Threat-Related Selective Attention Predicts Treatment Success in Childhood Anxiety Disorders

JEROEN S. LEGERSTEE, M.Sc., JOKE H.M. TULEN, Ph.D., VICTOR L. KALLEN, Ph.D., GWEN C. DIELEMAN, M.D., PHILIP D.A. TREFFERS, M.D., Ph.D., FRANK C. VERHULST, M.D., Ph.D., AND ELISABETH M.W.J. UTENS, Ph.D.

ABSTRACT

Objective: The present study examined whether threat-related selective attention was predictive of treatment success in children with anxiety disorders and whether age moderated this association. Specific components of selective attention were examined in treatment responders and nonresponders. **Method:** Participants consisted of 131 children with anxiety disorders (aged 8–16 years), who received standardized cognitive-behavioral therapy. At pretreatment, a pictorial dot-probe task was administered to assess selective attention. Both at pretreatment and posttreatment, diagnostic status of the children was evaluated with a semistructured clinical interview (the Anxiety Disorders Interview Schedule for Children). **Results:** Selective attention for severely threatening pictures at pretreatment assessment was predictive of treatment success. Examination of the specific components of selective attention revealed that nonresponders showed difficulties to disengage their attention away from severe threat. Treatment responders showed a tendency not to engage their attention toward severe threat. Age was not associated with selective attention and treatment success. **Conclusions:** Threat-related selective attention is a significant predictor of treatment success in children with anxiety disorders. Clinically anxious children with difficulties disengaging their attention away from severe threat profit less from cognitive-behavioral therapy. For these children, additional training focused on learning to disengage attention away from anxiety-arousing stimuli may be beneficial. *J. Am. Acad. Child Adolesc. Psychiatry*, 2009;48(2):196–205. **Key Words:** anxiety disorders, selective attention, threat, dot-probe task. Clinical trial registration information—Cognitive-Behavioral Treatment of Children and Adolescents With Anxiety Disorders: Optimizing Treatment Based on Patient Characteristics. URL: *www.trialregister.nl/trialreg/admin/rctview.asp?TC=347*. Unique identifier: ISRCTN48511871.

Anxiety disorders are the most prevalent psychiatric disorders among children and adolescents,[1] are associated with considerable impairments in social and academic functioning,[2] and constitute a risk factor for the development of other psychiatric disorders in adolescence and adulthood.[3] Several randomized controlled trials[4] have demonstrated that 50% to 70% of children with anxiety disorders are free of their primary anxiety diagnosis after cognitive-behavioral therapy (CBT).[5] A substantial minority of children with anxiety disorders, however, does not show a clinically significant improvement after CBT. Gaining insight into the differential characteristics of children who respond and do not respond to CBT may aid in improving current treatment programs.

Biased attentive processing, along with other distorted cognitive information processes, is hypothesized to be involved in the etiology and maintenance of anxiety disorders.[6] Indeed, studies in both clinical and community samples have shown with different experimental paradigms that anxious children tend to selectively allocate their attention toward threatening

Accepted September 13, 2008.

Drs. Legerstee and Dieleman, Prof. Dr. Verhulst, and Dr. Utens are with the Department of Child and Adolescent Psychiatry; Dr. Tulen is with the Department of Psychiatry, Erasmus Medical Center Rotterdam/Sophia Children's Hospital; Dr. Kallen is with the Leiden University Institute for Psychological Research; Prof. Dr. Treffers is with the Department of Child and Adolescent Psychiatry, Leiden University Medical Center/Curium.

This study has been made possible by financial aid from the Netherlands Foundation for Mental Health, Utrecht (project 2001-5484).

Correspondence to Elisabeth Utens, Ph.D., Department of Child and Adolescent Psychiatry, Erasmus Medical Center Rotterdam/Sophia Children's Hospital, Dr. Molewaterplein 60, PO Box 2060, 3000 CB Rotterdam, The Netherlands; e-mail: e.utens@erasmusmc.nl

0890-8567/09/4802-0197©2009 by the American Academy of Child and Adolescent Psychiatry.

DOI: 10.1097/CHI.0b013e31819176e4

information in the context of other nonthreatening information, although this trend is not apparent in nonanxious children.[7–11] Selective attention toward threat in children is specific for anxiety disorders and not for other psychiatric disorders, such as major depression (for a comprehensive review, see Puliafico and Kendall[12]). Selective attention toward threat can reflect a quick orientation (i.e., vigilance) toward threatening stimuli and/or a difficulty in disengaging attention away from threatening stimuli.[13] Research in adults has shown that selective attention toward threat reflects attention disengagement difficulties rather than vigilance to threat.[14,15] These specific components of selective attention have not been examined in anxious children.

Selective attention toward threat has been demonstrated particularly in studies with written words as target stimuli. Performance on experimental tasks on selective attention with lexical stimuli, however, can be influenced by differences in individuals' reading abilities and by familiarity with specific threat-related words.[16] In addition, the ecological validity of words is questionable.[17] The pictorial dot-probe paradigm is considered to be the most effective measure to assess selective attention.[18] In the pictorial dot-probe task, two pictures that differ in emotional valence (i.e., threat or neutral) are simultaneously presented for a short time on a computer screen. Subsequently, the picture pair disappears, after which a probe appears on the spatial location of one of the preceding pictures. Participants are asked to press a button that corresponds to the spatial location of the probe (i.e., left or right), and the response latency (RL) is recorded. It is assumed that anxious individuals selectively attend to threat-related information and therefore will respond faster to probes that appear on the spatial location of threatening pictures as compared with probes that appear on the spatial location of neutral pictures.

The scarce number of studies that have used a pictorial dot-probe task in anxious children found mixed and contradictory results. In general community samples, an association has been consistently found between selective attention and childhood anxiety, although the type of selective attention (i.e., toward or away from threat) differed.[6,19,20] Such divergent findings have also been reported in relatively small clinical samples of anxiety-disordered children.[21,22] These divergent findings on the pictorial-dot-probe task in children may have resulted from age differences. Several executive functioning processes, which are believed to shape selective attention, develop considerably throughout childhood and adolescence.[23] Through development, children become progressively more able to use strategic and controlled attentional processes.[24] In addition, differences in threat intensity of the pictures may have accounted for these divergent findings. It has been suggested that selective attention toward high threat is common to all children, regardless of anxiety problems.[22,25] High anxious children are assumed to display a greater attention toward mildly threatening stimuli than nonanxious children, as a result of their increased subjective arousal. Previous studies have indeed indicated that anxious adults display a greater tendency than nonanxious adults to initiate increased attentional allocation toward intermediate levels of threat.[26] If left untreated, tendencies to selectively allocate attention toward intermediate levels of threat may maintain or enhance anxiety.

Studies in relatively small samples of anxiety-disordered adults have generally shown that a predisposition to selectively attend toward threat can be minimized or even eliminated by CBT.[27–32] This finding was, however, not replicated by a recent study in anxiety-disordered children.[33] Reductions of threat-related selective attention may facilitate anxiety improvement during the course of therapy.[34] Changes in visuospatial attentional processing during CBT may, on the other hand, be a direct by-product of anxiety changes during treatment.[34] Although no causal conclusions can be drawn as to the association between changes of selective attention and anxiety changes during CBT, the type (i.e., selective attention toward or away from threat) and level of threat-related selective attention at pretreatment may have predictive value for treatment success. Individual differences in visuospatial attentional processing of threatening stimuli exist between anxiety-disordered children. Anxiety-disordered children may respond differently to CBT as a function of their specific tendency to selectively allocate their attention to threatening stimuli at pretreatment.

The aim of the present study was to examine whether pretreatment selective attention is predictive of treatment outcome in a clinical sample of 131 anxiety-disordered children aged between 8 and 16 years. The effect of age and the predictive power of different threat intensities on CBT outcome were investigated.

Furthermore, specific components of selective attention (e.g., vigilance and disengagement difficulties) were examined in treatment responders and nonresponders. A pictorial dot-probe task and standardized CBT were used. We hypothesized that threat-related selective attention is predictive of treatment success in children. As selective attention toward threat tends to diminish during the course of CBT,[27–32] we expected that CBT is more effective for children that show a selective attention toward threat as opposed to children that tend to selectively attend away from threat at pretreatment. Previous studies have shown that nonanxious and anxious adults differ in their allocation of attention toward mild threat as compared with severe threat.[22,25] Because selective attentional processing of different threat intensities has never been examined in relation to treatment outcome, no hypotheses were formulated as to the effect of selective attention for mildly and severely threatening stimuli. In addition, no specific hypotheses were formulated for the effect of age because it can be argued that older children have more attentional control and may therefore profit more from CBT. On the other hand, older children may profit less from CBT because most of them have a more long-lasting pattern of anxiety problems than younger children.

METHOD

Participants

Eligible for participation were children (aged 8–16 years) consecutively referred between May 2003 and December 2005 to the Departments of Child and Adolescent Psychiatry of the Leiden University Medical Center and the Erasmus Medical Center, Sophia Children's Hospital, in Rotterdam. As part of the routine intake procedure, all children and their parents were interviewed with the Anxiety Disorders Interview Schedule for Children (ADIS-C).[35]

Inclusion Criteria. Children with a separation anxiety disorder, generalized anxiety disorder, social phobia, or specific phobia as primary anxiety diagnoses were included.

Exclusion Criteria. Exclusion criteria were as follows: an IQ below 85, poor command of the Dutch language, serious physical disease, substance abuse, pervasive developmental disorder, obsessive-compulsive disorder, posttraumatic stress disorder, and acute stress disorder. Substance abuse and pervasive developmental disorder were determined by a standard psychiatric examination during the intake procedure. IQ was determined with the Wechsler Intelligence Scale for Children-Third Edition.[36] None of the children with anxiety disorders used anxiety medication during treatment. Children who received medication for comorbid ADHD were not excluded ($n = 5$). Dosage of ADHD medication was held constant throughout the study.

The present study is part of a larger study into the effect of CBT on childhood anxiety disorders (for details, see Legerstee et al.[37] and Liber et al.[38]). A total of 154 children who met the inclusion criteria and their parents gave written informed consent and were enrolled in the larger treatment outcome study. Children younger than 12 years were randomly assigned in sequences of six to receive either individual CBT (ICBT) or group CBT (GCBT). For logistic reasons (i.e., to avoid a long waiting list for GCBT), children aged between 12 and 16 years received ICBT. Data of 6 children were not included in the larger treatment outcome study (2 children refused GCBT, and 4 could not be randomized because of logistic and practical reasons). As children with anxiety disorders with a comorbid depressive disorder typically do not show selective attention to threatening stimuli,[12] 10 children with a comorbid affective disorder were excluded from the present study. The experimental task was not completed in seven children because one child did not start with CBT, and for six children, it was not possible to complete the experimental task because of practical and logistic reasons.

The final sample consisted of 131 children. The characteristics of the final sample are presented in Table 1. Of the 131 children, 75 children (57%) had one anxiety disorder, 40 children (31%) had two anxiety disorders, and 16 children (12%) had more than two anxiety disorders.

Instruments

Anxiety Disorders Interview Schedule for Children. The ADIS-C[35,39] was used to assess the following *DSM-IV* diagnoses: generalized anxiety disorder, social phobia, specific phobia, separation anxiety disorder, panic disorder, agoraphobia, obsessive-compulsive disorder, posttraumatic stress disorder, dysthymia, major depressive disorder, and attention-deficit/hyperactivity disorder (ADHD). The ADIS-C consists of a child and parent interview. If the minimal requirements for a *DSM-IV* diagnosis were met, the parent or the child was asked to indicate on a 9-point scale (i.e., 0-8) to what extent the symptoms interfered with the

TABLE 1
Sample Characteristics

	Children With Anxiety Disorders ($n = 131$)
Age (SD), y	11.1 (2.0)
IQ	102.5 (12.3)
Sex, % female	50
SES, %	
Low	13
Middle	41
High	46
Treatment, %	
ICBT	69
GCBT	31
Anxiety diagnosis, %	
SP	32
SOP	37
SAD	42
GAD	43
PAD	1

Note: GAD = generalized anxiety disorder; GCBT = group cognitive-behavioral therapy; ICBT = individual cognitive-behavioral therapy; IQ = intelligence quotient; PAD = panic disorder; SES = socioeconomic status; SOP = social phobia; SP = specific phobia; SAD = separation anxiety disorder.

child's daily life. Subsequently, the interviewer gave an interference rating (Clinician Severity Rating [CSR]), on the same 9-point scale, for the child and parent interview, separately. If the CSR was 4 or higher, a diagnosis was assigned. Several researchers[40,41] have shown that the interrater and test–retest reliability of the ADIS-C are good to excellent.

Experienced and trained postdoctoral clinicians administered the ADIS-C at pretreatment. Clinicians of both institutions met several times to ensure that the procedures and decision making were alike. Master's degree–level students conducted the ADIS-C at posttreatment. The master's degree–level students were trained by observing live and videotaped interviews and completed an examination to prove acceptable administration of the interview. Postdoctoral psychologists reviewed, supervised, and discussed the interview reports of the master's degree–level students during the conduct of the research project to ensure that administration, scoring, and reporting would be congruent. Interviewers were blind to pretreatment diagnoses and to the performance on the experimental task.

Treatment

Treatment consisted of the FRIENDS program,[42,43] a structured CBT, which comprises psychoeducation, relaxation, breathing exercises, exposure, problem-solving skills training, social support training, and cognitive restructuring training. FRIENDS has been found to be "probably" efficacious for the treatment of childhood anxiety disorders.[44,45]

Treatment Success

Treatment success was defined as being free from any anxiety disorder (CSR < 4) diagnosed with the ADIS-C at posttreatment assessment.

Experimental Task

The pictorial dot-probe task was a modification of the task of Yiend and Mathews.[46] The task consisted of series of randomized severely threatening/neutral pictures (ST, N), mildly threatening/neutral (MT, N), and neutral/neutral (N, N) picture pairs. Pictures were selected from the International Affective Picture System (IAPS).[47] Based on standard ratings on valence and arousal, pictures were selected from the IAPS that were mildly threatening (i.e., low to moderate valence and moderate on arousal), severely threatening (i.e., low valence and high on arousal), and neutral (i.e., moderate valence and low on arousal). The following pictures from the IAPS were selected: 1120, 1280, 1300, 1321, 1660, 1930, 1931, 2120, 2130, 2683, 2780, 2800, 2900.1, 3230, 3280, 3500, 3530, 5950, 6190, 6213, 6230, 6242, 6244, 6250, 6260, 6300, 6370, 6940, 7380, 7390, 8179, 9000, 9041, 9050, 9160, 9280, 9404, 9411, 9421, 9470, 9471, 9480, 9530, 9584, 9630, 9635, 9911, 9920. Two pictures were combined in each trial: either a mildly or a severely threatening picture with a neutral picture, or two neutral pictures. This yielded 37 N, N; 24 MT, N; and 24 ST, N picture pairs. The location of the threatening pictures (i.e., severe or mild) was balanced (left or right of the neutral picture).

First, a white cross was presented for 500 milliseconds on the middle of a computer screen, after which a picture pair was presented horizontally during 500 milliseconds. Immediately after the picture pair disappeared, a probe appeared on the spatial location of one of the preceding pictures. The probes consisted of two white dots, positioned either next to each other or above each other. In response to the appearing probe, a corresponding key had to be pressed. Intertrial intervals varied randomly between 500, 750, 1,000, and 1,500 milliseconds.

Children were instructed to react as quickly and accurately as possible to the probe stimulus. After the instruction, 10 practice trials were completed, followed by the actual pictorial dot-probe task (3 buffer [N, N] and 72 randomized trials).

Selective Attention

Based on the RLs, two selective attention scores were computed for the severely and mildly threatening pictures.[48] First, the mean RL on trials in which the probe (p) emerged at the spatial location of the threatening picture (pT, N) was used, also named *congruent trials*. Second, the mean RL on trials in which the probe emerged at the spatial location of the neutral picture (T, pN) was used, also named *incongruent trials*. To calculate the selective attention score, the mean RL on congruent trials (pT, N) was subtracted from the mean RL on incongruent trials (T, pN).

A positive score reflects selective attention toward threat, and a negative score reflects a selective attention away from threat. A selective attention score was separately calculated for severely threatening pictures (ST, pN − pST, N) and for mildly threatening pictures (MT, pN − pMT, N).

Components of Selective Attention

Koster et al.[14] have proposed a method to examine the specific components of selective attention (i.e., vigilance or disengagement difficulties) in dot-probe tasks, by incorporating RLs on neutral-neutral trials. Response latencies on congruent trials (pT, N) and incongruent trials (T, pN) were each compared with RLs on neutral-neutral trials (pN, N).

Selective attention toward threat (positive score) can reflect a quick orientation toward threat and/or difficulties to disengage attention away from threat (Table 2).[13–15] Smaller RLs on congruent trials (pT, N) than on neutral-neutral trials (pN, N) indicate a quick orientation toward threat (i.e., vigilance). However, larger RLs on incongruent trials (T, pN) than on neutral-neutral trials (pN, N) indicate difficulties to disengage attention away from threat.

In our opinion, selective attention away from threat (negative score) can reflect avoidance of threat and/or the tendency not to engage attention toward threat. Smaller RLs on incongruent trials (T, pN) than on neutral-neutral trials (pN, N) indicate that the attention is directed away from threat toward the neutral picture (i.e., avoidance). Larger RLs on congruent trials (pT, N) than on neutral-neutral trials (pN, N) may reflect a tendency not to engage or shift attention toward threat (Table 2).

TABLE 2
Specific Components of Selective Attention

	RL (T, N) < (pN, N)	RL (T, N) > (pN, N)
Congruent trial (pT, N)	Vigilance	Tendency not to engage attention toward threat
Incongruent trial (T, pN)	Avoidance	Difficulties to disengage attention away from threat

Note: N = neutral; p = probe; RL = response latency; T = threat.

Procedure

During the intake procedure and 1 week posttreatment, children and their parents were interviewed separately with the ADIS-C. Approximately 2 weeks before treatment, the pictorial dot-probe task was administered to the children individually, in a dark and empty room, at both institutions. Procedures complied with strict ethical standards in the treatment of human subjects and were approved by the medical ethical committees of both institutions.

Statistical Analyses

Total Sample. With a repeated-measures analysis of variance (ANOVA), the pretreatment RLs were compared between neutral-neutral and mildly and severely threatening pictures. It was tested whether both the severe and mild selective attention scores showed a normal distribution with Kolmogorov-Smirnov tests, differed significantly from zero with one-sample *t* tests, and whether the pretreatment demographic characteristics (i.e., sex, socioeconomic status [SES], IQ) were related to either of the two pretreatment selective attention scores and to treatment success. For this purpose, one-way ANOVAs and χ^2 tests were conducted for categorical variables and correlations for continuous variables. Significant pretreatment demographic characteristics were included as covariates in the subsequent analyses.

The components of selective attention were examined by means of a repeated-measures ANOVA, with congruent trials (pT, N) versus neutral-neutral trials (pN, N) as within-subjects variables. A similar analysis was performed with incongruent trials (T, pN) versus neutral-neutral trials (pN, N). Both analyses were conducted for the mildly and severely threatening pictures, separately.

Treatment Response. Overall RLs on neutral-neutral and mildly and severely threatening pictures were compared between treatment responders and nonresponders with a multivariate ANOVA. A binary logistic regression analysis was performed, with treatment success as the dependent variable. In the first step, the severe and mild threat selective attention scores were entered as independent variables. If preliminary analyses showed that age was significantly related to treatment success and/or either of the two selective attention scores, we examined whether age moderated the association between selective attention and treatment success. To test for a moderating effect of age, age at pretreatment was also included as an independent variable. In the second step, two interaction terms were included between age and the severe and mild selective attention scores, respectively. If one or both interaction terms explained a statistically significant amount of variance, a moderator effect was present.[49] In addition, we tested whether selective attention predicts treatment success, when adjusted for pretreatment anxiety disorder severity. A blockwise multiple linear regression analysis was conducted, adjusted for pretreatment anxiety disorder severity. Posttreatment anxiety disorder severity was entered as a dependent variable. Pretreatment anxiety disorder severity was entered in block one. Subsequently, the mild and severe selective attention scores were entered simultaneously in block two. Pretreatment and posttreatment anxiety disorder severity were based on the CSR of the ADIS-C.

The specific components of selective attention were examined separately for treatment responders and nonresponders by means of a repeated-measures ANOVA. Congruent trials (pT, N) versus neutral-neutral trials (pN, N) were included as within-subjects variables. A similar analysis was performed with incongruent trials (T, pN) versus neutral-neutral trials (pN, N). Both analyses were conducted separately for mildly and severely threatening pictures.

A Bonferroni correction of the α level was used to adjust for multiple comparisons. Results were considered significant if the (two-tailed) α level was lower than .005 ($p < .005$).

RESULTS

Data Preparation

Trials with erroneous responses (2.6%) and extreme RLs (0.4%; <100 milliseconds and >3,000 milliseconds) were discarded from further analyses, in accordance with Watts and Weems.[6]

Pretreatment Analyses: Total Sample

Picture Content. A repeated-measures ANOVA, with pretreatment RL as dependent variable, showed a significant main effect of picture content ($F_{1,118} = 8.34$, $p = .001$). Polynomial contrasts indicated a significant linear increase of RL with an increase of threatening content of the pictures (i.e., from neutral to mildly threatening to severely threatening).

Selective Attention Scores. Calculation of the severe selective attention score (mean 15.01, SD 107.10) resulted in a positive value. One-sample *t* test indicated, however, that the severe selective attention score did not differ significantly from zero ($t_{119} = 1.53$, $p = .13$). The mild selective attention score (mean −23.49, SD 82.42) was negative and differed significantly from zero ($t_{119} = -3.12$, $p = .002$), indicating a selective attention away from mild threat. Kolmogorov-Smirnov tests for both selective attention scores indicated that both scores showed a normal distribution.

Pretreatment demographic characteristics (i.e., sex, SES, IQ) and pretreatment anxiety levels (i.e., CSR) were not related to either of the two selective attention scores. Although age was significantly related to the overall RL on neutral-neutral and mildly and severely threatening trials (i.e., RLs were smaller with increasing age), age was not related to either of the two selective attention scores.

Components of Selective Attention. For severely threatening pictures (Table 3), a repeated-measures ANOVA showed no significant difference between congruent trials (pST, N) and neutral-neutral trials ($F_{1,119} = 4.89$, $p = .03$). A second repeated-measures ANOVA showed that the RLs on incongruent severely threatening trials (ST, pN) were significantly higher than neutral-neutral trials ($F_{1,119} = 13.43$, $p = .001$), indicating difficulties to disengage attention away from the severely threatening pictures.

TABLE 3
Mean Probe Detection Response Latencies and SDs in Milliseconds on Neutral-Neutral, and Congruent and Incongruent Mild and Severe Threat Trials for Treatment Responders and Nonresponders

		Total Sample (n = 120)		Responders (n = 52)		Nonresponders (n = 60)	
Trial Type	Congruency	Mean	SD	Mean	SD	Mean	SD
Neutral-neutral	—	1,038.32	255.02	1,003.73	237.49	1,083.72	263.33
Mild threat-neutral	Incongruent	1,036.73	265.93	1,007.32	254.78	1,076.27	269.74
	Congruent	1,060.21	275.66	1,027.29	257.46	1,106.03	288.08
	Bias score	−23.49	82.42	−19.97	78.02	−29.76	86.15
Severe threat-neutral	Incongruent	1,070.47	293.11	1,017.65	261.54	1,133.66	310.58
	Congruent	1,055.45	267.40	1,035.56	261.39	1,085.28	269.57
	Bias score	15.01	107.10	−17.91	78.88	48.38	121.79

Note: Congruent = probe emerges at the spatial location of the threatening picture; Incongruent = probe emerges at the spatial location of the neutral picture; Bias score = incongruent − congruent.

For mildly threatening pictures (Table 3), a repeated-measures ANOVA showed that the RLs on congruent mildly threatening trials (pMT, N) were significantly higher compared with neutral-neutral trials ($F_{1,119}$ = 12.15, p = .001), indicating a tendency not to engage attention toward mild threat. The RLs between incongruent mildly threatening trials (MT, pN) and neutral-neutral trials were not significantly different ($F_{1,119}$ = 0.10, p = .78).

Selective Attention and CBT

Treatment Response. Of the children with anxiety disorders, 46% were free of any anxiety disorder at posttreatment. Treatment success did not significantly differ between ICBT and GCBT.[38] Treatment responders and nonresponders did not significantly differ on pretreatment demographic characteristics (i.e., sex, SES, IQ) or on age. Treatment responders and nonresponders also did not differ significantly on pretreatment anxiety levels (i.e., CSR).

Because age was not related to selective attention or to treatment response, age was not included as covariate in the subsequent analyses.

RLs in Treatment Responders and Nonresponders. The overall RLs on neutral/neutral, mildly threatening/neutral, and severely threatening/neutral trials did not significantly differ between treatment responders and nonresponders ($F_{3,108}$ = 1.25, p = .30).

Selective Attention as Predictor of Treatment Success. The severe selective attention score seemed to be a significant predictor of treatment success (odds ratio 0.994; 95% confidence interval [CI] 0.990–0.998, p = .001; (Table 4). The severe selective attention score accounted between 10% (Cox and Snell R^2) and 13% (Nagelkerke R^2) of the total variance of treatment outcome. The mild selective attention score did not significantly predict treatment success (odds ratio 1.001; 95% CI 0.996–1.006, p = .65).

Table 3 and Figure 1 show that the pretreatment severe selective attention score for treatment responders was negative (mean −17.91, SD 78.88), whereas the score was positive for nonresponders (mean 48.38, SD 121.79). The mild selective attention score for both treatment responders (mean −19.97, SD 78.02) and nonresponders (mean −29.76, SD 86.15) was negative.

After adjusting for pretreatment anxiety disorder severity, a nonsignificant trend emerged (b = .009; 95% CI 0.002–0.016, p = .012), suggesting that severe selective attention predicted treatment success. The mild selective attention score did not seem to be a significant predictor of posttreatment anxiety disorder severity, when adjusted for pretreatment anxiety

TABLE 4
Binary Logistic Regression Analyses (Method: Enter): Mild and Severe Threat Selective Attention Scores as Predictor of Treatment Success

Predictor Variable	OR (95% CI)	p
Mild attention score	1.001 (0.996–1.006)	.65
Severe attention score	0.994 (0.990–0.998)[a]	.00

Note: OR = odds ratio; CI = confidence interval.
[a]Cox and Snell R^2 = 0.10; Nagelkerke R^2 = 0.13; Percentage correct = 59%.

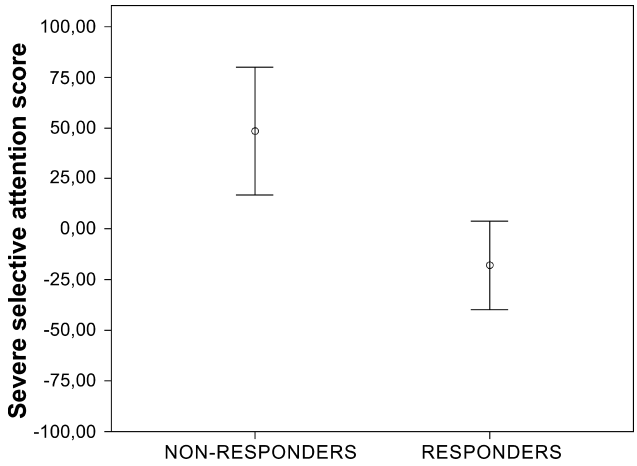

Fig. 1 Pretreatment selective attention score for severe threat (95% confidence intervals) for treatment responders and nonresponders.

disorder severity (b = −.002; 95% CI −0.012 to 0.007, p = .615).

Components Selective Attention: Treatment Responders. For treatment responders (Table 3), a nonsignificant trend was found, such that the RLs on congruent severely threatening trials (pST, N) differed from neutral-neutral trials ($F_{1,52}$ = 7.64, p = .008). A nonsignificant trend was also found, such that the RLs of treatment responders differed between congruent mildly threatening trials (pMT, N) and neutral-neutral trials ($F_{1,52}$ = 7.82, p = .007). These nonsignificant trends suggest that treatment responders showed a tendency not to engage their attention toward severe and mild threat.

The RLs on incongruent severely threatening trials (ST, pN) and neutral-neutral trials did not significantly differ for treatment responders ($F_{1,52}$ = 1.58, p = .21). No significant difference was found between the RLs on incongruent mildly threatening trials (MT, pN) and neutral-neutral trials ($F_{1,52}$ = 0.20, p = .65).

Components Selective Attention: Treatment Nonresponders. For treatment nonresponders (Table 3), no significant difference was found between the RLs on congruent severely threatening trials (pST, N) and neutral-neutral trials ($F_{1,59}$ = 0.23, p = .88). A significant difference, however, was found between the RLs on incongruent severely threatening trials (ST, pN) and neutral-neutral trials ($F_{1,59}$ = 13.00, p = .001). The RLs were significantly higher on the incongruent severely threatening trials (ST, pN) than neutral-neutral trials, indicating that treatment nonresponders had difficulties in disengaging attention away from severe threat. For mild threat, the RLs of treatment nonresponders on congruent mildly threatening pictures (pMT, N) did not significantly differ from neutral-neutral trials ($F_{1,59}$ = 5.24, p = .03). No significant difference was found between the RLs on incongruent mildly threatening pictures (MT, pN) and neutral-neutral trials ($F_{1,59}$ = 1.22, p = .28).

DISCUSSION

To our knowledge, this is the first study that examined the predictive value of selective attention, and its specific components, on treatment outcome in children with anxiety disorders. For the total sample of children with anxiety disorders, a selective attention away from mildly threatening pictures was found. No selective attention was found for the severely threatening pictures, neither toward nor away from severe threat. The results regarding selective attention away from mild threat contradict previous findings in adults,[14,50] which predominantly showed a selective attention toward mild threat. With respect to the specific components of selective attention, children with anxiety disorders showed difficulties to disengage attention away from severe threat, which has also been fairly consistently reported in adults.[14,15] Furthermore, children with anxiety disorders showed a tendency not to engage their attention toward mild threat. These results may suggest that children with anxiety disorders experience a general difficulty with shifting their attention (i.e., engaging or disengaging attention). Shifting of attention is a fundamental voluntary and strategic control process in the executive functioning system.[51] Attentional control, an important aspect of "effortful control,"[52] is important for the regulation of both positive and negative emotional reactions.[53] It has been consistently demonstrated that poor attentional control is significantly related to anxiety problems.[53–55]

As to the aim of this study, our result showed that selective attention for severe threat at pretreatment assessment, but not for mild threat, was predictive of treatment success in children with anxiety disorders. Selective attention toward severe threat explained a medium to large amount of variance in treatment outcome.[56] Treatment responders showed a selective attention away from severe threat, whereas nonresponders showed a selective attention toward severe threat. These results indicate that the direction (i.e., toward or away from threat) of selective attention for severe threat at

pretreatment is able to differentiate between children who will respond and will not respond to CBT. Consistent with findings of a recent study of Watts and Weems,[6] age was not related to selective attention. Because age was neither related to treatment response, examination of a moderating effect of age on the association between selective attention and treatment success was not warranted.

Investigation of the specific components of selective attention for severely threatening pictures showed that treatment responders tended not to engage their attention toward severe threat. In contrast, treatment nonresponders had difficulties in disengaging their attention away from severe threat before CBT. Apparently, anxious children who tend not to engage their attention toward threat profit more from CBT than anxious children with "disengaging difficulties" as to severe threat. Although speculative at this moment, CBT may be less beneficial for children with anxiety disorders who are already inclined to attend to severe threat and have problems in disengaging their attention away from it. During CBT, children with anxiety disorders are repeatedly exposed to anxiety-arousing and threatening topics or situations, which may reinforce their tendency to "focus on and stick to" frightening topics.[57] They are, to a far lesser extent, trained to disengage their attention away from severe threat, which may be more helpful for some of them. Indeed, Waters et al.[33] showed that selective attention toward threat, which can reflect attention disengagement difficulties, does not reduce during the course of CBT in children with anxiety disorders. Clinically, anxious children who exhibit a selective attention toward severe threat may need more specific attention training directed at learning to disengage attention away from threatening topics and attend to positive or neutral objects or situations.[33] To our knowledge, no systematic study has examined whether attention training, targeting attention disengagement difficulties, can decrease selective attention toward severe threat. Future studies should examine moderating or mediating effects of attentional control on the association between threat-related selective attention and treatment outcome.

Several limitations of our study need to be taken into consideration. First, it must be stressed that our experimental task probably tapped the more conscious and voluntary controlled attentional processes in response to threat rather than early automatic stages of attention processing. The picture exposure duration of the pictorial dot-probe task in our study was 500 milliseconds. Other studies[58] have demonstrated that short exposure durations of 100 milliseconds summon rapid and automatic allocation of attention, whereas longer exposure durations allow for relatively late voluntary controlled attentional processes. Therefore, although this study did not demonstrate any vigilance or avoidance of threat, such biased initial attentional processes may well be apparent in childhood anxiety disorders in general and also in relation to treatment success. Furthermore, children with anxiety disorders in this study did not rate the valence and arousal of the threatening pictures. This did not allow us to check whether the ratings of children with anxiety disorders corresponded to the normative ratings. However, the larger RLs with increasing severity of the pictures, as well as the differential impact between severe and mild selective attention on treatment success, are suggestive of the validity of the used threatening pictures. Another limitation of the present study was that the rate of pure anxiety diagnoses was relatively small, which prevented us to examine the association between selective attention and treatment response for specific anxiety disorder subgroups. Furthermore, we interpreted larger RLs on congruent trials as compared with neutral-neutral trials as a tendency not to engage attention toward threat. Studies in both clinical and community samples are needed to determine whether this slower response on congruent over neutral-neutral trials in children with anxiety disorders reflects a more conscious tendency not to engage attention toward threat or rather a difficulty in engaging attention toward it.

In conclusion, the present study demonstrated that children with anxiety disorders experience difficulties in disengaging their attention away from severe threat and show a tendency not to engage their attention toward mild threat. Selective attention for severely threatening pictures seemed to be a significant predictor of treatment response. Treatment responders showed a tendency not to engage their attention toward severe threat, whereas nonresponders showed difficulties in disengaging their attention away from severe threat. Children with anxiety disorders and attention disengagement difficulties may profit from training focused on learning to disengage their attention away from anxiety-arousing topics and to focus more on pleasant or neutral objects or situations.

Disclosure: The authors report no conflicts of interest.

REFERENCES

1. Verhulst FC, van der Ende J, Ferdinand RF, Kasius MC. The prevalence of *DSM-III-R* diagnoses in a national sample of Dutch adolescents. *Arch Gen Psychiatry*. 1997;54:329–336.
2. Pine DS, Cohen P, Brook J. Adolescent fears as predictors of depression. *Biol Psychiatry*. 2001;50:721–724.
3. Bittner A, Egger HL, Erkanli A, Costello E, Foley DL, Angold A. What do childhood anxiety disorders predict? *J Child Psychol Psychiatry*. 2007; 48:1174–1183.
4. Manassis K, Mendlowitz SL, Scapillato D et al. Group and individual cognitive-behavioral therapy for childhood anxiety disorders: a randomized trial. *J Am Acad Child Adolesc Psychiatry*. 2002;41:1423–1430.
5. In-Albon T, Schneider S. Psychotherapy of childhood anxiety disorders: a meta-analysis. *Psychother Psychosom*. 2007;76:15–24.
6. Watts SE, Weems CF. Associations among selective attention, memory bias, cognitive errors and symptoms of anxiety in youth. *J Abnorm Child Psychol*. 2006;34:841–852.
7. Roy AK, Vasa RA, Bruck M et al. Attention bias toward threat in pediatric anxiety disorders. *J Am Acad Child Adolesc Psychiatry*. 2008; 47:10.
8. Vasey MW, Daleiden EL, Williams LL, Brown LM. Biased attention in childhood anxiety disorders: a preliminary study. *J Abnorm Child Psychol*. 1995;23:267–279.
9. Taghavi MR, Dalgleish T, Moradi AR, Neshat-Doost HT, Yule W. Selective processing of negative emotional information in children and adolescents with generalized anxiety disorder. *Br J Clin Psychol*. 2003; 42:221–230.
10. Vasey MW, El-Hag N, Daleiden EL. Anxiety and the processing of emotionally threatening stimuli: distinctive patterns of selective attention among high- and low-anxious children. *Child Dev*. 1996;67:1173–1185.
11. Martin M, Horder P, Jonges GV. Integral bias in naming of phobia-related words. *Cogn Emot*. 1992;6:479–486.
12. Puliafico AC, Kendall PC. Threat-related attentional bias in anxious youth: a review. *Clin Child Fam Psychol Rev*. 2006;9:162–180.
13. Posner MI, Petersen SE. The attention system of the human brain. *Annu Rev Neurosci*. 1990;13:25–42.
14. Koster EH, Crombez G, Verschuere B, De Houwer J. Selective attention to threat in the dot probe paradigm: differentiating vigilance and difficulty to disengage. *Behav Res Ther*. 2004;42:1183–1192.
15. Salemink E, van den Hout MA, Kindt M. Selective attention and threat: quick orienting versus slow disengagement and two versions of the dot probe task. *Behav Res Ther*. 2007;45:607–615.
16. McNally RJ, Riemann BC, Kim E. Selective processing of threat cues in panic disorder. *Behav Res Ther*. 1990;28:407–412.
17. Schippell PL, Vasey MW, Cravens-Brown LM, Bretveld RA. Suppressed attention to rejection, ridicule, and failure cues: a unique correlate of reactive but not proactive aggression in youth. *J Clin Child Adolesc Psychol*. 2003;32:40–55.
18. Dalgleish T, Taghavi R, Neshat-Doost H, Moradi A, Canterbury R, Yule W. Patterns of processing bias for emotional information across clinical disorders: a comparison of attention, memory, and prospective cognition in children and adolescents with depression, generalized anxiety, and posttraumatic stress disorder. *J Clin Child Adolesc Psychol*. 2003;32:10–21.
19. Heim-Dreger U, Kohlmann CW, Eschenbeck H, Burkhardt U. Attentional biases for threatening faces in children: vigilant and avoidant processes. *Emotion*. 2006;6:320–325.
20. Kallen VL, Ferdinand RF, Tulen JH. Early attention processes and anxiety in children. *Percept Mot Skills*. 2007;104:221–235.
21. Pine DS, Mogg K, Bradley BP et al. Attention bias to threat in maltreated children: implications for vulnerability to stress-related psychopathology. *Am J Psychiatry*. 2005;162:291–296.
22. Waters AM, Lipp OV, Spence SH. Attentional bias toward fear-related stimuli: an investigation with nonselected children and adults and children with anxiety disorders. *J Exp Child Psychol*. 2004;89:320–337.
23. Luna B, Garver KE, Urban TA, Lazar NA, Sweeney JA. Maturation of cognitive processes from late childhood to adulthood. *Child Dev*. 2004; 75:1357–1372.
24. Brodeur DA. Age changes in attention control: assessing the role of stimulus contingencies. *Cogn Dev*. 2004;19:241–252.
25. Mathews A, Mackintosh B. Induced emotional interpretation bias and anxiety. *J Abnorm Psychol*. 2000;109:602–615.
26. Wilson E, MacLeod C. Contrasting two accounts of anxiety-linked attentional bias: selective attention to varying levels of stimulus threat intensity. *J Abnorm Psychol*. 2003;112:212–218.
27. Devineni T, Blanchard EB, Hickling EJ, Buckley TC. Effect of psychological treatment on cognitive bias in motor vehicle accident-related posttraumatic stress disorder. *J Anxiety Disord*. 2004;18:211–231.
28. Foa EB, McNally RJ. Sensitivity to fear stimuli in obsessive-compulsives: a dichotic listening analysis. *Cognit Ther Res*. 1986;10:477–485.
29. Lavy E, van den Hout M, Arntz A. Attentional bias and spider phobia: conceptual and clinical issues. *Behav Res Ther*. 1993;31:17–24.
30. Lundh LG, Öst LG. Attentional bias, self-consciousness, and perfectionism in social phobia before and after cognitive-behaviour therapy. *Scand J Behav Ther*. 2001;30:4–16.
31. Mattia JI, Heimberg RG, Hope DA. The revised Stroop color-naming task in social phobics. *Behav Res Ther*. 1993;31:305–313.
32. Watts FN, McKenna FP, Sharrock R, Trezise L. Colour naming of phobia-related words. *Br J Psychol*. 1986;77:97–108.
33. Waters AM, Wharton TA, Zimmer-Gembeck MJ, Craske MG. Threat-based cognitive biases in anxious children: comparison with non-anxious children before and after cognitive behavioural treatment. *Behav Res Ther*. 2008;46:358–374.
34. Mobini S, Grant A. Clinical implications of attentional bias in anxiety disorders: an integrative literature review. *Psychother Theory Res Pract Train*. 2007;44:450–462.
35. Silverman WK, Albano AM. *Anxiety Disorders Interview Schedule for DSM-IV Child Version*. San Antonio: The Psychological Corporation; 1996.
36. Wechsler D. *The Wechsler Intelligence Scale for Children–Third Edition (WISC-III)*. San Antonio: The Psychological Corporation; 1991.
37. Legerstee JS, Huizink AC, van Gastel W et al. Maternal anxiety predicts favourable treatment outcomes in anxiety-disordered adolescents. *Acta Psychiatr Scand*. 2008;117:289–298.
38. Liber JM, Van Widenfelt BM, Utens EM et al. No differences between group versus individual treatment of childhood anxiety disorders in a randomised clinical trial. *J Child Psychol Psychiatry*. 2008;49:886–893.
39. Siebelink BM, Treffers PDA. *Anxiety Disorder Interview Schedule for DSM-IV–Child Version/ Dutch Translation*. Lisse: SWETS Test Publishers; 2001.
40. Lyneham HJ, Abbott MJ, Rapee RM. Interrater reliability of the Anxiety Disorders Interview Schedule for *DSM-IV*: child and parent version. *J Am Acad Child Adolesc Psychiatry*. 2007;46:731–736.
41. Silverman WK, Saavedra LM, Pina AA. Test-retest reliability of anxiety symptoms and diagnoses with the Anxiety Disorders Interview Schedule for *DSM-IV*: child and parent versions. *J Am Acad Child Adolesc Psychiatry*. 2001;40:937–944.
42. Barrett PM, Lowry-Webster H, Holmes J. *The Friends Anxiety Prevention Program*. Queensland: Australian Academic Press; 2000.
43. Utens EMWJ, Nijs de P, Ferdinand RF. *Friends for Children–Manual for Group Leaders (Dutch Translation)*. Rotterdam: Department of Child and Adolescent Psychiatry, ErasmusMC/Sophia Children's Hospital; 2001.
44. Shortt AL, Barrett PM, Fox TL. Evaluating the FRIENDS program: a cognitive-behavioral group treatment for anxious children and their parents. *J Clin Child Psychol*. 2001;30:525–535.
45. WHO. *Prevention of Mental Disorders: Effective Interventions and Policy Options: Summary Report*. Geneva: Department of Mental Health and Substance Abuse; 2004.
46. Yiend J, Mathews A. Anxiety and attention to threatening pictures. *Q J Exp Psychol A*. 2001;54:665–681.
47. Lang PJ, Bradley MM, Cuthbert BN. *International Affective Picture System (IAPS): Instruction Manual and Affective Ratings (Technical Report A-5)*. Gainesville: The Center for Research in Psychophysiology, University of Florida; 2001.

48. MacLeod C, Mathews A. Anxiety and the allocation of attention to threat. *Q J Exp Psychol A*. 1988;40:653–670.
49. Bennett JA. Focus on research methods. Mediator and moderator variables in nursing research: conceptual and statistical differences. *Res Nurs Health*. 2000;23:415–420.
50. Koster EH, Crombez G, Verschuere B, Van Damme S, Wiersema JR. Components of attentional bias to threat in high trait anxiety: facilitated engagement, impaired disengagement, and attentional avoidance. *Behav Res Ther*. 2006;44:1757–1771.
51. Wager TD, Jonides J, Smith EE. Individual differences in multiple types of shifting attention. *Mem Cognit*. 2006;34:1730–1743.
52. Eisenberg N, Ma Y, Chang L, Zhou Q, West SG, Aiken L. Relations of effortful control, reactive undercontrol, and anger to Chinese children's adjustment. *Dev Psychopathol*. 2007;19:385–409.
53. Derryberry D, Reed MA. Anxiety-related attentional biases and their regulation by attentional control. *J Abnorm Psychol*. 2002;111:225–236.
54. Eysenck MW, Derakshan N, Santos R, Calvo MG. Anxiety and cognitive performance: attentional control theory. *Emotion*. 2007;7:336–353.
55. Lonigan CJ, Vasey MW, Phillips BM, Hazen RA. Temperament, anxiety, and the processing of threat-relevant stimuli. *J Clin Child Adolesc Psychol*. 2004;33:8–20.
56. Cohen J. *Statistical Power Analysis for the Behavioral Sciences (2nd edition)*. Hillsdale: Erlbaum; 1988.
57. Bouchard S, Mendlowitz SL, Coles ME, Franklin M. Considerations in the use of exposure with children. *Cogn Behav Pract*. 2004;11:56–65.
58. Koster EH, Verschuere B, Crombez G, Van Damme S. Time-course of attention for threatening pictures in high and low trait anxiety. *Behav Res Ther*. 2005;43:1087–1098.