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The Role of Temperament in the Etiology of Child Psychopathology

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A substantial proportion of children and adolescents come to suffer from psychological disorders. This article focuses on the temperament factors that are involved in the pathogenesis of child psychopathology. It is argued that besides the reactive temperament factor of emotionality/neuroticism, the regulative process of effortful control also plays an important role in the etiology and maintenance of internalizing and externalizing problems in youths. More specifically, vulnerability to child psychopathology is determined by a temperament that is characterized by high levels of emotionality/neuroticism and low levels of effortful control. Models are hypothesized in which reactive and regulative temperament factors either have interactive or additive effects on the development of psychological disorders in children, and conceptualized in terms of a developmental psychopathology perspective. Directions for future research and clinical implications of this temperamental view on psychopathology are discussed.

KEY WORDS: temperament; emotionality/neuroticism; effortful control; psychopathology; children and adolescents.

Three children are referred to a clinical child psychologist. The parents of all three have divorced during the past year. Tim (9-years old) has become extremely anxious since that event. He does not dare to stay home alone anymore. When his mother wants to go out for shopping, Tim panics and begs her not to go. Going to bed at night is also a problem. His mother has great difficulties getting Tim upstairs to go to bed and when he is finally in bed, she has to stay with him until he falls asleep. Almost every night, Tim awakens in terror because of a nightmare, and after being calmed down he has problems falling asleep again. It is clear that Tim exhibits many characteristics of an anxiety disorder. Tony (11-years old) displays different symptoms. Since the divorce of his parents, he has become very quiet and increasingly retreats in his room. He seems unhappy and sad most of the time, and even things that used to bring him great joy do not seem to interest him anymore. At school, Tony shows a total lack of energy: his performance deteriorates and because of his aloof attitude, he becomes increasingly isolated from the other children. Obviously, Tony appears to suffer from a depressive disorder. And finally Trevor (10-years old), since his parents have divorced, has become very touchy and gets easily annoyed. He often argues with his parents, does not obey his teachers any more, and frequently fights with other students on the schoolyard. Lately, he was caught while stealing candy in the local supermarket. Clearly, Trevor shows early signs of a disruptive behavior disorder.

Tim, Tony, and Trevor: three children who have been confronted with the same negative life event and since then display different abnormal behavior. Two important questions can be raised in the context of this common clinical observation. The first question is why do these children develop psychological problems after being exposed to a negative

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life event, whereas others adapt themselves without any trouble to comparable difficult circumstances? For example, in Western countries, up to 50% of marriages are dissolved, and many times children involved in these divorces do not develop psychopathological problems. The second question has to do with a phenomenon that within the domain of developmental psychopathology is referred to as "multifinality" (Mash & Wolfe, 2002), and can be formulated as follows: How is it possible that three children respond so differently to the same stressful event and come to display divergent types of problem behavior? Although it should be borne in mind that the etiology of psychopathology is undoubtedly a complex, multifactorial process (Ollendick & Hersen, 1999), this article proposes that temperament plays an important role in the etiology, manifestation, and even maintenance of the most common emotional and behavioral disorders in children. Briefly, it can be argued that Tim, Tony, and Trevor suffer from a psychological disorder, precisely because their temperament is characterized by high levels of emotional reactivity/neuroticism and low levels of self-regulation. This article first briefly describes the most common types of psychopathology in children. Then, the construct of temperament is introduced and the role of the reactive temperament factor "emotionality/neuroticism" in the origins of child psychopathology is presented. Following this, the concept of effortful control as a regulative temperament factor is put forward, and research is reviewed which has demonstrated that the combination of high emotionality/neuroticism and low effortful control is particularly relevant for understanding the etiology of child psychopathology. Next, it is argued that these temperament factors might also be involved in the formation of cognitive distortions, which are thought to play a crucial role in the maintenance of psychopathological problems. Finally, models for the hypothesized role of reactive and regulative temperament factors in the development of psychological disorders in youths are described and directions for future research on the link between temperament and child psychopathology are suggested.

CHILD PSYCHOPATHOLOGY

Epidemiological studies have shown that a substantial proportion of youths suffer from a psychological disorder. For example, Costello, Mustillo, Erkanli, Keeler, and Angold (2003) followed a sample of 1,420 children and young adolescents over a 4–8-year period. Every year, children and adolescents were tested by means of a structured interview to assess the most common types of psychopathology. Results indicated that internalizing disorders (such as anxiety disorders and depression) as well as externalizing disorders (disruptive behavior disorders, such as oppositional-defiant disorder and conduct disorder) were highly prevalent: every year, prevalence rates were around 5% for both types of disorders. In keeping with previous research, girls more frequently exhibited internalizing disorders, whereas boys more often suffered from externalizing disorders (e.g., Verhulst, Van der Ende, Ferdinand, & Kasius, 1997). However, the most remarkable finding of the study was that 36.7% of the youths had fulfilled the diagnostic criteria for at least one psychological disorder before they reached the age of 16. Inasmuch as the researchers assessed clinical diagnoses, including the presence of significant impairment in daily functioning, it is evident that the problems were substantial and clinically meaningful ones.

However, only a small proportion of the youths with psychological problems are actually referred for treatment (Champion, Goodall, & Rutter, 1995). In addition, although in some children complaints spontaneously diminish, in others the problems continue and subsequently manifest themselves as a mental disorder in adulthood. Retrospective and prospective research has indeed shown that anxiety disorders in youths frequently are a precursor of anxiety disorders and depression in adults, that depressive episodes during adolescence are a good predictor of later episodes, and that behavioral problems during childhood are solid markers for the development of antisocial personality disorder (Bernstein, Borchardt, & Perwien, 1996; Birmaher et al., 1996; Loeber, Burke, Lahey, Winters, & Zera, 2000; Ollendick & King, 1994). These findings, and others, have increasingly led researchers to study the origins of psychological disorders in children. This increase in research has yielded the insight that childhood psychopathology is not caused by a single factor operating in isolation, but rather originates from the dynamic interplay of multiple vulnerability and protective factors. For example, Vasey and Dadds (2001) have formulated a model for the etiology of childhood anxiety disorders, in which various biological (e.g., genetics, hormones, and neurotransmitters), psychological (e.g., coping, self-esteem, and cognitive distortions), and social factors (e.g., parental

rearing, stress, and negative learning experiences) are involved. Temperament also plays an important role in their multifactorial model for the etiology of childhood anxiety disorders, and this seems also true for models that account for the pathogenesis of depression and disruptive behavior disorders (Frick & Morris, 2004; Goodyer, 2001; Nigg, Goldsmith, & Sachek, 2004; Reid, Patterson, & Snyder, 2002).

TEMPERAMENT

Temperament can be defined as "biologically rooted individual differences in behavior tendencies that are present early in life and are relatively stable across various kinds of situations and over the course of time" (Bates, 1987, p. 1101). The difference between temperament and personality is rather vague. Some researchers view temperament as the part of personality that is genetically determined (see Carey & DiLalla, 1994), others consider temperament as the observable manifestation of the child's emerging personality (see for a discussion Matthews, Deary, & Whiteman, 2003), which is a point to which we will return later.

Many blueprints have been hypothesized for the structure of temperament in children. A frequently cited framework is the one formulated early on by Chess and Thomas (1985; see also Thomas & Chess, 1977) who identified as much as nine temperamental categories in their longitudinal study on child characteristics. These categories were (1) activity level, which refers to the motor component present in a given child's functioning and diurnal proportion of active and inactive periods, (2) rhythmicity, which has to do with the predictability and/or unpredictability in time of any function, (3) approach or withdrawal, which pertains to the initial response to a new stimulus, for example a new food, a new toy, or a new person, (4) adaptability, which is concerned with the ease with a child modifies new or altered situations in desired directions, (5) threshold of responsiveness, which is concerned with the intensity level of stimulation that is necessary to evoke a discernible response, irrespective of the specific form that the response may take, or the sensory modality affected, (6) intensity of reaction, which refers to the energy level of response, irrespective of its quality or direction, (7) quality of mood, which pertains to the amount of pleasant, joyful, and friendly behavior as contrasted with unpleasant, crying, and unfriendly behavior, (8) distractibility, which has to do with the effectiveness of extraneous environmental stimuli in interfering with or in altering the direction of the ongoing behavior, and (9) attention span and persistence, which can be defined respectively as the length of time a particular activity is pursued by the child and the continuation of an activity in the face of obstacles to the maintenance of the activity direction. On the basis of a quantitative analysis of their data, Chess and Thomas (1985) noted that specific combinations of these temperament categories yield three fundamental temperament types. The first type of "easy temperament" is characterized by regularity, positive approach responses to new stimuli, high adaptability to change, and mild to moderate intense mood that is preponderantly positive. These children are quickly at ease in a new environment or with new people, and are welcomed by others because they are good-natured and helpful. The second type of "difficult temperament" shows the signs of irregularity in biological functions, negative withdrawal responses to new stimuli, nonadaptability or slow adaptability to change, and intense mood expressions that are frequently negative. These troublesome children show prolonged adjustment periods to new routines, people, or situations, and relatively frequent outbursts of crying and aggression. The third and final type is defined as "slow-to-warm-up" and refers to children who are characterized by a combination of negative responses to new stimuli with slow adaptability after repeated contact. Chess and Thomas (1985) noted that two thirds of all children fit into these three temperament groups, with other children demonstrating somewhat different constellations of the nine basic temperament categories.

Other descriptive frameworks for children's temperament have been formulated, but many of these models, including the one described by Chess and Thomas (1985), seem to be conceptually and empirically related to three basic dimensions. These basic dimensions are described by Buss and Plomin (1984) as the Emotionality-Activity-Sociability (EAS) model. The first dimension is "emotionality" and refers to psychological instability and a proneness to experience feelings of fear, anger, and sadness. The second dimension is "activity" and concerns characteristics such as tempo, vigor, and endurance. The third and final dimension is "sociability" and refers to traits such as tendencies to affiliate and to be responsive to others. Interestingly, a comparison of the EAS model with current theories of personality such as the "Big Five" (Costa & McCrae, 1992) and the "Giant Three" (Eysenck,

1991) makes clear that the three temperament dimensions for most part can be further divided into the personality factors of "neuroticism" and "extraversion." Neuroticism can be viewed as an equivalent for emotionality, whereas extraversion can be regarded as a mixture of activity level and sociability.

Interestingly, Gray (1987, 1991) has described three basic brain systems that are relevant for understanding behavior in response to salient environmental stimuli, and as such largely are associated with temperament and personality. The first system is the behavioral inhibition system (BIS), which consists of subcortical structures such as the hippocampus, the septum, and parts of the limbic system, and has projections to the frontal lobes of the cerebral cortex. The BIS serves to alert the person to the possibility of danger or punishment, thereby enhancing avoidance behavior. Activity in the BIS is responsible for feelings of anxiety and incites the individual to stop whatever action is going on and to scan the environment for further cues. The second system is the behavioral approach system (BAS), which is sensitive to signals of reward, and involved in approach behavior. Activity in the BAS produces impulsive behavior: the person will vigorously pursue any action that might result in reward, with little attention for the possibility of negative consequences. This system is primarily located in brain structures that are guided by the neurotransmitter of dopamine. Finally, the flight/fight system is sensitive to conditioned, aversive stimuli (such as pain, loud noises) and is thought to be involved in strong emotions such as rage and panic. This system is associated with brain structures that are involved with the control of negative emotions, such as the amygdala and the hypothalamus. Gray (1987, 1991; see also Gray & McNaughton, 2000) has hypothesized that differences in the reactivity of these three brain systems determine differences in temperament and personality. Although the empirical evidence is not totally consistent, most research has demonstrated that a stronger reactivity of the BIS and the fight/flight system are associated with higher levels of neuroticism, whereas stronger responsivity of the BAS is related to extraversion (e.g., Caseras, Avila, & Torrubia, 2003), and there are indications that this is also true in child populations (Muris, Meesters, De Kanter, & Eek Timmerman, 2005).

Gray's brain systems model of personality bears strong resemblance to the so-called tripartite theory (see Watson, Clark, & Harkness, 1994), which emphasizes negative affectivity, positive affectivity, and physiological hyperarousal as the central organizing dimensions of personality that are useful when studying psychopathology. Briefly, negative affectivity is similar to the BIS, positive affectivity is akin to the BAS, whereas physiological hyperarousal shows clear overlap with the fight/flight system. There is increasing support for the applicability of the tripartite theory to child populations (Chorpita, Daleiden, Moffitt, Yim, & Umemoto, 2000; Laurent et al., 1999), and this evidence converges on the notion that negative affectivity corresponds with neuroticism, whereas positive affectivity matches with extraversion (Phillips, Lonigan, Driscoll, & Hooe, 2002).

TEMPERAMENT, PERSONALITY, AND STABILITY

As mentioned earlier, researchers view temperament as the observable manifestation of children's emerging personality. Empirical evidence for this notion has been provided by Caspi and colleagues in the so-called Dunedin study (Caspi, 2000; Caspi et al., 2003; Caspi & Silva, 1995). In this study, over 1,000 3-year-old children were classified into temperament groups on the basis of observations of their behavior. There were three temperament groups that were of particular importance: (1) the well-adjusted group, which resembled Chess and Thomas' (1985) "easy type," included children who were adequately self-confident and who did not become upset when confronted with novel stimuli and situations, (2) the undercontrolled group, which resembled Chess and Thomas' "difficult type," contained children who were impulsive, restless, negativistic, distractible, and labile in their emotional responses, and (3) the inhibited group, which resembled Chess and Thomas' "slow-to-warm-up type," comprising of children who were socially uncommunicative, fearful, and easily upset by novelty. When studying these three temperament groups, more than 20 years later, results showed that temperamental qualities predicted adult personalities. More specifically, children who had been classified as undercontrolled when they were 3-years old, were intolerant, easily upset, overreactive to minor events, and distrustful to other people at age 26. Children who had been identified as inhibited, were overcontrolled and nonassertive as adults, and seemed to express little pleasure in their later life. Finally, those children who had been classified as well adjusted when they were young, still represented the normative group in adulthood.

Although the links between childhood temperament and adult personality were at best modest, this study demonstrates that there is reasonable stability in individuals' behavioral characteristics over long time periods.

As it is clear that temperament and personality change over time as a result of a person's interaction with the environment and as such have modest stability over longer time periods (Caspi & Roberts, 2001), it could be concluded that temperament has little value for predicting psychopathology. However, two remarks can be made that qualify this negatively tinted conclusion. First of all, it should be borne in mind that methods for assessing temperament in young people may be subject to error, thereby decreasing the power for predicting the development of personality features over longer time periods. Second, the stability of temperament and personality factors over shorter time periods seems to be remarkably better, and therefore such features may still be important as precursors of child psychopathology.

EMOTIONALITY/NEUROTICISM AND PSYCHOPATHOLOGY

Research has demonstrated that the temperament dimension of emotionality or its equivalent neuroticism is involved in the etiology of child psychopathology (Calkins & Fox, 2002; Lonigan & Phillips, 2001). For example, John, Caspi, Robins, Moffitt, and Stouthamer-Loeber (1994) demonstrated early on that this temperament/personality dimension was associated with high levels of emotional and behavioral symptoms in youths. In their study, mothers' Q-sorts of 350 12–13-year-old boys were subjected to a factor analysis. Neuroticism clearly emerged as one of five personality factors (which showed remarkable resemblance to the "Big Five"), but most importantly in the context of this review, high levels of this reactive personality factor were accompanied by high levels of psychopathological symptoms, and this appeared especially true for internalizing symptoms. Similar findings were obtained by Huey and Weisz (1997) who assessed personality factors in 116 clinic-referred youths by means of the Q-sort technique administered to a teacher who was familiar with the child. Results demonstrated that neuroticism was positively related to internalizing but not to externalizing symptoms. A further study by Ehrler, Evans, and McGhee (1999), which employed a teacher-rated questionnaire for assessing personality variables including neuroticism in a small sample of 86 school children, yielded a highly similar finding. That is, neuroticism was accompanied by higher levels of anxiety and depression but not with conduct problems.

The above-described research demonstrates that there seem to be concurrent relationships between emotionality/neuroticism and behavior problems in youths. A number of studies have demonstrated that this reactive temperament/personality dimension is also associated with psychological *disorder*. For example, Prior, Sanson, Smart, and Oberklaid (1999) studied temperament factors in 11–12-year-old "at risk" children ($N = 186$) of whom almost half met the diagnostic criteria for a *DSM*-defined disorder. Results demonstrated that these children displayed higher levels of negative reactivity and withdrawal (which are both indicators of an emotional/neurotic temperament) as compared to children in the control group. Another investigation by Rettew, Copeland, Sytanger, and Hudziak (2004) examined temperament characteristics in children with attention-deficit and hyperactivity disorder (ADHD), disruptive behavior disorder, disruptive behavior disorder plus an affective and/or anxiety disorder, and control children who did not suffer from a psychiatric disorder. Results revealed many temperament differences across the four groups, but most interesting for the present discussion was the finding that children in the disruptive behavior disorder plus affective and/or anxiety disorder clearly displayed higher levels of harm avoidance (which parallels emotionality/neuroticism) than children in the other three groups.

Besides cross-sectional data on the link between emotionality/neuroticism and psychopathology, there is also evidence coming from prospective studies that support this relationship. A first study that is mentioned in this respect was carried out by Caspi, Henry, McGee, Moffitt, and Silva (1995). These researchers assessed various temperament dimensions when children were 3 and 5 years of age. Results demonstrated that the temperament dimension of withdrawal, which can be regarded as a derivate of emotionality/neuroticism, predicted parent- and teacher-rated internalizing symptoms when children reached middle childhood and early adolescence. A longitudinal twin study of Gjone and Stevenson (1997) examined the significance of genetic and common environmental influences on temperament (the above-described EAS dimensions)

and behavioral and emotional problems in a sample of 758 twin pairs aged 7 through 17 years who were followed for a 2-year period. Results supported the idea that the temperament factor of emotionality is (at least in part) genetically determined. Further, the data indicated that emotionality was the strongest predictor of emotional and behavioral problems. In an investigation by Asendorpf and Van Aken (2003), the personality development of 151 children was followed from the first or second year in preschool until age 12, using Q-sorts and rating scale data of teachers, parents, and friends. In addition to personality characteristics, judgments and behavioral observations of inhibition, aggressiveness, and self-esteem were also obtained. Results demonstrated that the personality factor of neuroticism was fairly stable and even showed continuity over longer time periods, in spite of the fact that different judges and instruments were used for assessing the personality factors of children at various ages. Further, neuroticism was significantly linked to higher levels of inhibition (but not to aggression) and lower levels of self-esteem. In a prospective study by Ruschena, Prior, Sanson, and Smart (2005), the impact of a negative family transition, that is, parental separation, divorce, or death, upon the lives of children and adolescents was examined. Results again indicated that the temperamental characteristic of withdrawal was a significant predictor of internalizing symptoms, and this appeared not only the case in youths who had been confronted with a negative family transition but also in youths of whom the families remained intact. Finally, Mun, Fitzgerald, Van Eye, Puttler, and Zucker (2001) investigated temperamental characteristics as predictors of externalizing and internalizing behavior problems in boys who were 3–5-years old and again when they were 6–8-years old. Results clearly indicated that reactivity and withdrawal, which both represent aspects of emotionality/neuroticism, were significant predictors of behavior problems. Interestingly, reactivity was clearly linked to externalizing behavior problems, whereas withdrawal was convincingly associated with internalizing behavior problems.

Longitudinal research demonstrating a link between emotionality/neuroticism and psychological *disorders* is scarce. One exception is a study by Craske, Poulton, Tsao, and Plotkin (2001) who evaluated the temperamental factor of emotionality at age 3 as a predictor of panic disorder and agoraphobia at ages 18 or 21 in an unselected sample ($N = 992$). Results indicated that emotionality at age 3 predicted later panic disorder and agoraphobia, but this appeared only the case in males.

Recently, a number of studies have included self-report questionnaires when investigating temperament and personality correlates of child psychopathology. This seems to be an important development as it is generally assumed that self-description is an important source of information in the field of personality research (Carver & Scheier, 1996). Muris, Winands, and Horselenberg (2003) showed that neuroticism as measured by the Junior version of the Eysenck Personality Questionnaire (Eysenck & Eysenck, 1975) was significantly associated with symptoms of anxiety disorders, depression, and somatization. Two studies that employed the recently developed Big Five Questionnaire for Children (Barbaranelli, Caprara, Rabasca, & Pastorelli, 2003; Muris, Meesters, & Diederen, 2005) found that neuroticism as indexed by this self-report inventory was not only associated with internalizing but also with externalizing symptoms, and this appeared true for various age groups of nonclinical children and adolescents. Finally, a longitudinal study by Lonigan, Phillips, and Hooe (2003) examined the tripartite theory in relation to children's symptoms of anxiety and depression. Results showed that self-reported negative affectivity (which as mentioned earlier can be viewed as an equivalent of emotionality/neuroticism) was relatively stable over a 7-month period. Most importantly, negative affectivity appeared to be a significant correlate of anxiety and depression symptoms on both occasions, and was found to predict changes in anxiety and depression symptoms over time.

This review of the link between emotionality/neuroticism and child psychopathology suggests that this reactive personality factor is particularly associated with high levels of internalizing symptoms in youths. This does not mean, however, that temperament factors are less relevant for the etiology of externalizing psychopathology in youths. Several longitudinal studies have demonstrated that a "difficult" temperament as assessed in early childhood is predictive of externalizing symptoms in middle childhood or adolescence (e.g., Bates, Pettit, Dodge, & Ridge, 1998; Guerin, Gottfried, & Thomas, 1997; Maziade et al., 1985, 1990; Shaw et al., 1998). The problem is that difficult temperament in this research is operationalized in terms of a construct that reflects several more basic temperament dimensions (e.g., resistance to control; see Bates et al., 1998). Thus, although such difficult temperament certainly contains features of

emotionality/neuroticism, it also refers to lack of regulative temperament factors, which makes it difficult to include these studies in the context of the present review. Further, it should be noted that emotionality/neuroticism consists of various lower-order traits, of which fear, anger/frustration, and sadness are most important. Most instruments that have been used to assess emotionality/neuroticism are mainly tapping the lower-order traits of fear and sadness, and as such it is not overly surprising that these measures are more convincingly related to internalizing symptoms than to externalizing symptoms. In fact, a recent study by Muris, Meesters, and Blijlevens (submitted) demonstrated that when emotionality/neuroticism is measured by an instrument covering the full range of lower-order traits (i.e., the Early Adolescent Temperament Questionnaire; Ellis & Rothbart, 2001), this reactive personality trait is predictive of both internalizing and externalizing symptoms in youths. Also noteworthy in this regard is a longitudinal study by Rydell, Berlin, and Bohlin (2003) who collected data on emotionality when children were 5-years old and internalizing and externalizing behavior problems some 1.5 years later. Results indicated that emotionality was positive linked to behavior problems. Interestingly, evidence was obtained for the notion that lower-order traits of the emotional temperament determined the type of behavior problems. That is, the lower-order trait of fear predicted internalizing problems, whereas the lower-order trait of anger/frustration was predictive of externalizing problems. Similar findings were obtained by Blair (2002) who followed low birth weight, premature infants for a 2-year period. Negative temperament assessed when infants were 12-months old appeared to predictive for the occurrence of behavior problems in children at age 3. Again, temperamental fear specifically predicted internalizing symptoms, whereas anger/frustration augured externalizing symptoms.

Thus, it seems plausible that emotionality/neuroticism predisposes children to internalizing as well as externalizing disorders. Further, it can be assumed that the lower-order traits of this reactive personality factor play an important role in the type of psychopathology from which children eventually come to suffer. A child with a fearful temperament is more prone to develop an anxiety disorder, a child with a temperament characterized by high anger/frustration runs greater risk to develop a disruptive behavior disorder, whereas a child with sad temperament is more susceptible to develop a depression. However, empirical evidence for this idea is still meager, and so the issue certainly needs further validation.

Although this review article focuses primarily on basic temperament factors in relation to child psychopathology, it is also worthy of note that some researchers have devoted their research attention to certain temperament *types* in their study of children's vulnerability to psychological disorders. A good example of such a temperament type is "behavioral inhibition to the unfamiliar," which can be defined as the tendency of children to be unusually shy and to react with fear and withdrawal in stimuli and situations that are novel and/or unfamiliar (Kagan, 1994). There is abundant evidence showing that behavioral inhibition is associated with the development of high levels of anxiety symptoms and anxiety disorders. For example, in a longitudinal study by Biederman et al. (1993), preschool children were followed for a 3-year period. Results showed that children initially identified as behaviorally inhibited were subsequently more likely to develop anxiety disorders compared to control children (i.e., children who at study onset were not classified as behaviorally inhibited; see for a review, Hirshfeld-Becker, Biederman, & Rosenbaum, 2004). Several authors have argued that behavioral inhibition is the perceptible manifestation of one or more underlying temperament or personality dimensions (Craske, 1997; Turner, Beidel, & Wolff, 1996). The most obvious candidate in this respect is of course emotionality/neuroticism, which also refers to psychological instability and proneness to experience negative emotions and as such bears strong similarity to behavioral inhibition (see Muris & Dietvorst, in press).

TEMPERAMENT AND PSYCHOPATHOLOGY: TAUTOLOGICAL?

The position that temperament plays a critical role in the etiology of child psychopathology can be criticized by pointing to the presumed tautological nature of the link between these temperament factors and psychopathology (Frick, 2004; Lahey, 2004). That is to say, it can be argued that children who are frequently fearful suffer from an anxiety disorder, children who become easily angry and frustrated display the symptoms of a disruptive behavior disorders, and those who are regularly sad show the signs of a depression. Nevertheless, research has demonstrated that the temperamental characteristics of emotionality are different from the symptoms of psychological

disorders. For example, Lemery, Essex, and Smider (2002) asked a group of experts (consisting of child psychologists with a clinical and/or a research background) to sort out items taken from behavioral rating scales for assessing temperament and psychopathology. Results showed that items for most part were correctly assigned to either the temperament or the psychopathology construct. This finding was confirmed in an empirical study in which temperament and psychopathology data of a large sample of children were subjected to a factor analysis. This procedure nicely produced the expected two-factor solution with most temperament items loading on one factor and most psychopathology items loading on the other factor. Most importantly, the elimination of confounded items did not affect the relation between temperament and psychopathological symptoms: emotionality/neuroticism remained a significant predictor of psychological problems, suggesting that this link was not due to measurement confounding. Lengua, West, and Sandler (1998) came to a similar conclusion in their study of temperament as a predictor of psychopathological symptoms in children. With regard to the contamination of measures of temperament and psychopathology, these researchers note: "Results show that even after removal of the threat of validity presented by overlap in measures, there continue to be significant, interpretable relations between temperament and symptoms" (p. 164).

A clinical observation that supports the role of the temperament dimension of emotionality/neuroticism and its lower-order traits in the manifestation of child psychopathology pertains to the fact that a substantial proportion of the children show adjustment problems or even develop an adjustment disorder (see Diagnostic and Statistical Manual of Mental Disorders; American Psychiatric Association, 2000) after being confronted with major life events (Newcorn & Strain, 1992). Actually, these children seem to be seriously upset by such events and display various psychopathological symptoms. There is indeed support for the notion that children with an emotional temperament, or if one likes a "neurotic personality," are more susceptible to develop such adjustment disorders (Heringa, 2003). Interestingly, an adjustment disorder appears in many guises: some children predominantly display anxiety symptoms, others suddenly show oppositional-defiant behavior and conduct problems, whereas again others exhibit depressive symptoms (think back of Tim, Tony, and Trevor). The reason for this diversity in symptoms appears to be obvious: it is likely the case that the underlying lower-order temperamental structure determines the type of a child's psychopathology.

EFFORTFUL CONTROL

Taken together, the temperamental dimension of emotionality/neuroticism and its underlying lower-order traits of fear, anger/frustration, and sadness appear to be involved in the origins and the manifestation of psychological disorders in children. But does this mean that the contribution of temperament to the etiology of child psychopathology should merely be viewed as a reactive process that occurs whenever a vulnerable child is exposed to potentially threatening stimuli or stressful life events? According to the recently formulated temperament theory of Rothbart (Putnam, Ellis, & Rothbart, 2002; Rothbart & Bates, 1998), the answer to this question would be negative. This theory proposes that temperament not only consists of reactive temperament dimensions such as emotionality/neuroticism, but also contains a regulative temperament factor, namely "effortful control." Several authors have put forward the notion that a combination of high emotionality/neuroticism and low effortful control makes children more prone to develop psychological disorders (Calkins & Fox, 2002; Lonigan & Phillips, 2001).

Effortful control refers to self-regulative processes and can best be defined as "the ability to inhibit a dominant response to perform a subdominant response" (Rothbart & Bates, 1998). Clearly, this definition is quite abstract and suggests that effortful control pertains to "controlling" or "regulating" one's behavior under certain circumstances. Yet, it should be kept in mind that effortful control not only pertains to behavioral control but also attentional control processes. More specifically, effortful control is generally thought to consist of two main components: inhibitory control, which pertains to the ability to inhibit one's behavior if necessary, and attentional control, which can be defined as the ability to focus and shift attention as needed. Effortful control shows strong similarities to what neuropsychologists refer to as "executive functions," and as such this temperament factor is usually assessed by means of cognitive performance tests, which tap children's capacity of governing their attention and controlling their behavior (Murray & Konchanska, 2002). Various tests have been employed that map on to diverse

aspects of effortful control. For example, various researchers have adapted go/no-go tasks for use with children (e.g., Schachar & Logan, 1990). These tasks tap children's level of impulsivity or lack of inhibitory control. In addition, the Test of Everyday Attention for Children (TEA-Ch; Manly et al., 2001; Manly, Robertson, Anderson, & Nimmo-Smith, 2004) includes various tasks that call on focusing, sustaining, and switching attention, thereby indexing important aspects of attentional control.

There are also behavior rating scales on which parents and teachers are asked to indicate to what extent children possess effortful control-related abilities. Noteworthy in this regard is the series of questionnaires that have been developed by Mary Rothbart and colleages, which intend to measure a wide range of reactive and regulative temperament factors in children of various ages: (1) the Infant Behavior Questionnaire (see Rothbart, 1981) can be used with very young children, aged between 3 and 12 months, (2) the Early Childhood Behavior Questionnaire basically is an extension of Goldsmith's (1996) Toddler Behavior Assessment Questionnaire, and can be employed in somewhat older children aged between 18 and 36 months, (3) the Children's Behavior Questionnaire (Rothbart, Ahadi, Hershey, & Fisher, 2001), which is suitable for children aged between 3 and 7 years, and finally (4) the Early Adolescent Temperament Questionnaire (Capaldi & Rothbart, 1992), which is appropriate for older children aged 8–15 years. All these questionnaires are parent-report behavior rating scales that not only include the main elements of emotionality/neuroticism, but also incorporate various aspects of effortful control (i.e., inhibitory control and attentional control; see Table I).

Table I. Examples of Effortful Control-Related Items Taken From Various Rothbart Questionnaires

Questionnaire	Scale	Definition of scale	Item example
Infant Temperament Questionnaire	Duration of orienting	The baby's attention to and/or interaction with a single object for extended periods of time	How often did the baby stare at a mobile, crib bumper or picture for 5 min or longer?
Early Childhood Behavior Questionnaire	Attentional focusing	Sustained duration of orienting on an object of attention; resisting distraction	When looking at picture books on his/her own, how often did your child stay interested in the book for more than 10 min at a time?
	Attentional shifting	The ability to transfer attentional focus from one activity/task to another	During everyday activities, how often did your child pay attention to you right away when you called to him/her?
	Inhibitory control	The capacity to stop, moderate, or refrain from a behavior under instruction	When asked to wait for a desirable item (such as ice cream), how often did your child wait patiently?
Children's Behavior Questionnaire	Attentional focusing	Tendency to maintain attentional focus upon task-related channels	When drawing or coloring in a book, shows strong concentration
	Inhibitory control	The capacity to plan and to suppress inappropriate approach responses under instructions or in novel or uncertain situations	Can easily stop an activity when he/she is told "No"
Early Adolescent Temperament Questionnaire	Attention control	The capacity to focus attention as well as to shift attention when desired	Is good at keeping track of several different things that are happening around him/her
	Activation control	The capacity to perform an action when there is a strong tendency to avoid it	Usually finishes her/his homework before it's due
	Inhibitory control	The capacity to plan, and to suppress inappropriate responses	Is able to stop him/herself from laughing at inappropriate times

Recently, a self-report version of the Early Adolescent Temperament Questionnaire has become available that assesses temperament from the child's point-of view; this scale can be completed by children as young as 8 years (Ellis & Rothbart, 2001). Further, it is worthy of note that several researchers have developed self-report questionnaires that specifically intend to tap (elements of) the regulative temperament factor of effortful control. Examples are the Attentional Control Scale (Derryberry & Reed, 2002; Vasey et al., 2002) and the Effortful Control Scale (Philipps & Lonigan, 2004).

It is generally assumed that the capacity for effortful control processes is innate (Poggi Davis, Bruce, & Gunnar, 2002). Relatively few data exist on the temporal stability of this regulative temperament factor, but available evidence has revealed fairly robust stability from toddlerhood through preschool and into early school years (Kochanska & Knaack, 2003; Kochanska, Murray, & Coy, 1997), and so it can be concluded that effortful control has trait-like qualities (see also Rothbart & Bates, 1998). Meanwhile, it is also clear that this regulative temperament factor further develops as a result of brain maturation and interaction with the environment (Kochanska, Murray, & Harlan, 2000; Posner & Rothbart, 2000). The gradual improvement of effortful control increasingly enables children to regulate emotions and to control their behavior, which may have positive effects on their social interactions with other children (Eisenberg, Liew, & Pidada, 2004; Fabes et al., 1999). In children who have little effortful control by nature or who fail to adequately develop this regulative trait, such normal processes can be disturbed. Precisely these children run greater risk for developing psychological disorders, in particular when their temperament is also characterized by high levels of emotionality.

VULNERABILITY AND TEMPERAMENT

Current temperament researchers assume that vulnerability to psychopathology is characterized by a combination of high levels of emotionality/neuroticism and low levels of effortful control (Calkins & Fox, 2002; Lonigan & Phillips, 2001). More specifically, high levels of emotionality/neuroticism make children prone to develop psychological disorders, but it may well be the case that the negative impact of this reactive temperament factor can be buffered by effortful control. That is, a stressful life event will elicit negative emotions in children and particularly in those who are characterized by high levels of emotionality. However, only children with low levels of effortful control will experience difficulties to deal adequately with these negative feelings and hence will react with avoidance behavior, aggression, and depression. In contrast, children with high levels of effortful control are capable of regulating these negative emotions by employing more strategic, flexible and effective coping strategies (Lengua & Long, 2002; Salmon & Pereira, 2002). This view on the role of temperament in the pathogenesis of child psychopathology is attractive, as it enables us to more precisely predict which children run greater risks to develop a psychological disorder. This representation also offers a plausible explanation for the high prevalence of comorbid disorders in children who suffer from ADHD (Jensen, Martin, & Cantwell, 1997). These children are typically characterized by low levels of effortful control and as such left to the mercy of their reactive temperament (Barkley, 2004), and hence run greater risk for developing internalizing and other externalizing disorders (Mangione Walcott & Landau, 2004; Nigg et al., 2004).

So far, only a handful of studies have actually examined the role of emotionality and effortful control in the etiology of child psychopathology. In an investigation by Eisenberg et al. (2001), parents and teachers completed rating scales for measuring reactive and regulative temperament factors in a sample of 4–8-year-old children. Some of these children clearly displayed internalizing problems, other children exhibited externalizing problems, whereas again other children did not manifest any psychological problems. Results showed that children with internalizing problems and children with externalizing problems scored relatively high on the reactive temperament factor of emotionality, and in particular on the lower-order traits that are relevant for their specific complaints (respectively fear and sadness versus anger/frustration). Further, children with internalizing problems and children with externalizing problems both evidenced lower levels of effortful control as compared to children without psychological problems. Comparable results were obtained in a subsequent investigation by Eisenberg et al. (2005). In this study, not only concurrent but also prospective relations between reactive and regulative temperament and behavior problems were investigated. Again, high emotionality and low effortful control were predictive of behavioral problems, although

the role of effortful control appeared more prominent in the case of externalizing symptoms. Further studies of this research group have predominantly focused on the relation between reactive and regulative temperament and externalizing problem behavior (Eisenberg et al., 1996, 2000; Valiente et al., 2003). The findings of this research consistently demonstrate that both internalizing and externalizing problems in children of various ages are associated with high levels of emotionality and low levels of effortful control.

Further support for a link between effortful control and externalizing problems in young (i.e., 3-years-old) children comes from a recent study of Olson, Sameroff, Kerr, Lopez, and Wellman (2005). The results of this study indicated that individual differences in effortful control abilities, as assessed using behavioral and parent rating measures, were negatively associated with children's externalizing problems as reported by mothers, fathers, and teachers. Thus, again lower levels of effortful control were accompanied by higher levels of externalizing problems (see for similar results Rubin, Burgess, Dwyer, & Hastings, 2003). Interestingly, this association remained significant after controlling for other cognitive factors (i.e., IQ) and reactive temperament factors (e.g., emotionality).

An interesting study was carried out by Lengua and Long (2002) who assessed emotionality and effortful control as predictors of children's appraisal and coping styles and adjustment problems in a community sample of 8–12-year-old children. Mothers rated children's temperament factors and adjustment problems, whereas children reported on threat appraisal and active and avoidant coping styles. Results demonstrated that emotionality was positively associated with threat appraisal, avoidant coping, and subsequent adjustment problems. In contrast, effortful control predicted more active coping and lower adjustment problems.

Recently, Oldehinkel, Hartman, De Winter, Veenstra, and Ormel (2004) studied a large sample of nonclinical youths aged between 10 and 12 years. Children's internalizing and externalizing problems were assessed by means of the Child Behavior Checklist (Achenbach, 1991), whereas temperament was evaluated with the parent version of the Early Adolescent Temperament Questionnaire (Capaldi & Rothbart, 1992). Temperament patterns were studied in (a) control children with neither internalizing nor externalizing problems, (b) children with only internalizing problems, (c) children with only externalizing problems, and (d) children with both internalizing and externalizing problems (i.e., comorbid problems). The expected patterns of temperament factors were found for the various groups. Compared to control children, children with internalizing problems and children with externalizing problems scored high on emotionality/neuroticism, with the former displaying particularly high levels of the lower-order trait of fear and the latter exhibiting high levels of frustration. Further, both groups of children also displayed low levels of effortful control. Finally, as expected, the children with comorbid problems were characterized by strong emotional reactivity as evidenced by high levels of both fear and frustration, in combination with low levels of effortful control. On the basis of these findings, Oldehinkel et al. (2004) conclude that both reactive (i.e., emotionality/neuroticism) and regulative (i.e., effortful control) temperament factors are involved in internalizing as well as externalizing psychopathology in children.

Recent self-report surveys in nonclinical children and adolescents (Meesters, Muris, & Van Rooijen, submitted; Muris, De Jong, & Engelen, 2004; Muris, Meesters, & Blijlevens, submitted) have also demonstrated that reactive and regulative temperament factors each make a unique contribution to the occurrence of psychopathological problems. Again it was found that high levels of emotionality/neuroticism and low levels of effortful control were accompanied by higher levels of anxious-depressive (internalizing) and aggressive-delinquent (externalizing) symptoms. Further, two of the three studies revealed a significant interaction effect of emotionality/neuroticism and effortful control on psychological problems, which indicated that the combination of high levels of emotionality/neuroticism and low levels of effortful control was associated with the highest levels of psychopathology. Finally, it should be mentioned that different aspects of effortful control were allied to specific psychopathological symptoms. More precisely, a lack of attentional control was more strongly linked to internalizing symptoms, whereas a deficiency of inhibitory control was more clearly related to externalizing symptoms. Note that these differential relations are in keeping with the clinical observation that internalizing disorders are typically characterized by uncontrollable negative thoughts while externalizing disorders are frequently marked by impulsive and disinhibited behavior (see American Psychiatric Association, 2000).

COGNITIVE DISTORTIONS

According to Beck's (1976) cognitive model, psychopathology is maintained by distortions that occur during various stages of information processing, and there is increasing evidence that this is also true for psychological disorders in children (e.g., Leung & Wong, 1998). For example, upon entering a social situation, children with behavioral disorders pay more attention to aggression-relevant information, more frequently make hostile attributions about others, and more often think up and enact aggressive behavioral responses (Crick & Dodge, 1994). Children with internalizing disorders display similar cognitive distortions: for example, anxious children show biased attention for threat-related stimuli (e.g., Vasey, El-Hag, & Daleiden, 1996), whereas anxious and depressed young people display a greater tendency to interpret ambiguous stimuli and situations in a more negative way (e.g., Muris, Luermans, Merckelbach, & Mayer, 2000). Interestingly, children with anxiety disorders predominantly interpret the external world as threatening, whereas depressed children more often make negative evaluations about themselves (Dineen & Hadwin, 2004).

Few studies have actually examined whether such cognitive distortions indeed contribute to the maintenance of psychological problems in children. One exception is a prospective study by Dodge et al. (2003) on the development of externalizing problems in primary school children. These authors found support for a model in which cognitive distortions predicted aggressive behavior in children who were rejected by their peers. Although empirical evidence is currently scant, it seems plausible that cognitive distortions play a similar role in the persistence of internalizing problems such as anxiety and depression (Muris, Jacques, & Mayer, 2004).

As noted, temperament factors may play a role in the formation of psychopathology-related cognitive distortions in children. Various studies have demonstrated that high levels of emotionality/neuroticism are associated with a higher frequency of cognitive distortions in youths (see for a review, Vasey & MacLeod, 2001). However, few studies can be found that have examined the influence of effortful control on cognitive distortions, in spite of the fact that most of such distortions refer to conscious, controlled processes, which possibly are susceptible to the regulative impact of this temperament factor. One exception is an experiment described by Lonigan, Vasey, Phillips, and Hazen (2004), investigating the effects of temperament factors of emotionality/neuroticism and effortful control on children's attentional bias regarding threat-related stimuli. In that study, a large sample of children was screened to identify four temperament groups: (1) children with high emotionality/neuroticism and high effortful control, (2) children with high emotionality/neuroticism and low effortful control, (3) children with low emotionality/neuroticism and high effortful control, and (4) children with low emotionality/neuroticism and low effortful control. All children were tested with a dot probe detection task that measures attentional bias for threat. It is important to note that the presentation interval used in this task was relatively long (i.e., 1250 s) in order to make it possible for the children to exert willful control over their attention. Results demonstrated that children high on emotionality/neuroticism generally displayed a larger attentional bias toward threat-related words than children low on emotionality/neuroticism. Most interestingly, however, was a significant interaction involving emotionality/neuroticism and effortful control. That is, children with high emotionality/neuroticism and low effortful control demonstrated a significant bias toward threat, whereas children with high emotionality/neuroticism and high effortful control did not exhibit a significant bias toward threat. There was no such differential effect of effortful control for children with low emotionality/neuroticism: children with low emotionality/neuroticism did not demonstrate a significant attentional bias. The results presented by Lonigan et al. (2004) are in keeping with our previous conclusion that in particular a combination of high emotionality/neuroticism and low effortful control is relevant for understanding vulnerability to child pychopathology.

A recent study by Muris, Meesters, and Rompelenberg (submitted) investigated the relation between attention control, which is a key component of effortful control, and cognitive distortions in a sample of nonclinical children between 9 and 13 years of age. Children first completed the Attentional Control Scale (Derryberry & Reed, 2002; Vasey et al., 2002) and were then tested with a vignette paradigm to assess threat perception bias. Results showed that attention control was negatively related to threat perception distortions, which means that children with low levels of this regulative temperament factor were more prone to show this cognitive bias. When controlling for neuroticism, correlations between attention control and threat perception distortions largely

disappeared. However, the link between attention control and threatening interpretations of ambiguous vignettes survived this correction. In other words, this study also found some support for the notion that effortful control is involved in psychopathology-related cognitive distortions.

Altogether, then, there is emerging evidence showing that high levels of emotionality/neuroticism and low levels of effortful control may make children prone to cognitive distortions, which in turn may play a role in the persistence of psychological problems. Obviously, these ideas warrant further empirical attention.

DISCUSSION

Taken together, it is increasingly acknowledged by developmental and clinical psychologists that temperament plays a role in the etiology and maintenance of psychological disorders in children, and there is growing awareness that not only reactive but also regulative temperament factors are involved (see also Frick, 2004). More specifically, vulnerability to child psychopathology is largely associated with a temperament that is characterized by high levels of emotionality/neuroticism and low levels of effortful control (Calkins & Fox, 2002; Lonigan & Phillips, 2001). Figures 1 and 2 show two possible models depicting the role of reactive and regulative temperament factors in the etiology of child psychopathology. In the first model, effortful control

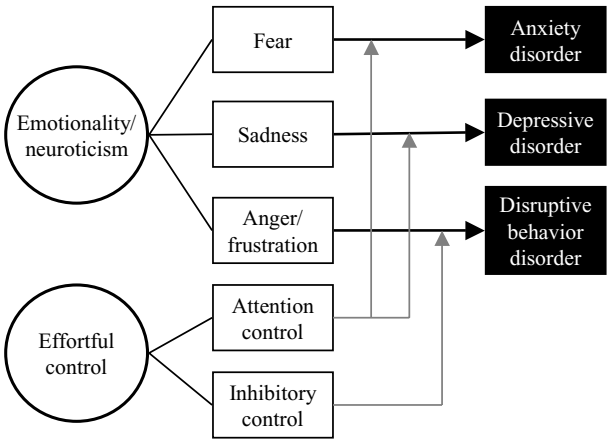

Fig. 1. Model in which effortful control moderates the effect of emotionality/neuroticism on the development of child psychopathology (black arrows indicate increased vulnerability, gray arrows indicate protective influence).

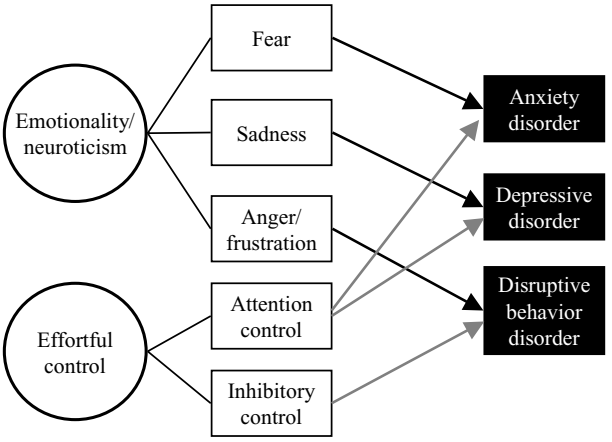

Fig. 2. Model in which emotionality/neuroticism and effortful control have additive effects on the development of child psychopathology (black arrows indicate increased vulnerability, gray arrows indicate protective influence).

acts as a moderator on the link between emotionality/neuroticism and psychopathology. This model assumes that the negative impact of emotionality/neuroticism may be either enhanced when a child possesses low levels of effortful control, or reduced in case the child has high levels of effortful control at its disposal. The second model assumes that emotionality/neuroticism and effortful control each play a unique role and hence have additive effects in the development of psychopathology. Although the first "interactive" model is intuitively more plausible, it should be acknowledged that, at present, there is more evidence for the second "additive" model. A final remark pertains to the specific links that are depicted in the models. It is clear that more research is needed to definitely establish the specificity of these relationships. Further, it should be borne in mind that only the most plausible relationships are shown. This does not mean, however, that attention control is merely involved in anxiety and depressive disorders, or that fear and sadness do not play a role in disruptive behavior disorders. As mentioned by Shiner and Caspi (2005) the role of temperament in child psychopathology should not merely be viewed in terms of vulnerability and resilience. Temperament may also play a "psychoplastic" role, which means that personality characteristics affect the presentation of psychopathology. This psychoplastic aspect is important for understanding the comorbidity among various disorders and may be helpful for identifying subtypes of childhood disorders.

The present article reviews the evidence on the links between the reactive and regulative temperaments factors of respectively emotionality/neuroticism and effortful control and child psychopathology. A critical evaluation of this evidence raises the following issues. First of all, many studies merely rely on one assessor (in most cases: the parent) who rates both temperament and psychopathological problems, thereby introducing the problem of informant bias. Second, most studies (even the longitudinal investigations) only rely on a single-time-point measurement of child temperament. Third, research has generally focused on the relation between emotionality/neuroticism and effortful control and psychopathological *symptoms*; few studies have examined the links between these temperament factors and psychological *disorders*. Fourth, the evidence for the link between effortful control and psychopathological symptoms is predominantly coming from cross-sectional studies. This makes clear that more research is required that rely on a multimethod approach using prospective, multiple-time-point assessments of reactive and regulative temperament factors and clinical manifestations of child psychopathology.

A somewhat different point of critique that can be raised with regard to the link between temperament and psychopathology pertains to the fact that associations between these two constructs in general are rather modest, and this is particularly true over longer time periods (e.g., Aguilar, Sroufe, Egeland, & Carlson, 2000). This point has been adequately tackled by Shiner and Caspi (2003) who noted that (1) even associations with small effect sizes can be of theoretical and practical significance, (2) it is implausible that complex behavior such as child psychopathology is the product of one or two temperament factors, (3) temperament factors may interact with each other and with other variables, and so the "true" impact of temperament is bigger than the effect of the single temperament factors, and (4) the effects of temperament factors accumulate over a lifetime, and so the focus on a single outcome measure may underestimate the contribution of temperament to the course of developmental trajectories.

The latter points also make clear that the role of temperament in the etiology of psychological problems in youths can best be conceptualized in terms of a developmental psychopathology perspective (Seifer, 2000). One important implication of adopting this perspective is that temperament factors and psychological disorders are developmental phenomena, which may manifest themselves differently at various ages. Thus, reactive and regulative temperament factors may look quite different in toddlers as compared to older children and adolescents, which stresses the need for age-appropriate assessment tools and underlines the necessity of multiple time-point assessments in long-term prospective research (Rothbart & Bates, 1998). The same is true for psychopathology as it is clear that externalizing and internalizing disorders each have their typical manifestations during various developmental stages (Loeber, Green, Lahey, Frick, & McBurnett, 2000; Muris, in press). Another implication pertains to the fact that most forms of psychopathology are the result of multiple, interacting causal influences. Previous research on the role of temperament in the pathogenesis of child psychopathology has predominantly looked for direct linear effects. However, it is far more likely that reactive and regulative temperament factors interact with other etiological factors. One obvious candidate is the occurrence of negative life events, as it is likely that both reactive and regulative temperament factors really come into play when the child is exposed to adverse or stressful circumstances. Further, it has been demonstrated that high levels of emotionality in children are associated with lower levels of responsiveness in their mothers (Owens, Shaw, & Vondra, 1998), which in turn may hinder the formation of a secure attachment relationship, thereby further enhancing the risk for developing internalizing and/or externalizing psychopathology (see Seifer, 2000). Finally, negative temperament factors such as high emotionality/neuroticism and low effortful control may not only influence parental responsiveness but may also elicit negative parental rearing behaviors, such as inconsistency and restrictiveness, which may accrue children's behavioral and emotional problems (Bates et al., 1998; Lengua & Kovacs, 2005; Rubin et al., 2003).

Obviously, more studies are required to further investigate the proposed temperamental influences on the etiology of child psychopathology. As mentioned earlier, research on the relation between reactive and regulative temperament factors and cognitive distortions, and longitudinal investigations, which examine the predictive value of temperament on the development of psychological problems, are urgently needed. In the latter research, other vulnerability and protective factors should also be included so that it becomes possible to investigate the relative contribution of temperament to the etiology of psychological disorders in children.

Attention should also be devoted to the development of reliable and valid instruments for assessing effortful control. So far, researchers have relied on neuropsychological performance tests and behavior rating scales for measuring this regulative temperament factor. With regard to the neuropsychological instruments, it should be noted that a great variety of tests have been used although they all seem to tap relevant aspects of effortful control (e.g., Manly et al., 2001, 2004; Murray & Konchanska, 2002; Rothbart, Ellis, Rueda, & Posner, 2003). Still, the lack of uniformity hinders the comparability of the studies, and hence it would be preferable to use a standardized battery of tests that is suitable for assessing effortful control processes in children of various ages. With respect to the behavior rating scales, one has to conclude that solid psychometric data are currently missing. Preliminary evaluations of the Rothbart questionnaires indicate that the reliability of some scales is not satisfactory (Muris, Meesters, & Blijlevens, submitted). In addition, it is also unknown to what extent scores on these measures are associated with performance on various neuropsychological tests. Finally, studies in clinical settings are also important. In this article, clear hypotheses have been formulated regarding the temperament profiles of children with anxiety disorders, depression, disruptive behavior disorders, ADHD, and adjustment disorders, and thus comparisons among these clinical groups and comparisons with nonclinical control children would make it possible to test these predictions.

Admittedly, the present review focused on the temperament traits of emotionality/neuroticism and effortful control. Although a temperament model of two components provides a thrifty theory for the pathogenesis of child psychopathology, the possibility cannot be rules out that other temperament dimensions are also relevant for understanding the etiology of child psychopathology. The most likely candidate in this respect is extraversion, although it should be borne in mind that this personality factor may act differently in various types of disorders. That is, there is some evidence that low levels of extraversion are associated with internalizing problems, whereas high levels of extraversion are linked to externalizing problems (e.g., Muris et al., 2003; Oldehinkel et al., 2004). Thus, it may be worthwhile to not only assess emotionality/neuroticism and effortful control, but also to include a measure of extraversion in future research on the link between temperament and child psychopathology.

It remains to be seen whether the proposed temperament model has implications for the treatment of child psychopathology. Most child-directed treatment programs for children with anxiety disorders, depression, or disruptive behavior disorders contain elements of emotion regulation (Southam-Gerow & Kendall, 2002), which seem to target at soothing the reactive temperament factor of emotionality. However, it is equally plausible to assume that these programs promote children's ability of effortful control. Note that this aspect is clearly present in cognitive-behavioral therapy. For example, for children with behavioral problems, the Stop-Think-Do method has been developed (see Petersen, 1995), which urges children not to respond immediately in provocative social situations, but rather to think about the feelings of oneself and others, before switching over to behavioral action. This method has clearly yielded positive effects (Orobio De Castro, Bosch, Veerman, & Koops, 2003), and as such it is appropriate that this approach is included in most of the treatment programs that target children with these types of problems (e.g., Lochman & Wells, 1996; Van Manen, Prins, & Emmelkamp, 2004). Although less obvious on first sight, cognitive-behavioral programs for anxiety disorders and depression also contain Stop-Think-Do elements (cf., Barrett, Lowry-Webster, & Turner, 2000; Barrett, Dadds, & Rapee, 1991; Shochet, Holland, & Whitefield, 1997): children are prompted to carefully analyze the stimuli and situations that cause their anxious and depressed feelings, to think about what is going on in their head, and to eventually choose a more adaptive behavioral response in stead of avoidance (anxiety) or passivity (depression). In other words, cognitive-behavioral therapy teaches techniques that help children to inhibit their maladaptive behaviors and to regulate their attention, thereby improving their effortful control.

Given the importance of effortful control in the etiology of child psychopathology, some authors (e.g., Rothbart, 2004) have even suggested that a specific attention-based intervention may prove helpful to prevent or to treat childhood disorders. In a pilot study, Rothbart and Rueda (2003) employed a computerized joystick-controlled program (see Washburn & Rumbaugh, 1992) to train children's attentional skills. It was found that children who received the attention training exhibited more increase in their IQ than control children who were not treated with the program. Further research is necessary to study whether such training is useful in

children who are characterized by low levels of effortful control, and can be employed as an intervention to reduce children's vulnerability to develop psychological problems.

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