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## Attentional control and psychopathological symptoms in children

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### Abstract

Attentional control is a regulative trait referring to individual differences in the ability to focus, sustain, and shift attention at will. This article presents two studies examining the relationship between attentional control and psychopathological symptoms in non-clinical children. In Study 1 ( $N = 82$ ), attentional control was measured by means of self-report and a neuropsychological test battery, and then related to scores of psychopathological symptoms. Results indicated that measures of self-reported and performance-based attentional control were moderately correlated. Furthermore, only self-reported attentional control was convincingly associated with symptom scores. Study 2 ( $N = 50$ ) investigated whether the relation between attentional control and psychopathological symptoms was mediated by emotional self-efficacy. Regression analyses provided support for the hypothesized mediation model but only in the case of emotional symptoms. The implications of these findings for the assessment of attentional control and theoretical models on the etiology of child psychopathology are discussed.

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*Keywords:* Attentional control; Psychopathological symptoms; Self-efficacy; Children

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## 1. Introduction

Epidemiological studies have demonstrated that a substantial proportion of children and adolescents suffer from psychiatric disorders, including internalizing problems such as anxiety and depression as well as externalizing problems such as hyperactivity and other disruptive behavior (Costello, Mustillo, Erkanli, Keeler, & Angold, 2003; Ford, Goodman, & Meltzer, 2003). Clinical psychology research has converged on the notion that most internalizing and externalizing problems in youths originate from the dynamic interplay of multiple factors, and studies have primarily focused on risk and vulnerability variables such as reactive temperament, negative learning experiences, stressful life events, and adverse family background, which all increase youths' proneness to develop psychiatric problems (Essau & Petermann, 1999; Reid, Patterson, & Snyder, 2002; Vasey & Dadds, 2001). Recently, there is also increasing research interest in protective influences, which may shield children and adolescents against the development of psychopathological problems.

The temperamental characteristic of effortful control is such a protective variable that is currently receiving an increasing amount of research attention. Briefly, effortful control can be defined as "the ability to inhibit a dominant response to perform a subdominant response" (Rothbart & Bates, 2006) and refers to self-regulative processes that enable a person to control and regulate behavior under certain circumstances. An important aspect of effortful control is attentional control, which pertains to the ability to organize incoming stimuli in order to maintain a calm state of mind, delay gratification, tolerate change, and create an appropriate cognitive and behavioral response to selected stimuli exclusively (Rothbart, Ellis, & Posner, 2004). It has been proposed that children and adolescents who habitually display low levels of attentional control are poor at regulating emotions and behavior, and hence run greater risk for developing various types of internalizing and externalizing problems (Muris & Ollendick, 2005; Nigg, 2006). Empirical evidence for this notion mainly comes from questionnaire studies in which children and adolescents completed self-reports of attentional control (e.g., the Attentional Control Scale for Children or ACS-C; Derryberry & Reed, 2002) and psychopathological symptoms (Meesters, Muris, & Van Rooijen, 2007; Muris, De Jong, & Engelen, 2004; Muris, Meesters, & Rompelberg, 2007). This research has consistently shown that lower levels of attentional control are associated with higher levels of psychopathological problems in youths, including symptoms of anxiety, aggression, depression, and ADHD.

This article presents two simultaneously run studies that further examined the relationship between attentional control and psychopathological symptoms in children. In Study 1, it was examined whether the negative association between attentional control and psychopathological symptoms could also be documented when using a neuropsychological test battery for measuring attentional control capacity. Admittedly, in a recent pilot study, Muris, Van der Pennen, Sigmond, and Mayer (submitted for publication) found that correlations between a performance-based measure of attentional control and symptoms scores were rather small. However, the researchers noted that this was possibly due to the fact that the behavioral test for measuring attentional control was rather limited and that a more extended battery might be necessary to really measure children's capacity for controlling attentional processes. For this reason, children in the current study were tested more extensively with the complete Test of Everyday Attention in Children (TEA-Ch; Manly et al., 2001), which includes a total of nine subtests that call upon focusing, sustaining, and switching attention.

Study 2 was set up to examine the nature of the relation between self-reported attentional control and psychopathological symptoms in children. As mentioned earlier, attentional control is probably linked to psychopathological symptoms, because low attentional control decreases the ability to regulate emotions, which in turn makes children more prone to psychopathological symptoms. Thus, in this second study, children not only completed scales for measuring attentional control and psychopathological symptoms, but also a questionnaire for measuring self-efficacy, which included a subscale of children's perceived capability of regulating negative emotions (i.e., emotional self-efficacy; Muris, 2001, 2002). It was hypothesized that emotional self-efficacy would act as a mediator in the relation between attentional control and various types of psychopathological symptoms.

## 2. Study 1

### 2.1. Method

#### 2.1.1. Participants and procedure

Eighty-two children (36 boys and 46 girls) of three primary schools in the Rotterdam region of the Netherlands participated in this study after obtaining written informed consent from their parents. Children had a mean age of 10.72 years ( $SD = 1.01$ , range 9 to 13 years). Somewhat more than half of the children (57.3%) had a Caucasian background; most of the other children were from Turkish, Moroccan, Surinam, or Antillean descent.

Children first completed the set of questionnaires (see below) in small group sessions, and were then individually tested with the TEA-Ch within one month of the completion of the questionnaires by a trained research assistant. The research assistant was trained in the administration of this test by the first author, and was always blind to children's scores on the questionnaires. Administration of the TEA-Ch took place in a private and quiet room at children's school and lasted for about 50 min. Testing sessions always occurred in the morning or during the first hour after the lunch break. After testing, children received a small present in return for their participation in the study.

#### 2.1.2. Questionnaires

The child version of the *Attention Control Scale* (ACS-C; see Derryberry & Reed, 2002) is a 20-item self-report questionnaire measuring the ability to focus and shift attention if necessary (e.g., "When concentrating, I do not notice what happens around me", "I can easily write or read, while I am talking on the phone"). Research has indicated that the total scale is internally consistent (with  $\alpha$ s in the .70 range), positively correlated with perceived control ( $r = 0.22$ ) and school performance (with  $r$ s between 0.23 and 0.42), and negatively with symptoms of Attention-Deficit and Hyperactivity Disorder ( $r = -0.50$ ; Muris, 2006; Muris et al., 2004). Furthermore, a recent study by Muris et al. (2007) demonstrated that the parent-child agreement of the scale also appears satisfactory ( $ICC = 0.72$ ).

The short version of the *Revised Child Anxiety and Depression Scale* (RCADS; Chorpita, Yim, Moffitt, Umemoto, & Francis, 2000) is a 25-item scale for measuring symptoms of DSM-defined anxiety disorders and depression. In the present study, a total anxiety and a total depression score

were obtained by summing across relevant items. Previous research has indicated that the (shortened) RCADS has a clear-cut factor structure, is reliable in terms of internal consistency (with Cronbach's alphas between 0.65 and 0.83 for various subscales) and temporal stability (with 4-week test–retest correlations between 0.79 and 0.85), and displays good validity as evidenced by positive associations with concurrent questionnaires (Chorpita et al., 2000; Muris, Meesters, & Schouten, 2002).

The self-report version of the *Strengths and Difficulties Questionnaire* (SDQ; Goodman, 2001) consists of 25 items measuring various types of psychopathological symptoms as well as children's strengths. In the current study, three scores were derived from this scale: emotional problems, behavioural problems, and hyperactivity-inattention (because of the conceptual overlap with attentional control). Research has shown that the SDQ has good psychometric properties (Goodman, 2001) and that this appeared also true in younger children (Muris, Meesters, Eijkelenboom, & Vincken, 2004). To cross-validate children's responses to the SDQ, parents were asked to fill out the parent version of the scale. This was done when they were asked to sign the informed consent form.

### 2.1.3. TEA-Ch

The TEA-Ch (Manly et al., 2001) is a neuropsychological test battery that measures children's ability of attentional control. The test consists of nine subtests: (1) *Sky Search*: children are instructed to find target spaceships on a large sheet filled with similar distracter space ships; (2) *Score!*: children are asked to mentally count the number of target tones that are presented at varying intervals during 10 trials; (3) *Creature Counting*: children are required to count the number of target stimuli printed on a sheet, but they have to repeatedly switch between counting forward and backward; (4) The *Sky Search-Dual Task* subtest asks children to simultaneously perform the tasks from the Sky Search and Score! subtests. Thus, this subtest requires children to identify visual targets among distracters as well as mentally counting tones; (5) *Map Mission*: children are given 1 min to quickly locate small target symbols on a complex city map; (6) The *Score!-Dual Task* subtest combines the Score! subtest with another listening task that requires the child to listen to an animal name during an audiotaped news report; (7) *Walk, Don't Walk*: children have to mark steps on a paper path each time they hear a target sound on the audiotape, but refrain from marking a step if the tone is immediately followed by a second sound indicating that the path is no longer safe; (8) *Opposite World*: in the 'Same World' condition, children are asked to read aloud the digits 1 and 2 as quickly as possible. In the 'Opposite World' condition, they have to name the opposite for each digit (i.e., "one" for 2, and "two" for 1); and (9) *Code Transmission*: children listen to a long, monotone series of numbers. When they hear two '5's in a row, they have to report the number presented just prior to the double 5. Number of correct responses and time needed to perform the task are measured during various TEA-Ch subtests. These raw scores were subjected to a Z-transformation and then recoded in such way that higher scores were indicative for higher levels of attentional control. In this way, it became also possible to compute a total TEA-Ch score in which various aspects of this regulative trait were combined. Previous research has provided evidence for the validity of this TEA-Ch, as evidenced by significant correlations with measures of intelligence, other measures of attention, and school performance (Manly et al., 2001). In addition, children with ADHD have been shown to perform significantly worse on this test than clinically referred control children (Heaton et al., 2001).

## 2.2. Results

Before discussing the main findings of Study 1, it should be noted that the reliability of various measures appeared sufficient to good (Table 1). Only the behavioral problems and hyperactivity-inattention scales of the child version SDQ produced too low Cronbach's alphas (see Muris et al., 2004). However, even for these scales, the parent-child correlations were acceptable (i.e., >0.48), implying that they might still provide useful information.

Correlations between ACS-C and TEA-Ch, and between attentional control scores and indexes of psychopathological symptoms are displayed in the right columns of Table 1. The correlation between ACS-C and TEA-Ch was significant but rather low ( $r = 0.27$ ). An additional analysis revealed that only the scores on the Sky Search ( $r = 0.34$ ,  $p < 0.01$ ), Map Mission ( $r = 0.35$ ,  $p < 0.001$ ), and Score-Dual Task ( $r = 0.26$ ,  $p < 0.05$ ) subtests were significantly related to ACS-C scores.

Results further demonstrated that only self-reported attentional control was convincingly linked to psychopathological symptoms. In the case of child report, ACS-C scores were significantly related to a wide range of symptoms. However, in the case of parent report, ACS-C scores were only significantly linked to symptoms of hyperactivity-inattention. In all cases, correlations were negative, indicating that lower levels of self-reported attentional control were associated with higher levels of psychopathological symptoms. Performance-based attentional control was not convincingly related to psychopathological symptoms. More precisely, the TEA-Ch total score was only significantly connected to self-reported behavioral problems and parent-reported symptoms of hyperactivity-inattention (see Table 1).

Table 1

Mean scores (standard deviations) and reliability coefficients for various measures, and correlations between attentional control measures (ACS-C and TEA-Ch) and psychopathology scales

	<i>M</i> ( <i>SD</i> )	Cronbach's $\alpha$	ACS-C	TEA-Ch
ACS-C	33.95 (8.70)	0.81		
TEA-Ch	0.00 (6.90) <sup>a</sup>	0.78	0.27*	
RCADS anxiety	14.95 (9.32)	0.88	-0.40***	-0.21
RCADS depression	3.45 (2.22)	0.61	-0.31**	-0.12
SDQ-C emotional problems	2.96 (2.33)	0.70	-0.38***	-0.02
SDQ-C behavioral problems	5.13 (2.67)	0.46	-0.38***	-0.25*
SDQ-C hyperactivity-inattention	3.43 (2.31)	0.56	-0.61***	-0.08
SDQ-P emotional problems	2.55 (2.17)	0.65	-0.14	-0.07
SDQ-P behavioral problems	3.34 (2.71)	0.65	-0.16	0.03
SDQ-P hyperactivity-inattention	3.87 (2.60)	0.78	-0.43***	-0.23*

Note.  $N = 82$ . ACS = attentional control scale for children, TEA-Ch = test of everyday attention for children, RCADS = revised child anxiety and depression scale, SDQ-C = strengths and difficulties questionnaire-child version, SDQ-P = strengths and difficulties questionnaire-parent version.

\*  $p < 0.05$ .

\*\*  $p < 0.01$ .

\*\*\*  $p < 0.001$ .

<sup>a</sup> Standardized total ( $Z$ ) score.

### 3. Study 2

#### 3.1. Method

##### 3.1.1. Participants and procedure

Fifty children (24 boys and 26 girls) of a primary school in Rotterdam, the Netherlands, were recruited for this study. Children had a mean age of 10.80 years ( $SD = 0.76$ , range 9–13 years). More than half of the children were from original Dutch descent; other children had a non-Caucasian background (e.g., Turkish, Moroccan). After obtaining informed consent from their parents, children completed a set of questionnaires (see below) in their classroom at school.

##### 3.1.2. Questionnaires

The *ACS-C* and self-report version of the *SDQ* were employed to measure attentional control and various types of psychopathological symptoms (see Study 1).

The *Self-Efficacy Questionnaire for Children* (SEQ-C; Muris, 2001) contains 24 items that can be allocated to three domains of self-efficacy: (1) social self-efficacy which has to do with the perceived capability for peer relationships, (2) academic self-efficacy which is concerned with the perceived capability to fulfil academic expectations, and (3) emotional self-efficacy which pertains to the perceived capability of coping with negative emotions, and which was considered as most relevant for the present study. Previous research has demonstrated that the reliability and validity of the SEQ-C are good (Muris, 2001, 2002).

#### 3.2. Results

Reliability coefficients of various scales were generally satisfactory. An exception was the behavioral problems scale of the *SDQ*, which had a Cronbach's  $\alpha$  of 0.50. Correlations between the *ACS-C* and other measures were as expected. That is, negative correlations were found with various types of psychopathological symptoms, whereas positive associations emerged with self-efficacy (see Table 2). In other words, lower levels of attentional control were associated with higher levels of psychopathological symptoms, while higher levels of attentional control were connected to higher levels of perceived self-efficacy.

To examine whether self-efficacy acted as a mediator in the relationship between attentional control and various types of symptoms, regression analyses were carried out to test the conditions for a mediation model as outlined by Baron and Kenny (1986). When predicting *SDQ* emotional problems (see Fig. 1), analyses demonstrated that (1) the predictor variable (i.e., attentional control) accounted for variation in the presumed mediator (i.e., emotional self-efficacy), (2) the mediator accounted for variation in the dependent variable (i.e., emotional problems), and (3) the relation between the predictor and the dependent variable significantly decreased when controlling for the effect of the mediator, thereby fulfilling the criteria of a mediation effect.<sup>1</sup> This was confirmed by the results of a Sobel test:  $Z = 2.51$ ,  $p < 0.05$  (see Preacher & Hayes, 2004).

<sup>1</sup> An additional analysis in which other self-efficacy scales were also considered as possible mediators demonstrated that only emotional self-efficacy fulfilled the criteria of mediation. Social and academic self-efficacy did not make a unique and significant contribution to the dependent variable.

Table 2

Mean scores (standard deviations) and reliability coefficients for various scales, and correlations between the attentional control scale (ACS-C) and self-efficacy and psychopathology questionnaires

	<i>M (SD)</i>	Cronbach's $\alpha$	ACS-C
ACS-C	33.88 (7.33)	0.70	
SEQ-C total score	81.86 (14.25)	0.89	0.57**
SEQ-C academic	27.48 (6.10)	0.85	0.66**
SEQ-C social	28.66 (5.05)	0.73	0.38*
SEQ-C emotional	25.72 (5.82)	0.78	0.37*
SDQ-C emotional problems	2.82 (2.25)	0.73	-0.47*
SDQ-C behavioral problems	5.28 (2.72)	0.50	-0.46*
SDQ-C hyperactivity-inattention	3.46 (2.47)	0.81	-0.68**

Note. *N* = 50. ACS = attentional control scale for children, TEA-Ch = test of everyday attention for children, SEQ-C = self-efficacy questionnaire for children, SDQ-C = strengths and difficulties questionnaire-child version.

\*  $p < 0.01$ .

\*\*  $p < 0.001$ .

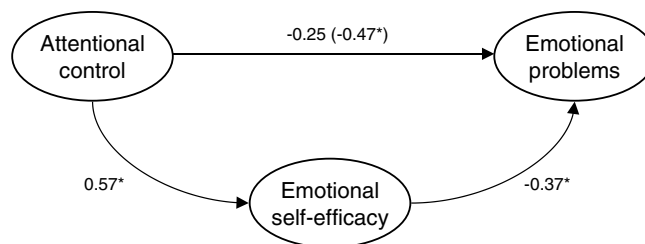


Fig. 1. Model depicting the mediating role of self-efficacy in the relationship between attentional control and emotional problems. \*  $p < 0.05$ .

A similar pattern of results emerged when analyzing behavioral problems: that is, attentional control predicted emotional self-efficacy ( $\beta = 0.37, p < 0.01$ ), self-efficacy predicted behavioral problems ( $\beta = -0.28, p < 0.05$ ), and the relation between attentional control attenuated when controlling for emotional self-efficacy ( $\beta$  reduced from  $-0.46$  to  $-0.35$ ), although the mediation effect did not really achieve statistical significance (Sobel test:  $Z = 1.85, p = 0.06$ ). When analyzing problems of hyperactivity-inattention, no support for a mediation effect emerged. For this type of psychopathology, only attentional control appeared a significant predictor ( $\beta = -0.65, p < 0.001$ ).

### 3.3. Discussion

The present investigation further examined the relation between attentional control and psychopathological symptoms in children. The results of Study 1 demonstrated that self-reported and performance-based indexes of attentional control were not convincingly related. More precisely, with a correlation of 0.27, the conclusion seems warranted that the ACS-C and the TEA-Ch actually share little variance (see also Muris et al., submitted for publication). Furthermore, Study 1 showed that ACS-C scores were clearly related to psychopathological symptoms, and this was particularly true for self-reported problems. As in previous research, lower levels of

self-reported attentional control were associated with higher levels of psychopathological symptoms (Meesters et al., 2007; Muris et al., 2004, 2007, submitted for publication). However, attentional control as measured by the TEA-Ch was hardly associated with emotional and behavioral problems in youths. Only self-reported behavioral problems and parent-rated symptoms of hyperactivity-inattention were to some extent related to performance on this neuropsychological battery of attentional control.

The findings of Study 1 raise several important issues. The first issue pertains to the assessment of attentional control and has to do with the low correlation between the ACS-C and the TEA-Ch. While there are other findings in the literature indicating that self-reports and behavioral tasks of cognitive constructs are poorly correlated (e.g., Reynolds, Ortengren, Richards, & De Wit, 2006), the question remains how the regulative trait of attentional control can best be measured in youths. On the one hand, it can be argued that the TEA-Ch is the most optimal instrument because this test directly measures how well children are capable of actively controlling (i.e., focusing, sustaining, and shifting) their attention. The ACS-C focuses on performance during tasks that require attentional resources (e.g., schoolwork), and obviously other variables (e.g., distracting environment, motivation) may also determine children's ratings on this scale. On the other hand, it may well be the case that the TEA-Ch is less suitable for measuring attentional control in non-clinical youths. Previous studies have demonstrated that children with ADHD, who clearly display attentional problems, indeed perform less well on the TEA-Ch (Heaton et al., 2001; Manly et al., 2001), which of course provides support for the validity of the test. However, little is known about the capacity of the TEA-Ch for measuring (mild) deficits in attentional control in normal children and adolescents. Clearly, more studies on the validity of assessment instruments for measuring attentional control in both clinical and non-clinical populations of youths are urgently needed.

The second issue is concerned with the role of attentional control in the development of psychopathological problems in youths. According to Muris and Ollendick (2005) and Nigg (2006), regulative traits such as attentional control have an important function in the buffering of negative emotions. More specifically, when confronted with stressful and challenging events, attentional control may help children to reduce emotional reactivity (Pérez-Edgar et al., 2007), and this may eventually be helpful against the development of various types of psychopathological problems. If the TEA-Ch provides the best index of attentional control, the role of regulative traits in the development of child psychopathology can be questioned, as clear-cut (negative) correlations between this test and symptom measures were not found. When the ACS-C yields the most optimal index of attentional control, the current findings are in keeping with the notion that this regulative trait may protect youths against the development of emotional and behavioral problems. Admittedly, the results of Study 1 should be interpreted with caution. Because psychopathological symptoms were mainly assessed by means of self-report, it is not surprising that the ACS-C (similar method) was convincingly correlated with symptom scores whereas the TEA-Ch (different method) was not.

It has been suggested that high levels of attentional control enable children to regulate negative emotions by employing more strategic, flexible and effective coping strategies (Lengua & Long, 2002; Salmon & Pereira, 2002). As such, it can be expected that attentional control is positively linked with emotional self-efficacy, i.e., the perceived ability of regulating negative emotions. Study 2 investigated this idea, and also examined whether the link between attentional control

and psychopathological symptoms was mediated by emotional self-efficacy. The results indeed showed that higher levels of attentional control were accompanied by higher emotional (and other) self-efficacy scores. Further, in the case of emotional problems, clear support was found for a (partial) mediation model, in which emotional self-efficacy acted as the link between attentional control and psychopathological symptoms. Altogether, these findings are in keeping with the idea that attentional control can best be viewed as a prerequisite for emotion regulation skills, which in turn protect children against the development of psychopathological problems (Zeman, Cassano, Perry-Parrish, & Stegall, 2006; see Muris & Ollendick, 2005).

The mediational effect of emotional self-efficacy on the relation between attentional control and behavioral problems was not significant. On the one hand, this may be due to the fact that the SDQ subscale that was employed to assess behavioral problems was rather unreliable thereby providing a less valid index of this type of psychopathology. On the other hand, while emotional self-efficacy seems to be involved in emotional problems such as anxiety and depression, it may be less relevant in the context of behavioral problems. In the case of hyperactivity-inattention problems, emotional self-efficacy did not make a unique contribution. These symptoms were solely explained by variations in levels of attentional control, which underlines the idea that children with ADHD symptoms are characterized by a deficit of this regulative trait (Barkley, 2004).

With regard to the present research, a number of limitations should be acknowledged. To begin with, both studies were correlational in nature, which means that in fact no conclusions on cause-effect relations can be drawn. For example, while it makes sense from a theoretical point of view to test a model “attentional control → emotional self-efficacy → emotional problems”, a reversed model “emotional problems → emotional self-efficacy → attentional control” would also fit with the current data. Obviously, longitudinal research is required to examine the temporal sequence of these variables. Further, no measure of intelligence was included in this study. It has been suggested that attentional control and in its wake emotion regulation skills are at least partly determined by intellectual capacity (Rueda, Posner, & Rothbart, 2004). Thus, the inclusion of a measure of intelligence would have provided an opportunity to investigate the relation between attentional control and psychopathological symptoms while controlling for general cognitive functioning.

Taken together, the present studies further examined the relationship between attentional control and psychopathological symptoms in non-clinical children. Although the results are generally in keeping with theoretical models which suggest that regulative traits are involved in the etiology of psychopathology in youths (Eisenberg, Smith, Sadovsky, & Spinrad, 2004; Muris & Ollendick, 2005; Nigg, 2006), findings also pointed out that further research is necessary (a) to determine how attentional control can best be measured in clinical and non-clinical youths of various ages, and (b) to test the role of attentional control in the regulation of emotions and the development of psychopathological symptoms using experimental and prospective designs.

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