and assessment strategies is the Achenbach System of Empirically Based Assessment⁴⁰ in the quantitative measure of psychopathology. These widely used instruments allow for

standardized results across informants (parent, self, teacher), using questionnaires. More recently, they also allow for the integration of observational data.⁴¹

In summary, there is significant variability found in regard to both the core temperament dimensions and the methods of information ascertainment. Questionnaires, in which parents report on their children, continue to represent the major method of temperament assessment, although many potential flaws in this method have been elucidated. While most temperament researchers have agreed upon the existence of a few core dimensions—such as vulnerability to negative emotions and levels of approach behavior—more convergence is needed concerning terminology and assessment strategies in order to increase the generalizability of findings across studies.

GENETIC AND ENVIRONMENTAL INFLUENCES

Behavioral genetic data has demonstrated strong, but not dominating, additive genetic influences of most major temperament and personality dimensions.⁴² In child studies, heritability coefficients ranging from .2 to .5 for many of the major dimensions^{38,43} have been reported, although they can be much higher.⁴⁴ These findings have been consistent across instruments and informants, although some of the studies have been conducted with older samples using “personality” rather than temperament scales.^{38,45} Heritability coefficients tend to be lower when observational, as opposed to parent report, data is used and also in adoption, as opposed to twin, study designs.⁴⁶ One explanation for the latter findings is “contrast effects,” whereby parents of dizygotic twins overreport temperamental differences.

The previously expected large effect of shared environmental factors (i.e., affecting all members within a household to make children alike) seems to have little empirical support for most dimensions. Strong influences of unshared environmental factors (i.e., environmental factors that are uniquely experienced by one individual in the family) have also been found, although some of this effect is confounded with measurement error. The stability and even change of temperamental traits across time also appear to be largely influenced by genetic and nonshared environmental factors.^{47,48} Interestingly, one finding that may at first seem counterintuitive is that heritability coefficients of temperament seem stable or may even increase with age.^{49–51}

More recently, molecular genetic techniques have documented associations between temperamental traits and specific genes. Perhaps the most celebrated, but somewhat inconsistent, finding is the association between novelty seeking and a polymorphism on the dopamine-4 receptor (DRD4) gene⁵²—which, interestingly, is also a candidate gene implicated in attention-deficit/hyperactivity disorder (ADHD).⁵³

Research has started to move away from the repeatedly demonstrated premise that both genetic and environmental factors make important contributions to temperament and psychopathology, and has instead begun to focus on the mechanisms of this interplay. Exciting work on both genotype-environment interactions (how the influence of genes is modified by experience) and genotype-environment correlations (how genes influence the probabilities of certain environmental factors that may themselves affect behavior) stands to help define the complex pathways through which genetic and environmental factors exert their effects.^{46,54} For example, the association between the DRD4 polymorphisms and the expression of high levels of novelty seeking may be partially dependent on more hostile parental environments.⁵⁵

STABILITY

Studies on the stability of temperamental traits across development continue to be a source of some confusion, especially when viewed through the contrasting lenses of a statistician or clinician. While most studies of stability find statistically significant correlations within a particular trait across different times,^{56,57} there continues to be substantial potential for change, especially at moderate, in contrast to more extreme, levels of a particular dimension. Observational assessments of temperament tend to report lower stability correlations^{38,58} compared to questionnaire assessments. Several studies have reported the increasing stability of temperament with age,^{59,60} whereas others have found stability to be similar across ages.³⁸

A related finding that has been reported is the preservation of physiological markers of temperament across time. Schwartz and colleagues⁶¹ showed increased MRI signal response in the amygdala to novel, but not familiar, faces in adults who as toddlers were found to have behavioral inhibition (BI)—a finding that persisted even after removing subjects with current social anxiety disorder. What could explain such a result? Extending Rothbart's model of how greater effortful control may help overcome the behavioral expression of high negative affectivity,⁶² it is possible that adults with continued temperamental predispositions toward social anxiety have been able to “fight the tide” using a high level of effortful control. To draw an analogy, in a car whose speed is controlled by separate acceleration and brake systems, slow car speed could be a function either of lower acceleration with minimal input of the brake (no BI) or concomitant high levels of both accelerator and brake (high BI and high effortful control).

ATTACHMENT AND TEMPERAMENT

For several decades, researchers have examined and theorized about the relation between temperament and attachment. While there is emerging consensus that the two constructs overlap considerably, controversy remains in regard to how this overlap should be construed.⁶³

According to Bowlby,⁶⁴ attachment can be described as both a process by which the relationship between an infant and caregiver unfolds over the first twelve months of life, and as an outcome that may influence future interpersonal relationships. Specifically, the young child acts to achieve physical proximity to the preferred caregiver when in need of comfort, safety, nurturance, and support. The caregiver, in turn, responds with available emotional and physical resources.⁶⁵ By the child's first birthday, it is possible to assess the security or quality of attachment with a laboratory paradigm known as the Strange Situation Procedure.⁶⁶ According to how the child reacts to his or her attachment figure and an unfamiliar adult in a series of separations and reunions, the child may be classified as exhibiting one of four patterns of attachment behavior: secure, avoidant, resistant, or disorganized. Individual differences emerge in the Strange Situation Procedure as a result of the history of interchanges between the child and caregiver. This classification is neither a diagnosis nor a symptom of psychopathology; rather, insecure attachment is a putative risk factor for future mal-adaptation and behavioral problems.⁶⁷

Attachment theory suggests that the relationship between child and caregiver is a bidirectional exchange: the child produces signals to capture the caregiver's attention, and the caregiver responds to the signals. Although some attachment theorists posit that temperament may affect the way in which the infant indicates distress, the care-giver's response has traditionally thought to be the driving force behind the quality of the attachment.⁶⁸ Belsky and Rovine,⁶⁹ for example, have suggested that infant temperament may influence the amount and type of distress exhibited at separation but that caregiver

responsiveness determines security or insecurity. Other theorists believe, instead, that infant temperament, either directly or indirectly, plays a larger role in determining attachment style.^{63,65} In a study demonstrating this close association between the two constructs, van den Bloom⁷⁰ showed an ability to enhance secure attachment with an intervention that taught sensitivity skills to mothers of temperamentally irritable infants.

TEMPERAMENT AND PSYCHOPATHOLOGY

As mentioned earlier, research in temperament and psychopathology existed mainly in parallel for many years. More recent efforts have begun to focus on our understanding of the complex association between the two constructs. The rest of this article will review the current state of knowledge concerning the interface between temperament and psychopathology. Like the boundaries between temperament and personality, disentangling these constructs has proven to be a difficult task. For this review, we have chosen to discuss child disorders for which there exist more data specifically focusing on the link between the disorder and particular temperament dimensions.

Disruptive Behavior Disorders

With many researchers including dimensions such as activity level, attentional control, and impulsivity as temperament dimensions, it should come as little surprise that the association between temperament and ADHD is strong enough to warrant speculation that the disorder is perhaps better understood dimensionally.⁷¹ Given the level of heterogeneity within the disruptive behavior disorders, however, one may also expect corresponding variability in their temperamental correlates.

ADHD symptoms are themselves divided between inattentive and hyperactive-impulsive subtypes and frequently co-occur with other externalizing problems.⁷² Since both types of symptoms have been hypothesized to relate to a deficit in inhibitory control,⁷³ low levels of persistence, task orientation, or effortful control have emerged as significant temperamental correlates of ADHD, as shown in Table 2.^{74–76} Sensation and novelty seeking, as well as extraversion, have also been found to be associated with ADHD,⁷⁷ although this association may be more closely linked to other disruptive behavior disorders.^{76,78} As mentioned earlier, molecular genetic work for both novelty seeking and ADHD has converged on similar targets, although the data are inconsistent.^{53,79} Less clear is the association between ADHD and negative affectivity or neuroticism—which has also been found but may actually be more related to common ADHD comorbidities.^{44,80}

While much of the earlier literature on the relation between temperament and conduct problems focused on children with “difficult” temperaments,⁸¹ advances in our understanding of different types of aggression (e.g., reactive versus proactive) have refined the exploration for different temperamental profiles.^{82–85} Research suggests, for example, that both very high and very low levels of emotional reactivity may be related to antisocial behavior.^{86,87} High levels of novelty or sensation seeking^{78,88} may also be a risk factor for later externalizing problems.⁸⁹

Depressive and Anxiety Disorders

Childhood-onset depressive disorders may be conceptualized dimensionally. Children who manifest more severe internalizing symptoms show qualitative rather than quantitative differences when compared to children with more moderate or subthreshold symptoms.^{90,91} Given the similar dimensional structure of temperament dimensions, temperament may have much to offer to our understanding of the development of depressive and anxiety disorders.

Clark and Watson⁹² have proposed that both anxiety and depressive disorders share the relation to high negative affectivity. Low positive affectivity or surgency, however, is thought to be more specifically related to depressive disorders, whereas high physiological arousal is associated more specifically with at least some childhood anxiety disorders.⁹³ This high degree of temperamental overlap could account for the high degree of “comorbidity” between anxiety and affective disorders, especially in children.⁹⁴ These associations have been confirmed to varying degrees in a number of studies.^{95,96} Lower effortful control, conscientiousness, task orientation, and flexibility have been reported in both cross-sectional^{97–99} and longitudinal studies,¹⁰⁰ although not to the degree seen in children with externalizing disorders. Behavioral inhibition, which contains elements of high negative affectivity and low extraversion, has also demonstrated links with later depressive and anxiety disorders.^{101,102}

Most of the aforementioned studies have been done with unipolar depression. A recent study of children with early onset bipolar disorder revealed a temperament profile similar to that of children with ADHD (low persistence, low reward dependence, high novelty seeking).¹⁰³ Other studies have been mixed in finding associations with both negative and positive affectivity.¹⁰⁴ Akiskal and colleagues¹⁰⁵ have found that temperamental instability, as well as higher neuroticism, is a significant predictor of depressed adults who later reveal a bipolar course. This aspect of temperament—namely, that it may be more stable in some individuals than others on a day-to-day basis—has been relatively understudied, in part perhaps because temperament dimensions have been, by definition, assumed to be stable in at least the short term. Indeed, most temperament questionnaires seek to reduce any variability in this regard by directing raters to assess a child’s “usual” state.

Substance Abuse

While there is strong evidence for associations between temperament and substance use, this area of research has suffered from the existence of multiple partially overlapping dimensions, each with its own name and scope. The diverging physiological effects of different substances, as well as their other attributes (for example, that some substances are legal and others are not), may be associated with different temperamental profiles and could account for the inconsistent results when studies are grouped together. For example, the harm-avoidance dimension, which includes some elements of negative emotionality but also a sensitivity to punishment, could be hypothesized to be positively related to legal, but not illegal, substances. Temperament dimensions that have been shown to be positively related to substance use and abuse include negative emotionality and activity level.^{106–109} High attentional control and positive emotionality have been found to be negatively related to substance use,¹¹⁰ although novelty or sensation seeking, when considered apart from positive emotionality, has been found to be related to increased substance use.^{110–112} The Dunedin Study found relations between observational measures of being either “undercontrolled” or “inhibited” and alcohol abuse, especially in males.⁹⁶

NONLINEAR RELATIONS BETWEEN TEMPERAMENT AND PSYCHOPATHOLOGY

A criticism of much of the literature on temperament/psychopathology relations is the preponderance of analyses testing a linear, one-to-one relation between a particular temperament dimension and corresponding psychiatric disorder. To address this limitation, some researchers have explored the association between temperament *profiles* and disorders, where levels of several different dimensions are thought to more fully describe a disorder. An example of this approach is Cloninger’s character cube, in which a specific psychiatric disorder may be conceptualized as lying in a unique, three-dimensional space based on

levels of multiple dimensions.¹¹³ A second methodological limitation has been the frequent failure to account for patterns of psychiatric comorbidity either statistically or through sampling techniques. Our own data have shown, for example, that the correlation between levels of harm avoidance and externalizing behavior is reduced from being positive and statistically significant to near zero after controlling for levels of comorbid internalizing problems.

Another area of inquiry that needs to be addressed concerns the possibility that the effect of a particular temperament dimension upon psychopathology is dependent on levels of another temperament dimension, either within the same individual or across individuals.¹¹⁴ Data from our own laboratory exploring the “fit” between child and parent temperamental traits have shown, for example, that the combination of high child harm avoidance and high paternal harm avoidance predicts higher levels of internalizing problems than would be predicted from either dimension acting alone. A similar trend was also found between levels of child and mother novelty seeking and attention problems.¹¹⁵

MECHANISMS OF ASSOCIATION

While there have been a number of potential mechanisms proposed for the association between temperament and psychopathology,⁶² perhaps the three most cited could be called the risk model, spectrum model, and scar effect. The risk mechanism supposes that temperament and psychopathology are qualitatively distinct entities and that certain temperament dimensions, alone or in combination, contribute to a higher likelihood of developing a particular psychiatric disorder. The spectrum model, in contrast, hypothesizes that much of the taxonomic distinction between temperamental traits and psychiatric disorders is artificial and tautological, and that many disorders are better conceptualized as extremes of temperament.¹¹⁶ Finally, the scar effect, a term developed from research on depression and cognitive style,¹¹⁷ supposes that much of the observed association between temperament and psychopathology is the effect of disease upon personality, more than the reverse. An illustration of the scar effect might be seen in Alzheimer’s disease. While personality changes are often documented that precede the full-fledged onset of the core disease symptoms,¹¹⁸ these personality traits are generally not considered to play an etiological role in the disorder.

Converging lines of evidence are beginning to suggest that qualitative differences do exist between temperament (even in more extreme forms) and at least most psychiatric disorders. The evidence supporting these hypotheses comes from a variety of sources. Temperament dimensions typically explain a substantial portion, but not nearly all, of the variance within diagnoses,⁷⁵ although it is possible that these differences could also reflect measurement error. Furthermore, behavioral genetic studies have examined the magnitude of genetic and environmental effects between individuals at extreme levels of a particular scale compared to those with low or more intermediate levels. These studies have revealed mixed results,⁴⁹ with increased heritability found with higher levels of internalizing behavior.^{119,120} Gjone and colleagues⁴⁴ found few common genetic links between temperament and anxiety, depression, or delinquency. Data from the MacArthur Longitudinal Twin Study also showed both shared and nonshared environmental influences for 14-month-old twins with low behavioral inhibition, whereas higher behavioral inhibition scores were influenced more by nonshared and genetic factors.⁴⁷ Similar influences were found, however, across various levels of shyness.

Thus, the vulnerability or risk model may be the most plausible mechanism for many conditions, including affective, anxiety, and substance use disorders. Advancing this hypothesis further have been the findings of important mediating and moderating variables

between a temperament dimension and corresponding psychiatric disorder. For example, levels of positive or negative emotionality in children may potentiate the effect of negative parenting or inter-parental discord upon child adjustment.^{97,121,122} Cognitive factors such as the development of negative attributions and expectations may also play a role in the pathway between temperament and psychopathology.^{123,124} In anxiety disorders, a bias toward increased attention to potential threat cues has been proposed as a mechanism that may mediate the relation between anxiety symptoms and temperament dimensions of negative affectivity and effortful control (see the 2004 review by Lonigan et al.).¹²⁵ These mediating and moderating processes may, in turn, contribute to an individual's inability to regulate emotions—a key feature that is likely involved in the link between temperamental predispositions and various forms of psychopathology.^{126,127}

The pathway from temperamental predisposition through key emotion-regulation capabilities to psychiatric symptoms also depends, of course, on key external influences, most notably parents, who can model, coach, and nurture this developing ability.¹²⁸ Through gene-environment interactions and correlations,¹²⁹ cycles can develop in which more complex causes of psychopathology develop from multiple influences. For example, in children with high negative emotionality and novelty seeking coupled with low effortful control, it is possible for substance abuse and externalizing behavior to develop via decreased competence, increased affiliation with similar peers, and higher levels of parent-child conflict.^{15,130,131}

Perhaps the most cogent case for a spectrum conceptualization may come from the connection between ADHD and the temperament dimensions of effortful control, activity level, and negative affectivity. ADHD symptoms themselves appear to be better represented as the end of a continuum rather than as a discrete entity.⁷¹ Gjone and colleagues⁴⁴ found shared genetic influences between emotionality and attention problems in the same study that found more discontinuities with other disorders. Similarly, the MacArthur Longitudinal Twin Study failed to find significant differences in the relative influence of genetic and environmental factors in infants with high versus low levels of activity or task orientation, although ADHD symptoms were not measured per se and the study was not powered to detect small differences.⁴⁷

To our knowledge, there are no data testing the effect of psychopathology upon temperamental traits, and very little data testing the scar effect in adults and personality measures.¹³² Shea and coworkers¹³³ did examine personality before and after a depressive episode in a group of adults with no psychiatric disorders at baseline and found little evidence for a scar effect. One intriguing hypothesis, however—yet to be tested—is that such an effect may be present in psychotic disorders. While little has been studied with regard to temperament and psychosis directly, it is known that there are increased levels of attention, thought, and social problems in children who later are diagnosed with schizophrenia.¹³⁴ Since it is likely that these behavioral problems have temperamental correlates, it is possible that the unique neuropathophysiology of the disease was responsible for some of these temperamental changes. A similar hypothesis could also be put forth with regard to autism.

In summary, a variety of mechanisms has been proposed that could potentially mediate temperamental influences. The conclusions vary, depending on which trait-disorder combination is studied, but do seem to indicate that the spectrum and scar hypotheses, in particular, are unlikely to explain away the associations between temperament and psychopathology for most DSM diagnoses. Since psychiatric disorders require the presence of functional impairment before a diagnosis can be made, it is likely that many qualities

other than absolute levels of psychopathologic load contribute to meeting this threshold, especially with regard to childhood disorders.

CLINICAL IMPLICATIONS

While the impact of temperament research upon our understanding of the taxonomy and development of psychiatric disorders is apparent, there is also a variety of emerging clinical implications, some of which have recently been tested. Early identification of temperamental risk factors could allow for the possibility of early interventions that could potentially shift children away from more pathological trajectories.¹³⁵ There is already evidence that early intervention may prevent the emergence of some behavioral problems,¹³⁶ and a temperament-based selection may help define those at higher risk. Using a cognitive-behavioral approach with a family component, the Queensland Early Intervention and Prevention of Anxiety Project found reduced rates of anxiety disorders at 6- and 24-month follow-up in the treatment group, compared to a monitoring group, of at-risk children.¹³⁷ Of note, however, temperament per se was not used to define the at-risk group, and greater gains of treatment were found in those children whom at baseline already qualified for an anxiety diagnosis.

Efforts could also be made to match a particular treatment modality to a child's temperamental strength. For example, one could attempt to enhance the trait of effortful control due to its potentially strong moderating effect upon other temperament dimensions such as negative affectivity.¹³⁸ A child with high negative emotionality but good effortful control may be better suited to take advantage of coping strategies, such as distraction or cognitive restructuring, than a child with lower levels of this trait.¹³⁹ Conversely, children with poor effortful control may need proportionately more effort, at least initially, devoted to reduce directly the amount of environmental stressors or their physiological manifestations.

FUTURE DIRECTIONS

Dimensions of temperament are emerging as critical factors in developmental psychopathology. Associations have been found across different categories of psychiatric disorders, with the links between temperament and psychopathology often found to be quite strong.

An increased tendency to experience negative emotions and a decreased ability to regulate emotional responses appear common to many childhood psychiatric disorders—although, not surprisingly, the links between other temperamental traits and psychopathology vary by disorder. Indeed, even within disorders, it is exceedingly likely that individuals can arrive at the same phenotype from multiple developmental pathways, some of which are more closely intertwined than others with temperamental factors. In pediatric obsessive-compulsive disorder, for example, some children may have strong temperamental origins consisting of high negative affectivity and persistence, whereas others may become symptomatic from autoimmune mechanisms,¹⁴⁰ with any temperament associations being mainly from a scar effect. The controversy surrounding pediatric bipolar disorder may also provide a stage for the application of temperament research. The pediatric phenotype, in contrast to the “classic” presentation more common in adults, may be more strongly associated with the temperament combination of high negative affectivity, high surgency, and low effortful control.

One general criticism of the literature has often related to content overlap; that is, the similar language used to define both DSM symptoms and temperament dimensions. While this remains both a methodological and theoretical problem, studies that have removed overlapping content continue to show significant relations between the two areas.^{141,142}

Another recurrent issue has been the continued strong reliance on a single informant—often a parent—for child temperament assessment. In order to address this limitation, many researchers are incorporating multiple informants both into the design of temperament instruments and into their statistical models.

Additional evidence about the organizational nature of temperament and its core dimensions will need to be obtained in order both to increase consensus with regard to classification schemes and to enhance the generalizability of findings between studies. Continued developments in genetic and neuroimaging techniques will aid in anchoring proposed temperament dimensions to specific neurobiological pathways. As for the problem of deciding upon the language used to describe these dimensions, the field may need to consider direct efforts at obtaining consensus.

In contrast to studies that search for “the cause” of a given disorder for an entire group, future research will need to address directly the dynamic and transactional nature of multiple factors within groups that is inherent in developmental psychopathology models. Increasingly complex designs utilizing genetically informative samples and multivariate statistics will be able to provide additional clues about these complex systems but will likely not obviate the need for additional large longitudinal studies. As future research proceeds along these directions, the previously parallel fields of temperament, personality, and psychiatric research seem ready to change the fundamental understanding of each other.

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REFERENCES

1. Kagan J. In the beginning: the contribution of temperament to personality development. *Mod Psychoanal.* 1997; 22:145–155.
2. Thomas, A.; Chess, S. *Temperament and development.* New York: Bruner/Mazel; 1977.
3. Kagan, J. *Galen’s prophecy.* Boulder, CO: Westview; 1994.
4. Goldsmith HH, Buss AH, Plomin R, et al. Roundtable: what is temperament? Four approaches. *Child Dev.* 1987; 58:505–529. [PubMed: 3829791]
5. Caspi A. The child is father of the man: personality continuities from childhood to adulthood. *J Pers Soc Psychol.* 2000; 78:158–172. [PubMed: 10653512]
6. Rothbart MK, Ahadi SA, Evans DE. Temperament and personality: origins and outcomes. *J Pers Soc Psychol.* 2000; 78:122–135. [PubMed: 10653510]
7. McCrae RR, Costa PT Jr, Ostendorf F, et al. Nature over nurture: temperament, personality, and life span development. *J Pers Soc Psychol.* 2000; 78:173–186. [PubMed: 10653513]
8. Lahey BB. Commentary: role of temperament in developmental models of psychopathology. *J Clin Child Adolesc Psychol.* 2004; 33:88–93. [PubMed: 15028544]
9. Cloninger, CR.; Przybeck, TR.; Svrakic, DM.; Wetzell, RD. *The Temperament and Character Inventory (TCI): a guide to its development and use.* St. Louis, MO: Center for Psychobiology of Personality, Washington University; 1994.
10. MacDonald DA, Holland D. Examination of relations between the NEO Personality Inventory–Revised and the Temperament and Character Inventory. *Psychol Rep.* 2002; 91:921–930. [PubMed: 12530745]
11. De Fruyt F, Van De Wiele L, Van Heeringen C. Cloninger’s psychobiological model of temperament and character and the five-factor model of personality. *Pers Individ Diff.* 2000; 29:441–452.
12. Van Gestel S, Van Broeckhoven C. Genetics of personality: are we making progress? *Mol Psychiatry.* 2003; 8:840–852. [PubMed: 14515135]

13. Cloninger CR, Svrakic DM, Przybeck TR. A psychobiological model of temperament and character. *Arch Gen Psychiatry*. 1993; 50:975–990. [PubMed: 8250684]
14. Cloninger CR, Svrakic DM. Integrative psychobiological approach to psychiatric assessment and treatment. *Psychiatry*. 1997; 60:120–141. [PubMed: 9257353]
15. Rothbart MK, Ahadi SA. Temperament and the development of personality. *J Abnorm Psychol*. 1994; 103:55–66. [PubMed: 8040481]
16. Digman JM, Shmelyov AG. The structure of temperament and personality in Russian children. *J Pers Soc Psychol*. 1996; 7:341–351. [PubMed: 8765485]
17. Cicchetti D. Perspectives on the interface between normal and atypical development. *Dev Psychopathol*. 1990; 2:329–333.
18. Hagekull B, Bohlin G. Preschool temperament and environmental factors related to the five-factor model of personality in middle childhood. *Merrill-Palmer Q*. 1998; 44:194–215.
19. Caspi A, Harrington O, Milne B, Amell JW, Theodore RF, Moffitt TE. Children’s behavioral styles at age 3 are linked to their adult personality traits at age 26. *J Pers*. 2003; 71:495–513. [PubMed: 12901429]
20. Thomas, A.; Chess, S.; Birch, HG. *Temperament and behavior disorders in children*. New York: New York University Press; 1968.
21. Thomas A, Chess S. Genesis and evolution of behavioral disorders: from infancy to early adult life. *Am J Psychiatry*. 1984; 141:1–9. [PubMed: 6691419]
22. Eysenck, HJ.; Eysenck, SBG. *Manual of the Eysenck Personality Inventory*. San Diego, CA: Educational and Industrial Testing Service; 1975.
23. Bates JE. The concept of difficult temperament. *Merrill- Palmer Q*. 1980; 26:299–319.
24. Martin, RP.; Wisenbaker, J.; Huttunen, M. Review of factor analytic studies of temperament measures based on the Thomas-Chess structural modal: implications for the big five. In: Halverson, CF.; Kohnstamm, GA.; Martin, RP., editors. *The developing structure of temperament and personality from infancy to adulthood*. Hillsdale, NJ: Erlbaum; 1994. p. 157-172.
25. Windle M, Lerner R. Reassessing the dimensions of temperamental individuality across the life span: the Revised Dimensions of Temperament Survey (DOTS-R). *J Adolesc Res*. 1986; 1:213–230.
26. Luby JL, Svrakic DM, McCallum K, Przybeck TR, Cloninger CR. The Junior Temperament and Character Inventory: preliminary validation of a child self-report measure. *Psychol Rep*. 1999; 84:1127–1138. [PubMed: 10477935]
27. Buss, AH.; Plomin, R. *Temperament: early developing personality traits*. Hillsdale, NJ: Erlbaum; 1984.
28. Rothbart MK, Ahadi SA, Hershey K, Fisher P. Investigations of temperament at three to seven years: the Children’s Behavior Questionnaire. *Child Dev*. 2001; 72:1394–1408. [PubMed: 11699677]
29. Costa, PT.; McCrae, RR. *Revised NEO Personality Inventory and NEO Five-Factor Inventory: professional manual*. Odessa, FL: Psychological Assessment Resources; 1992.
30. Gray, JA. *The neuropsychology of anxiety: an enquiry into the functions of the septo-hippocampal system*. New York: Oxford University Press; 1982.
31. Gray, JA. *The psychology of fear and stress*. New York: Oxford University Press; 1987.
32. Bates JE, Freeland CAB, Loundsbury ML. Measurement of infant difficultness. *Child Dev*. 1979; 50:794–803. [PubMed: 498854]
33. Kagan J. Temperament and the reactions to unfamiliarity. *Child Dev*. 1997; 68:139–143. [PubMed: 9084130]
34. Zuckerman M. Dimensions of sensation seeking. *J Consult Clin Psychology*. 1971; 36:45–52.
35. Pickering, AD.; Gray, JA. The neuroscience of personality. In: Pervin, LA.; John, OP., editors. *Handbook of personality: theory and research*. New York: Guilford; 1999. p. 277-299.
36. Frick PJ. Integrating research on temperament and childhood psychopathology: its pitfalls and promise. *J Clin Child Adolesc Psychology*. 2004; 33:2–7.

37. Lerner RM, Palermo M, Spiro A III, Nessleroad J. Assessing the dimensions of temperamental individuality across the lifespan: the Dimensions of Temperament Survey (DOTS). *Child Dev.* 1982; 53:149–159.
38. Saudino, KJ.; Cherny, SS. Sources of continuity and change in observed temperament. In: Emde, RN.; Hewitt, JK., editors. *Infancy to early childhood*. New York: Oxford University Press; 2001. p. 89-110.
39. Rothbart, MK.; Derryberry, D.; Hershey, K. Stability of temperament in childhood: laboratory infant assessment to parent report at seven years. In: Molfese, VJ.; Molfese, DL., editors. *Temperament and personality development across the lifespan*. Mahwah, NJ: Erlbaum; 2000. p. 85-119.
40. Achenbach, TM.; Rescorla, LA. *Manual for the ASEBA School-Age Forms & Profiles*. Burlington: University of Vermont, Research Center for Children, Youth, & Families; 2001.
41. McConaughy SH, Achenbach TM, Gent CL. Multiaxial empirically based assessment: parent, teacher, observational, cognitive, and personality correlates of child behavior profile types for 6- to 11-year-old boys. *J Abnorm Child Psychol.* 1988; 16:485–509. [PubMed: 3235743]
42. Loehlin, JC.; Nichols, RC. *Heredity, environment, and personality*. Austin: University of Texas Press; 1976.
43. DiLalla, LF.; Jones, S. Genetic and environmental influences on temperament in preschoolers. In: Molfese, VJ.; Molfese, DL., editors. *Temperament and personality development across the life span*. Mahway, NJ: Erlbaum; 2000. p. 33-55.
44. Gjone H, Stevenson J. A longitudinal twin study of temperament and behavior problems: common genetic or environmental influences? *J Am Acad Child Adolesc Psychiatry.* 1997; 36:1448–1456. [PubMed: 9334559]
45. Riemann R, Angleitner A, Strelau J. Genetic and environmental influences on personality: a study of twins reared together using the self- and peer report NEO-FFI scales. *J Pers.* 1997; 65:449–476.
46. Plomin, R.; Caspi, A. Behavioral genetics and personality. In: Pervin, LA.; John, OP., editors. *Handbook of personality: theory and research*. New York: Guilford; 1999. p. 251-276.
47. Manke, B.; Saudino, KJ.; Grant, JD. Extremes analyses of observed temperament dimensions. In: Emde, RN.; Hewitt, JK., editors. *Infancy to early childhood: genetic and environmental influences on developmental change*. New York: Oxford University Press; 2001. p. 52-72.
48. Matheny AP. A longitudinal twin study of stability of components from Bayley's Infant Behavior Record. *Child Dev.* 1983; 54:356–360. [PubMed: 6683619]
49. Nigg JT, Goldsmith HH. Developmental psychopathology, personality, and temperament: reflections on recent behavioral genetics research. *Hum Biol.* 1998; 70:387–412. [PubMed: 9549245]
50. Cyphers LH, Phillips K, Fulker DW, Mrazek DA. Twin temperament during the transition from infancy to early childhood. *J Am Acad Child Adolesc Psychiatry.* 1990; 29:392–397. [PubMed: 2347836]
51. Plomin R, Emde RN, Braungart JM, et al. Genetic change and continuity from fourteen to twenty months: the MacArthur Longitudinal Twin Study. *Child Dev.* 1993; 64:1354–1376. [PubMed: 8222877]
52. Munafo MR, Clark TG, Moore LR, Payne E, Walton R, Flint J. Genetic polymorphisms and personality in healthy adults: a systematic review and meta-analysis. *Mol Psychiatry.* 2003; 8:471–484. [PubMed: 12808427]
53. DiMaio S, Grizenko N, Joobor R. Dopamine genes and attention-deficit hyperactivity disorder: a review. *J Psychiatry Neurosci.* 2003; 28:27–38. [PubMed: 12587848]
54. Rutter M, Dunn J, Plomin R, et al. Integrating nature and nurture: implications of person-environment correlations and interactions for developmental psychopathology. *Dev Psychopathol.* 1997; 9:335–364. [PubMed: 9201448]
55. Keltikangas-Jarvinen L, Raikkonen K, Ekelund J, Peltonen L. Nature and nurture in novelty seeking. *Mol Psychiatry.* 2004; 9:308–311. [PubMed: 14569271]
56. Kagan J, Reznick JS, Snidman N. Biological bases of childhood shyness. *Science.* 1988; 240:167–171. [PubMed: 3353713]

57. Sigvardsson S, Bohman M, Cloninger CR. Structure and stability of childhood personality: prediction of later social adjustment. *J Child Psychol Psychiatry*. 1987; 28:929–946. [PubMed: 3436998]
58. Rothbart MK. Longitudinal observation of infant temperament. *Dev Psychol*. 1986; 22:356–365.
59. McDevitt, SC. Continuity and discontinuity of temperament in infancy and early childhood: a psychometric perspective. In: Plomin, R.; Dunn, J., editors. *The study of temperament: changes, continuities and challenges*. Hillsdale, NJ: Erlbaum; 1986. p. 27-38.
60. Plomin, R.; Defries, JC.; Fulker, DW. *Nature and nurture during infancy and early childhood*. New York: Cambridge University Press; 1988.
61. Schwartz CE, Wright CI, Shin LM, Kagan J, Rauch SL. Inhibited and uninhibited infants “grown up”: adult amygdalar response to novelty. *Science*. 2003; 300:1952–1953. [PubMed: 12817151]
62. Rothbart MK. Commentary: differential measures of temperament and multiple pathways to childhood disorders. *J Clin Child Adolesc Psychol*. 2004; 33:82–87. [PubMed: 15028543]
63. Vaughn, BE.; Bost, KK. Attachment and temperament: redundant, independent, or interacting influences on interpersonal adaptation and personality development?. In: Cassidy, J.; Shaver, PR., editors. *Handbook of attachment: theory, research, and clinical applications*. New York: Guilford; 1999. p. 198-225.
64. Bowlby, J. *Attachment and loss*. New York: Basic; 1969.
65. Zeanah CH, Fox NA. Temperament and attachment disorders. *J Clin Child Adolesc Psychol*. 2004; 33:32–41. [PubMed: 15028539]
66. Ainsworth, MS.; Blehar, MC.; Waters, E.; Wall, S. *Patterns of attachment: a psychological study of the strange situation*. Hillsdale, NJ: Erlbaum; 1978.
67. Renken B, Egeland B, Marvinney DMS, Sroufe LA. Early childhood antecedents of aggression and passive-withdrawal in early elementary school. *J Pers*. 1989; 57:257–281. [PubMed: 2769557]
68. Sroufe LA. Attachment classification from the perspective of infant-caregiver relationships and infant temperament. *Child Dev*. 1985; 56:1–14. [PubMed: 3987395]
69. Belsky J, Rovine M. Temperament and attachment security in the strange situation: an empirical rapprochement. *Child Dev*. 1987; 58:787–795. [PubMed: 3608649]
70. van den Boom DC. The influence of temperament and mothering on attachment and exploration: an experimental manipulation of sensitive responsiveness among lower-class mothers with irritable infants. *Child Dev*. 1994; 65:1457–1477. [PubMed: 7982362]
71. Levy F, Hay DA, McStephen M, Wood C, Waldman I. Attention-deficit hyperactivity disorder: a category or a continuum? Genetic analysis of a large-scale twin study. *J Am Acad Child Adolesc Psychiatry*. 1997; 36:737–744. [PubMed: 9183127]
72. Biederman J, Faraone S, Milberger S, et al. A prospective 4-year follow-up study of attention-deficit hyperactivity and related disorders. *Arch Gen Psychiatry*. 1996; 53:437–446. [PubMed: 8624187]
73. Barkley RA. Behavioral inhibition, sustained attention, and executive functions: constructing a unified theory of ADHD. *Psychol Bull*. 1997; 121:65–94. [PubMed: 9000892]
74. Bussing R, Gary FA, Mason DM, Leon CE, Sinha K, Garvan CW. Child temperament, ADHD, and caregiver strain: exploring relationships in an epidemiological sample. *J Am Acad Child Adolesc Psychiatry*. 2003; 42:184–192. [PubMed: 12544178]
75. Nigg JT, John OP, Blaskey LG, et al. Big five dimensions and ADHD symptoms: links between personality traits and clinical symptoms. *J Pers Soc Psychol*. 2002; 83:451–469. [PubMed: 12150240]
76. Rettew DC, Copeland W, Stanger C, Hudziak JJ. Associations between temperament and DSM-IV externalizing disorders in children and adolescents. *J Dev Behav Pediatr*. 2004; 25:383–391. [PubMed: 15613986]
77. White JD. Personality, temperament and ADHD: a review of the literature. *Pers Individ Diff*. 1999; 27:589–598.
78. Schmeck K, Poustka F. Temperament and disruptive behavior disorders. *Psychopathology*. 2001; 34:159–163. [PubMed: 11316963]

79. Kluger AN, Siegfried Z, Ebstein RP. A meta-analysis of the association between DRDR polymorphism and novelty seeking. *Mol Psychiatry*. 2002; 7:712–717. [PubMed: 12192615]
80. Nigg JT, Goldsmith HH, Sachek J. Temperament and attention deficit hyperactivity disorder: the development of a multiple pathway model. *J Clin Child Adolesc Psychol*. 2004; 33:42–53. [PubMed: 15028540]
81. Frick PJ, Morris AS. Temperament and developmental pathways to conduct problems. *J Clin Child Adolescent Psychol*. 2004; 33:54–68.
82. Hubbard JA, Smithmyer CM, Ramsden SR, et al. Observational, physiological, and self-report measures of children's anger: relations to reactive versus proactive aggression. *Child Dev*. 2002; 73:1101–1118. [PubMed: 12146736]
83. Brennan PA, Hall J, Bor W, Najman JM, Williams G. Integrating biological and social processes in relationship to early-onset persistent aggression in boys and girls. *Dev Psychol*. 2003; 39:309–323. [PubMed: 12661888]
84. Moffit TE, Caspi A. Childhood predictors differentiate life-course persistent and adolescent-limited antisocial pathways in males and females. *Dev Psychopathol*. 2001; 13:355–376. [PubMed: 11393651]
85. Shields A, Cicchetti D. Reactive aggression among maltreated children: the contributions of attention and emotion dysregulation. *J Clin Child Psychol*. 1998; 27:381–395. [PubMed: 9866075]
86. Frick PJ, Cornell AH, Bodin SD, Dane HA, Barry CT, Loney BR. Callous-unemotional traits and subtypes of conduct disorder. *Dev Psychol*. 2003; 39:246–260. [PubMed: 12661884]
87. Loney BR, Frick PJ, Clements CB, Ellis ML, Kerlin K. Callous-unemotional traits, impulsivity, and emotional processing in antisocial adolescents. *J Clin Child Adolesc Psychol*. 2003; 32:139–152. [PubMed: 12573939]
88. Fowles DC. Psychophysiology and psychopathology: a motivational approach. *Psychophysiology*. 1988; 25:373–391. [PubMed: 3051073]
89. Kuo PH, Chih YC, Soong WT, Yang HJ, Chen WJ. Assessing personality features and their relations with behavioral problems in adolescents: Tridimensional Personality Questionnaire and junior Eysenck Personality Questionnaire. *Compr Psychiatry*. 2004; 45:20–28. [PubMed: 14671733]
90. Gotlieb IH, Lewinsohn PM, Seeley JR. Symptoms versus a diagnosis of depression: differences in psychosocial functioning. *J Consult Clin Psychol*. 1995; 63:90–100. [PubMed: 7896995]
91. Ruscio J, Ruscio AM. Informing the continuity controversy: a taxometric analysis of depression. *J Abnorm Psychol*. 2000; 109:473–487. [PubMed: 11016117]
92. Clark LA, Watson D. Tripartite model of anxiety and depression: psychometric evidence and taxonomic implications. *J Abnorm Psychol*. 1991; 100:316–336. [PubMed: 1918611]
93. Chorpita BF, Plummer CM, Moffitt CE. Relations of tripartite dimensions of emotion to childhood anxiety and mood disorders. *J Abnorm Child Psychol*. 2000; 28:299–310. [PubMed: 10885687]
94. Angold A, Costello EJ. Depressive comorbidity in children and adolescents: empirical, theoretical, and methodological issues. *Am J Psychiatry*. 1993; 150:1779–1791. [PubMed: 8238631]
95. Anthony JL, Lonigan CJ, Hooe ES, Phillips BM. An affect-based, hierarchical model of temperament and its relations with internalizing symptomatology. *J Clin Child Adolesc Psychol*. 2002; 31:480–490. [PubMed: 12402567]
96. Caspi A, Moffitt TE, Newman DL, Silva PA. Behavioral observations at age 3 predict adult psychiatric disorders: longitudinal evidence from a birth cohort. *Arch Gen Psychiatry*. 1996; 53:1033–1039. [PubMed: 8911226]
97. Davies PT, Windle M. Interparental discord and adolescent adjustment trajectories: the potentiating and protective role of intrapersonal attributes. *Child Dev*. 2001; 72:1163–1178. [PubMed: 11480940]
98. Eisenberg N, Cumberland A, Spinrad TL, et al. Losoya SH, Guthrie IK. The relations of regulation and emotionality to children's externalizing and internalizing problem behavior. *Child Dev*. 2001; 72:1112–1134. [PubMed: 11480937]
99. John OP, Caspi A, Robins PW, Moffitt TE, Stouthamer-Loeber M. The "little five": exploring the nomological network of the five-factor model of personality in adolescent boys. *Child Dev*. 1994; 65:160–178. [PubMed: 8131645]

100. Caspi A, Henry B, McGee RO, Moffitt TE, Silva PA. Temperamental origins of child and adolescent behavior problems: from age three to age fifteen. *Child Dev.* 1995; 66:55–68. [PubMed: 7497829]
101. Biederman J, Rosenbaum JF, Bolduc-Murphy EA, et al. A 3-year follow-up of children with and without behavioral inhibition. *J Am Acad Child Adolesc Psychiatry.* 1993; 32:814–821. [PubMed: 8340303]
102. Schwartz CE, Snidman N, Kagan J. Adolescent social anxiety as an outcome of inhibited temperament in childhood. *J Am Acad Child Adolesc Psychiatry.* 1999; 38:1008–1015. [PubMed: 10434493]
103. Tillman R, Geller B, Craney JL, et al. Temperament and character factors in a prepubertal and early adolescent bipolar disorder phenotype compared to attention deficit hyperactive and normal controls. *J Child Adolesc Psychopharmacol.* 2003; 13:531–543. [PubMed: 14977466]
104. Klein, DN.; Durbin, CE.; Shankman, SA.; Santiago, NJ. Depression and personality. In: Gotlieb, IH.; Hammen, CL., editors. *Handbook of depression and its treatment.* New York: Guilford; 2002. p. 115-140.
105. Akiskal HS, Maser JD, Zeller PJ, et al. Switching from “unipolar” to bipolar II. An 11-year prospective study of clinical and temperamental predictors in 559 patients. *Arch Gen Psychiatry.* 1995; 52:114–123. [PubMed: 7848047]
106. Pulkkinen L, Pitkanen T. A prospective study of the precursors to problem drinking in young adulthood. *J Stud Alcohol.* 1994; 55:578–587. [PubMed: 7990468]
107. Wills TA, Dishion TJ. Temperament and adolescent substance use: a transactional analysis of emerging self-control. *J Clin Child Adolesc Psychology.* 2004; 33:69–81.
108. Lerner JV, Vicary JR. Difficult temperament and drug use. *J Drug Educ.* 1984; 14:1–8. [PubMed: 6537440]
109. Wills TA, Sandy JM, Yaeger A. Temperament and adolescent substance use: an approach to risk and protection. *J Pers.* 2000; 68:1127–1152. [PubMed: 11130735]
110. Wills TA, Windle M, Cleary SD. Temperament and novelty-seeking in adolescent substance use. *J Pers Soc Psychol.* 1998; 74:387–406. [PubMed: 9491584]
111. Masse LC, Tremblay RE. Behavior of boys in kindergarten and the onset of substance use during adolescence. *Arch Gen Psychiatry.* 1997; 54:62–68. [PubMed: 9006402]
112. Wills TA, Vaccaro D, McNamara G. Novelty seeking and related constructs as predictors of adolescent substance use. *J Subst Abuse.* 1994; 6:1–20. [PubMed: 8081104]
113. Cloninger, CR.; Svrakic, DM.; Bayon, C.; Przybeck, TR. Measurement of psychopathology as variants in personality. In: Cloninger, CR., editor. *Personality and psychopathology.* Washington, DC: American Psychiatric Press; 1999.
114. Clark LA, Kochanska G, Ready R. Mothers’ personality and its interaction with child temperament as predictors of parenting behavior. *J Pers Soc Psychol.* 2000; 79:274–285. [PubMed: 10948980]
115. Rettew, DC.; McKee, L.; Stanger, C.; Hudziak, JJ. Badness of fit: temperamental interactions between children and parents. Paper presented at the 51st annual conference of the American Academy of Child and Adolescent Psychiatry; October 2004; Washington, DC.
116. Carey WB. Problems in diagnosing attention and activity. *Pediatrics.* 1999; 103:664–667. [PubMed: 10049973]
117. Lewinsohn PM, Steinmetz JL, Larson DW, Franklin J. Depression-related cognitions: antecedent or consequence? *J Abnorm Psychol.* 1981; 3:213–219. [PubMed: 7288016]
118. Copeland MP, Daly E, Hines V, et al. Psychiatric symptomatology and prodromal Alzheimer’s disease. *Alz Dis Assoc Disord.* 2003; 17:1–8.
119. Slutske WS, Heath AC, Dinwiddie SH, et al. Modeling genetic and environmental influences in the etiology of conduct disorder: a study of 2,682 adult twin pairs. *J Abnorm Psychol.* 1997; 106:266–279. [PubMed: 9131847]
120. Gjone H, Stevenson J, Sundet JM, Eilertsen DE. Changes in heritability across increasing levels of behavior problems in young twins. *Behav Genet.* 1996; 26:419–426. [PubMed: 8771902]

121. Lengua LJ, Wolchik SA, Sandles IN, West SG. The additive and interactive effects of parenting and temperament in predicting adjustment problems of children of divorce. *J Clin Child Psychol.* 2000; 29:232–244. [PubMed: 10802832]
122. Morris AS, Silk JS, Steinberg L, Sessa FM, Avenevoli S, Essex MJ. Temperamental vulnerability and negative parenting as interacting predictors of child development. *J Marr Fam.* 2002; 64:461–471.
123. Nolen-Hoeksema S, Girgus JS, Seligman MEP. Predictors and consequences of childhood depressive symptoms: a 5-year longitudinal study. *J Abnorm Psychol.* 1992; 101:405–422.
124. Beevers CG, Meyer B. Lack of positive experiences and positive expectancies mediate the relationship between BAS responsiveness and depression. *Cognit Emot.* 2002; 16:549–564.
125. Lonigan CJ, Vasey MW, Phillips BM, Hazen RA. Temperament, anxiety, and the processing of threat-relevant stimuli. *J Clin Child Adolesc Psychology.* 2004; 33:8–20.
126. Eisenberg N, Fabes RA, Guthrie IK, Reiser M. Dispositional emotionality and regulation: their role in predicting quality of social functioning. *J Pers Soc Psychol.* 2000; 78:136–157. [PubMed: 10653511]
127. Olson SL, Schilling EM, Bates JE. Measurement of impulsivity: construct coherence, longitudinal stability, and relationship with externalizing problems in middle childhood and adolescence. *J Abnorm Child Psychol.* 1999; 27:151–165. [PubMed: 10400061]
128. Eisenberg N, Morris AS. Children's emotional-related regulation. *Adv Child Dev Behav.* 2002; 30:189–229. [PubMed: 12402675]
129. Ge X, Conger RR, Cadoret RJ, et al. The developmental interface between nature and nurture: a mutual influence model of child antisocial behavior and parent behaviors. *Dev Psychol.* 1996; 32:574–589.
130. Dishion, TJ.; French, DC.; Patterson, GR. The development and ecology of antisocial behavior. In: Cicchetti, D.; Cohen, D., editors. *Manual of developmental psychopathology.* New York: Wiley; 1995.
131. Dodge KA, Pettit GS. A biopsychosocial model of the development of chronic conduct problems in adolescence. *Dev Psychol.* 2003; 39:349–371. [PubMed: 12661890]
132. Widiger, TA.; Verheul, R.; van den Brink, W. Personality and psychopathology. In: Pervin, LA.; John, OP., editors. *Handbook of personality: theory and research.* New York: Guilford; 1999. p. 347-366.
133. Shea MT, Leon AC, Mueller TI, Solomon DA, Warshaw MG, Keller MB. Does major depression result in lasting personality change? *Am J Psychiatry.* 1996; 153:1404–1410. [PubMed: 8890672]
134. Walker EF, Diforio D, Baum K. Developmental neuropathology and the precursors of schizophrenia. *Acta Psychiatr Scand Suppl.* 1999; 395:12–19. [PubMed: 10225328]
135. Hirshfeld-Becker DR, Biederman J. Rationale and principles for early intervention with young children at risk for anxiety disorders. *Clin Child Fam Psychol Rev.* 2002; 5:161–172. [PubMed: 12240705]
136. Olds D, Henderson CR Jr, Cole R, et al. Long-term effects of nurse home visitation on children's criminal and antisocial behavior: 15-year follow-up of a randomized controlled trial. *JAMA.* 1998; 280:1238–1244. [PubMed: 9786373]
137. Dadds MR, Holland DE, Laurens KR, Mullins M, Barrett PM, Spence SH. Early intervention and prevention of anxiety disorders in children: results at 2-year follow-up. *J Consult Clin Psychol.* 1999; 67:145–150. [PubMed: 10028219]
138. Derryberry D, Reed MA. Anxiety-related attentional biases and their regulations by attentional control. *J Abnorm Psychol.* 2002; 111:225–236. [PubMed: 12003445]
139. Compas BE, Connor-Smith J, Jaser S. Temperament, stress reactivity, and coping: implications for depression in children and adolescents. *J Clin Child Adolesc Psychol.* 2004; 33:21–31. [PubMed: 15028538]
140. Swedo SE. Pediatric autoimmune neuropsychiatric disorders associated with streptococcal infections (PANDAS). *Mol Psychiatry.* 2002; 7 suppl 2:S24–S25. [PubMed: 12142939]

141. Lemery KS, Essex MJ, Smider NA. Revealing the relation between temperament and behavior problem symptoms by eliminating measurement confounding: expert ratings and factor analyses. *Child Dev.* 2002; 73:867–882. [PubMed: 12038557]
142. Lengua LJ, West SG, Sandler IN. Temperament as a predictor of symptomatology in children: addressing contamination of measures. *Child Dev.* 1998; 69:164–181. [PubMed: 9499565]

TABLE 1

Major Taxonomies of Temperament in Children and Adolescents

Scale	Principal temperament dimensions	Method of ascertainment	Comments
Dimensions of Temperament Survey ²⁵	Activity level—general Activity level—sleep Approach/withdrawal Flexibility/rigidity Mood quality Rhythmicity—sleep Rhythmicity—eating Rhythmicity—daily habits Talk orientation	Questionnaire—54 items, 4-point scale	Closely derived from original Thomas and Chess dimensions
Junior Temperament and Character Inventory ^{9,26}	Novelty seeking Harm avoidance Reward dependence Persistence	Questionnaire—108 items, true/false	Instrument also contains several character dimensions New version under development with 5-point Likert scale
EAS Temperament Survey ²⁷	Emotionality Activity level Sociability Shyness	Questionnaire—20 items, 5-point scale	Modifications from the Colorado Childhood Temperament Inventory
Behavioral Inhibition ³	Behavioral inhibition (yes/no)	Laboratory observation	Protocol varies by age
Child Behavior Questionnaire ²⁸	Negative affectivity Extraversion/surgency Effortful control	Questionnaire—195 items, 7-point scale	Shorter versions exist, as do scales for other age groups

TABLE 2

Summary of the Relations Between Temperament and Psychopathology

	Negative affectivity	Extraversion	Effortful control	Mechanism of association
ADHD	High	High	Low	Spectrum
Other disruptive behavior disorders	High * or Low [†]	High	Low	Risk
Major depression	High	Low	Low	Risk
Anxiety disorders	High	Low	Low	Risk/spectrum
Substance use	High	High [‡]	Low	Risk

* **Bold** print indicates stronger associations.

[†] Low negative affectivity is seen in some conduct disorders characterized by more predatory aggression and premeditated rule-breaking.

[‡] Especially related to novelty or sensation seeking.