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CBT for childhood anxiety disorders: differential changes in selective attention between treatment responders and non-responders

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Background: This study examined whether treatment response to stepped-care cognitive-behavioural treatment (CBT) is associated with changes in threat-related selective attention and its specific components in a large clinical sample of anxiety-disordered children. **Methods:** Ninety-one children with an anxiety disorder were included in the present study. Children received a standardized stepped-care CBT. Three treatment response groups were distinguished: initial responders (anxiety disorder free after phase one: child-focused CBT), secondary responders (anxiety disorder free after phase two: child–parent-focused CBT), and treatment non-responders. Treatment response was determined using a semi-structured clinical interview. Children performed a pictorial dot-probe task before and after stepped-care CBT (i.e., before phase one and after phase two CBT). **Results:** Changes in selective attention to severely threatening pictures, but not to mildly threatening pictures, were significantly associated with treatment success. At pre-treatment assessment, initial responders selectively attended away from severely threatening pictures, whereas secondary responders selectively attended toward severely threatening pictures. After stepped-care CBT, initial and secondary responders did not show any selectivity in the attentional processing of severely threatening pictures. Treatment non-responders did not show any changes in selective attention due to CBT. **Conclusions:** Initial and secondary treatment responders showed a reduction of their predisposition to selectively attend away or toward severely threatening pictures, respectively. Treatment non-responders did not show any changes in selective attention. The pictorial dot-probe task can be considered a potentially valuable tool in assigning children to appropriate treatment formats as well as for monitoring changes in selective attention during the course of CBT. **Keywords:** Childhood anxiety disorders, selective attention, cognitive-behavioural therapy, dot-probe task. **Abbreviations:** CBT: cognitive-behavioural therapy; ADIS-C: anxiety disorders interview schedule for children; ICBT: individual cognitive-behavioural therapy; GCBT: group cognitive-behavioural therapy; CSR: clinician severity rating.

Anxiety disorders are among the most common psychiatric disorders in children, and their presence significantly interferes with social and academic functioning (La Greca & Lopez, 1998). Untreated childhood anxiety disorders tend to persist into adulthood and may develop in other psychiatric disorders (Gregory et al., 2007). Most anxiety-disordered children are free of their anxiety disorder after completion of cognitive-behavioural therapy (CBT; In-Albon & Schneider, 2007). However, a substantial proportion of children does not benefit, or benefit only partially, from CBT. Gaining insight into the mechanisms underlying treatment response may aid in improving current CBT programs or contribute to the development of new therapeutic approaches. Selective attention is hypothesized to be involved in the etiology and maintenance of anxiety disorders (Mathews & MacLeod, 2005); as such, selective attention may be an essential process facilitating anxiety changes during CBT (Mobini & Grant, 2007).

The pictorial dot-probe task is considered the most effective instrument for assessing selective attention in children (Dalgleish et al., 2003). In this task, two pictures that differ in emotional valence (i.e., threat or neutral) are simultaneously shown on a computer screen. Immediately after the picture pair disappears, a probe appears on the spatial location of one of the preceding pictures. Participants are instructed to press a button that corresponds to the spatial location of the probe. Differences in response latencies for probes replacing threatening pictures versus probes replacing neutral pictures provide a score for selective attention (MacLeod & Mathews, 1988). Selective attention toward threat is indicated by faster responses to probes that appear on the spatial location of threatening pictures as compared to probes that appear on the spatial location of neutral pictures. Slower responses to probes that replace threatening pictures, compared to probes that replace neutral pictures, indicate selective attention away from threat.

Studies in anxious children with the pictorial dot-probe task found both evidence for selective

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attention toward threat (e.g., Monk et al., 2008), as well as selective attention away from threat (e.g., Pine et al., 2005). These divergent findings may be caused by differences in threat value of the stimuli. It has been suggested that selective attention toward high threat is common in all children, regardless of anxiety problems (Mathews & Mackintosh, 2000). Highly anxious children are assumed to display a greater selective attention toward mildly threatening stimuli than non-anxious children, as a result of their increased subjective arousal. Previous studies have indeed indicated that anxious adults display a greater selective attention toward intermediate levels of threat than non-anxious adults (Wilson & MacLeod, 2003).

Research has indicated that selective attention toward threat can comprise two specific components, namely a facilitated attention toward threat (i.e., vigilance) and/or a difficulty in disengagement from threat (Koster, Crombez, Verschuere, & De Houwer, 2004). Selective attention away from threat, on the other hand, might reflect an initial avoidance and/or a strategy not to engage attention toward threat (Legerstee et al., 2009). Research with adults has shown that selective attention toward threat comprises difficulties in disengaging attention away from threat rather than vigilance (Salemink, van den Hout, & Kindt, 2007).

In a recent study using a large clinical sample, we showed that selective attention to severely threatening stimuli, but not to mildly threatening stimuli, is predictive of CBT success in childhood anxiety disorders (Legerstee et al., 2009). Treatment responders showed a selective attention away from severe threat at pre-treatment assessment, and a concomitant strategy not to engage attention toward threat. Treatment non-responders, on the other hand, showed a selective attention toward severe threat and concomitant difficulties in disengaging attention away from threat. Changes in selective attention during the course of CBT have scarcely been examined in children, whereas a number of studies on anxious adults have shown that threat-related selective attention could be minimized or even eliminated by CBT (Lavy, van den Hout, & Arntz, 1993; Lundh & Öst, 2001; Mattia, Heimberg, & Hope, 1993). Only one study has examined changes in selective attention during CBT in 19 anxiety-disordered children aged between 8 and 12 years (Waters, Wharton, Zimmer-Gembeck, & Craske, 2008). Following treatment, selective attention toward threat was not significantly reduced. Studies on the relationship between selective attention and treatment in both children and adults were mostly conducted in relatively small samples without differentiation between treatment responders and treatment non-responders. No prior study has examined changes in selective attention to threat of different intensities (i.e., mild or severe) during CBT. Neither have changes in the specific components of selective attention during CBT been previously addressed.

The aim of the present study was to examine whether treatment response to stepped-care CBT in anxiety-disordered children is related to changes in selective attention. More specifically, pre-treatment levels of selective attention and its specific components were compared with post-treatment levels (i.e., after stepped-care CBT). Changes in these levels were compared between different treatment response groups. In addition, changes in selective attention were examined for different threat intensities (i.e., mildly and severely threatening stimuli). It was hypothesized that treatment responders would show a reduction of their predisposition to selectively attend either away or toward threat and its specific components, and that treatment non-responders would not show any change of selective attention. Based on our earlier findings (Legerstee et al., 2009), it was expected that these findings would apply to severely threatening stimuli and not to mildly threatening stimuli.

The present study is part of a larger study on the efficacy of group versus individual CBT (Liber et al., 2008a) and on predictors of treatment success (Legerstee et al., 2008, 2009; Liber et al., 2008b). The efficacy of group CBT did not significantly differ from the efficacy of individual CBT (Liber et al., 2008a) during the first phase of the stepped-care CBT; 48% of the children were free of their anxiety disorders after individual CBT versus 41% of the children after group CBT.

Method

Participants

Eligible for participation were children (aged 8–16) consecutively referred to the departments of Child and Adolescent Psychiatry of the Leiden University Medical Centre and the Erasmus Medical Centre, Sophia Children's Hospital in Rotterdam between May 2003 and May 2007. The Anxiety Disorders Interview Schedule for Children (ADIS-C; Silverman & Albano, 1996) was administered to both children and their parents to assess childhood anxiety disorders. Children with a separation anxiety disorder, generalized anxiety disorder, social phobia, or specific phobia as primary anxiety diagnosis were included in the present study. Exclusion criteria were: an IQ below 85, poor command of the Dutch language, serious physical condition, substance abuse, pervasive developmental disorder, obsessive-compulsive disorder, posttraumatic stress disorder, and acute stress disorder.

None of the anxiety-disordered children received medication for their anxiety disorder during treatment. Five children with co-morbid attention deficit/hyperactivity disorder (ADHD) received ADHD-related medication; the dosage of this medication was held constant throughout the study. A total of 154 children who met the inclusion criteria, and their parents, gave written informed consent and these children were enrolled in

the larger treatment outcome study. Six children were excluded because they could not be randomized to group CBT (GCBT) versus individual CBT (ICBT). Ten children with co-morbid affective disorder were excluded as previous studies have shown that threat-related selective attention is not apparent for anxious children with co-morbid affective disorders (Taghavi, Neshat-Doost, Moradi, Yule, & Dalgleish, 1999). Seven children did not complete the pictorial dot-probe task at pre-treatment assessment for practical and logistic reasons (for details see Legerstee et al., 2009).

Of the 131 children, 40 children did not participate in the post-treatment (i.e., after stepped-care CBT) pictorial dot-probe assessment for logistic and practical reasons. The distribution of background variables (i.e., gender, age, IQ, and socioeconomic status), pre-treatment anxiety severity, treatment success, and performance on the pre-treatment pictorial dot-probe task was not significantly different between participants and non-participants in the post-treatment assessment (i.e., after stepped-care CBT). Of the final sample of 91 children, 50 (55%) children had one anxiety disorder, 28 (31%) children had two anxiety disorders and 13 (14%) children had more than two anxiety disorders (see Table 1).

Instruments

Anxiety Disorders Interview Schedule for Children (ADIS-C). The ADIS-C (Siebelink & Treffers, 2001; Silverman & Albano, 1996) consisted of a child and parent interview and assessed anxiety disorders and other diagnoses. The parents and child give a severity rating for each disorder on a 9-point scale (i.e., 0–8). Based on the severity rating of the parents and child, the clinician also gives a severity rating for each disorder on the same 9-point scale. The clinician severity rating (CSR) is used to determine the clinical significance of anxiety disorders. An anxiety diagnosis is assigned if the CSR is larger than or equal to 4. Good inter-rater and test–retest reliability have been reported (Lyneham, Abbott, & Rapee, 2007).

Experienced and trained postdoctoral clinicians administered the ADIS-C at pre-treatment. 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 after phase one and at post-treatment (i.e., after phase two of the stepped-care CBT). The master's degree-level students were trained by observing live and videotaped interviews and completed an examination to prove adequate 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.

Treatment. A standardized stepped-care CBT program for childhood anxiety disorders was used, consisting of two phases. Phase one consisted of the FRIENDS program (Barrett, Lowry-Webster, & Holmes, 2000), a standardized CBT, which comprised psycho-education, relaxation and breathing exercises, exposure, problem-solving skills training, social support training, and cognitive restructuring. FRIENDS comprised 10 child sessions and 4 separate parent sessions. Children up to 12 years of age were randomly assigned in sequences of 6 to receive either individual CBT (ICBT) or group CBT (GCBT). Children older than 12 years of age received ICBT. Children who were not successfully treated after phase one received supplementary CBT (i.e., phase two).

Phase two consisted of 10 standardized individual CBT sessions involving both the child and the parents (Van Widenfelt, Franswa, Utens, van der Toorn, & Liber, 2002). Parents were more actively involved than in phase one and participated in all sessions. The skills learned during phase one were further elaborated upon (e.g., cognitive restructuring, exposure and long-term relapse control). Furthermore, phase two was aimed at modifying negative communication processes between parents as to anxiety, negative parent–child communication, cognitions of parents, and the impact of parental anxiety on the child's avoidant behaviour and anxiety.

Treatment success. Treatment success was defined as being free from any anxiety disorder (CSR < 4). Children who were successfully treated with phase one

Table 1 Sample characteristics for the total sample as well as for different treatment response groups

	Anxiety-disordered children (n = 91)	Initial responders (N = 39)	Secondary responders (N = 37)	Non-responders (N = 13)	χ^2 / F	p
Age (SD)	11.1 (2.1)	10.9 (1.9)	11.1 (2.2)	11.2 (2.4)	.18	.84
IQ	102.5 (12.6)	105.4 (14.2)	99.7 (11.3)	101.9 (10.3)	1.97	.15
Sex, female	50%	44%	43%	92%	11.17	.01
SES,					3.63	.46
Low	11%	8%	11%	23%		
Middle	43%	39%	49%	31%		
High	46%	54%	41%	46%		
Anxiety diagnosis,						
SP	31%	28%	31%	31%	.61	.78
SOP	41%	36%	41%	41%	.82	.67
SAD	44%	41%	44%	44%	.67	.71
GAD	43%	39%	43%	43%	.95	.62
PAD	1%	0%	3%	0%	1.73	.56

Note. IQ: intelligence quotient; SES: socioeconomic status; SP: specific phobia; SOP: social phobia; SAD: separation anxiety disorder; GAD: generalized anxiety disorder; PAD: panic disorder.

CBT were considered initial treatment responders. Secondary treatment responders were children who were anxiety disorder free after phase two CBT. Treatment non-responders were children who still were diagnosed with an anxiety disorder after phase one and phase two CBT.

Pictorial dot-probe task. The pictorial dot-probe task was a modification of the task of Yiend and Mathews (2001). Each trial started with a white cross that was presented for 500 milliseconds on the middle of a computer screen. The presentation of the white cross was followed by the horizontal presentation of a picture pair for 500 milliseconds. Two pictures were combined in each trial: either a mildly threatening picture (e.g., battle tank, graveyard) or a severely threatening picture (e.g. aimed gun, biting dog) with a neutral picture, or two neutral pictures (e.g., ice cream, clown). The location of the threatening pictures was balanced. Pictures were selected from the International Affective Picture System (Lang, Bradley, & Cuthbert, 2001) based on standard ratings on valence and arousal. Immediately after the picture pair disappeared, a probe (p) appeared on the spatial location of one of the preceding pictures. Trials with probes appearing on the spatial location of the preceding threatening picture (pT, N) were named congruent trials. Incongruent trials were trials with probes appearing on the location of the preceding neutral picture (T, pN). The probes consisted of two white dots, positioned either next to each other or above each other. In response to the probe appearing, a corresponding key had to be pressed. The task began with an instruction and 10 practice trials, followed by the actual pictorial dot-probe task (3 buffer (N, N) and 72 randomized trials). Inter-trial intervals varied randomly between 500, 750, 1,000 and 1,500 milliseconds.

Selective attention. A selective attention score was calculated (MacLeod & Mathews, 1988) by subtracting the mean response latency (RL) to congruent trials (pT, N) from the mean RL to incongruent trials (T, pN). In equation form:

$$\textit{Selective attention score} = \text{RL incongruent trials } (\mathrm{T}, \mathrm{pN}) - \text{RL congruent trials} (\mathrm{pT}, \mathrm{N})$$

A positive score reflects selective attention toward threat and a negative score reflects selective attention away from threat. A selective attention score was calculated for severely threatening pictures and for mildly threatening pictures, separately.

Components of selective attention. Koster et al. (2004) proposed a method to examine the specific components of selective attention to threat in dot-probe tasks, by comparing the mean RL to congruent trials (pT, N) and incongruent trials (T, pN) separately, with the mean RL to neutral–neutral trials (pN, N). For purposes of the present study, two index scores were calculated, namely a congruent index score and an incongruent index score (for more details see Table 2).

The congruent index score was calculated by subtracting the mean RL to neutral–neutral trials (pN, N) from the mean RL to congruent trials (pT, N) for pre-treatment as well as post-treatment (i.e., after stepped-care CBT) data. The incongruent index score was calculated in a similar way for incongruent trials (T, pN). In equation form:

$$\textit{Congruent index score} = \text{RL congruent trials } (\mathrm{pT}, \mathrm{N}) - \text{RL neutral - neutral trials (pN, N)}$$

$$\textit{Incongruent index score} = \text{RL incongruent trials } (\mathrm{T}, \mathrm{pN}) - \text{RL neutral} - \text{neutral trials } (\mathrm{pN}, \mathrm{N})$$

A positive score on the congruent index score indicates a strategy not to engage toward threat, whereas a negative score indicates a quick orientation toward threat (i.e., vigilance). A positive score on the incongruent index score indicates difficulties in disengaging attention away from threat, whereas a negative score indicates that the attention is directed away from threat toward the neutral picture (i.e., avoidance).

Table 2 Specific components of selective attention

	Negative index score RL (T, N) < (pN, N)	Positive index score RL (T, N) > (pN, N)
Congruent trial (pT,N)	Vigilance	Strategy not to engage attention toward threat
Incongruent trial (T, pN)	Avoidance	Difficulties in disengaging attention away from threat

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

Procedure

The pictorial dot-probe task was administered to children individually, in a quiet, dimly lit and empty room, at pre-treatment and post-treatment (i.e., after stepped-care CBT). The ADIS-C was administered to children and their parents at three time points, namely at pre-treatment, after phase one and post-treatment (i.e., after stepped-care CBT). The administration of the pictorial dot-probe task co-occurred with the administration of the ADIS-C after phase two of the stepped-care CBT. Postdoctoral psychologists and supervised master's-level students conducted the ADIS-C before treatment, after phase one CBT and at post-treatment (i.e., after stepped-care CBT). 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

Preliminary analyses. Normality of the distribution of selective attention scores to the mildly and severely threatening pictures at pre-treatment and post-treatment (i.e., after stepped-care CBT) assessment was tested with Kolmogorov–Smirnov tests. We tested whether pre-treatment demographic characteristics (i.e., gender, age, IQ, and socioeconomic status) and pre-treatment anxiety severity were related to either selective attention or treatment success by means of one-way analyses of variance (ANOVA), chi-square tests, or correlations. Significant pre-treatment demographic characteristics were included as covariates in the subsequent analyses. Additionally, pre-treatment

CSR on the ADIS-C was included as covariate in the subsequent analyses, to rule out the possibility that treatment response to CBT was related to the extent and severity of pre-treatment anxiety problems.

Primary analyses. Changes in selective attention in relation to treatment success were examined by means of a repeated measures MANOVA. Selective attention scores for mildly and severely threatening pictures at pre-treatment and post-treatment (i.e., after stepped-care CBT) assessment were included as within-subjects variables and treatment success (i.e., initial responders, secondary responders, and treatment non-responders) as between-subjects factor. Additionally, changes in the specific components of selective attention were examined for threat-related selective attention scores (i.e., mild and/or severe selective attention) that showed a significant interaction effect with treatment success. More specifically, pre-treatment versus post-treatment changes in the congruent index score as well as in the incongruent index score were compared between initial responders, secondary responders, and treatment non-responders by means of two separate repeated measures ANOVAs. All analyses were adjusted for pre-treatment CSR. A Bonferroni correction was employed for the three primary analyses. Results were considered significant if the obtained (two-tailed) *p*-value was lower than .016.

Secondary analyses. To gain more insight into significant associations between changes in selective attention and treatment success, we examined whether selective attention scores at pre-treatment and post-treatment (i.e., after stepped-care CBT) assessment differed significantly from zero by means of one-sample *t*-tests. Similar one-sample *t*-tests were performed for the congruent and incongruent index score at pre-treatment and post-treatment (i.e., after stepped-care CBT) assessment. These analyses for the incongruent and congruent index scores provide more insight into significant associations between changes in the specific components of selective attention and treatment success. All secondary analyses were conducted for initial treatment responders, secondary treatment responders and treatment non-responders, separately.

Results

Preliminary analyses

Trials with erroneous responses (2.6% pre-treatment; 3.3% post-treatment) and extreme RLs (RLs < 100 milliseconds and > 3000 milliseconds; .4% pre-treatment; 0% post-treatment) were discarded from further analyses. Treatment response was not related to the rate of trials with erroneous responses and extreme RLs, either at pre-treatment or at post-treatment (i.e., after stepped-care CBT) assessment. The selective attention scores for mildly and severely threatening pictures showed a normal distribution, both at pre-treatment and post-treatment (i.e., after stepped-care CBT) assessment. Gender appeared to be significantly related to treatment success but not to selective attention. Ninety-eight percent of the boys were anxiety disorder free after phases one and two CBT versus 73% of the girls. The percentage of girls was significantly higher in treatment non-responders as compared to treatment responders (see Table 1). Other pre-treatment demographic characteristics were not related to treatment success (see Table 1) or pre-treatment selective attention. The total number and the type of anxiety disorders were not related to treatment success or selective attention. Treatment success was related neither to pre-treatment co-morbid anxiety disorders nor to depressive symptoms.

Treatment response

Of the anxiety-disordered children, 39 (44%) were free of any anxiety disorder after phase one, and 37 (42%) after phase two of the stepped-care CBT program. Efficacy of phase one CBT did not significantly differ between ICBT (48%) and GCBT (41%; Liber et al., 2008a). Thirteen children (14%) were not successfully treated after having received phases one and two of the stepped-care CBT program.

Primary analyses

Changes in selective attention in different treatment response groups. No significant interaction effect was found between treatment success and the mild selective attention score ($F_{2,75} = 2.86$, $p = .06$). A significant interaction effect was found between changes in the severe selective attention score and treatment success ($F_{2,75} = 4.79$, $p = .01$), when adjusted for gender and pre-treatment anxiety disorder severity. The effect size of the interaction between changes in the severe selective attention score and treatment success was medium to large according to the Cohen's (1988) criteria; partial eta squared was .12.

The significant interaction effect indicated that the three treatment response groups differed in pre- to post-treatment (i.e., after stepped-care CBT) changes in selective attention to severely threatening pictures (see Table 3 and Figure 1). Subsequent analyses of changes in the specific components of selective attention were examined for selective attention only to severely, and not to mildly, threatening stimuli.

Changes in specific components of severe selective attention in relation to treatment success. Figure 2 displays the significant interaction effect between pre- and post-treatment (i.e., after stepped-care CBT) changes in the congruent index score and treatment success ($F_{2,75} = 4.61$, $p = .01$), when adjusted for gender and pre-treatment anxiety disorder severity. No significant interaction effect was found between pre-treatment and post-treatment (i.e., after stepped-care CBT) changes in the incongruent index score

Table 3 Severe and mild selective attention of different treatment response groups at pre-treatment and post-treatment (i.e., after stepped-care CBT) assessment.

	Pre-treatment		Post-treatment				
	M	(SD)	M	(SD)	*F*	*p*	Partial η^2
Initial treatment responders							
Severe selective attention	−41.89	(105.47)	20.27	(73.39)	4.34	.04	.119
Mild selective attention	−32.95	(75.96)	2.98	(117.38)	4.85	.04	.132
Secondary treatment responders							
Severe selective attention	66.25	(121.50)	16.26	(117.66)	5.29	.03	.154
Mild selective attention	−38.46	(95.81)	−8.16	(113.75)	1.88	.18	.060
Treatment non-responders							
Severe selective attention	43.38	(121.30)	32.51	(95.11)	.03	.86	.003
Mild selective attention	−3.96	(54.30)	−5.23	(59.16)	.02	.89	.003

and treatment success ($F_{2,74}$ = .97, p = .38), when adjusted for gender and pre-treatment anxiety disorder severity.

Secondary analyses

Severe selective attention at pre-treatment and post-treatment assessment. ANOVA for pre-treatment selective attention to severe threat showed a significant main effect of treatment success ($F_{2,80}$ = 8.15, p = .001). Subsequent comparisons using Helmert contrasts indicated that the pre-treatment severe selective attention score of initial treatment responders was significantly lower (p = .001) than those of secondary treatment responders and treatment non-responders. Secondary treatment responders did not differ from treatment non-responders regarding pre-treatment selective attention to severe threat. At post-treatment (i.e., after phase two of the stepped-care CBT), no significant differences ($F_{2,75}$ = .13, p = .88) were found between initial treatment responders, secondary treatment responders and treatment non-responders as regards severe selective attention. This suggests that both initial and secondary responders, and treatment non-responders, showed a similar manner of attentional processing of severely threatening pictures after the stepped-care CBT.

At pre-treatment assessment, the severe selective attention score for initial treatment responders was negative (M = −41.89, SD = 105.47) and differed significantly from zero (t(34) = −2.35, p = .03), indicating selective attention away from severe threat. At post-treatment (i.e., after phase two of the stepped-care CBT), the severe selective attention score (M = 18.26, SD = 73.44) of initial treatment responders did not significantly differ from zero (t(37) = 1.68, p = .1), indicating that they did not show selective attention after the stepped-care CBT. Secondary treatment responders showed a positive severe selective attention score (M = 66.25, SD = 121.50) at pre-treatment assessment that differed significantly from zero (t(34) = 3.23, p = .003), indicating selective attention toward severe threat. At post-treatment, the severe selective attention score (M = 14.21, SD = 114.92) of secondary

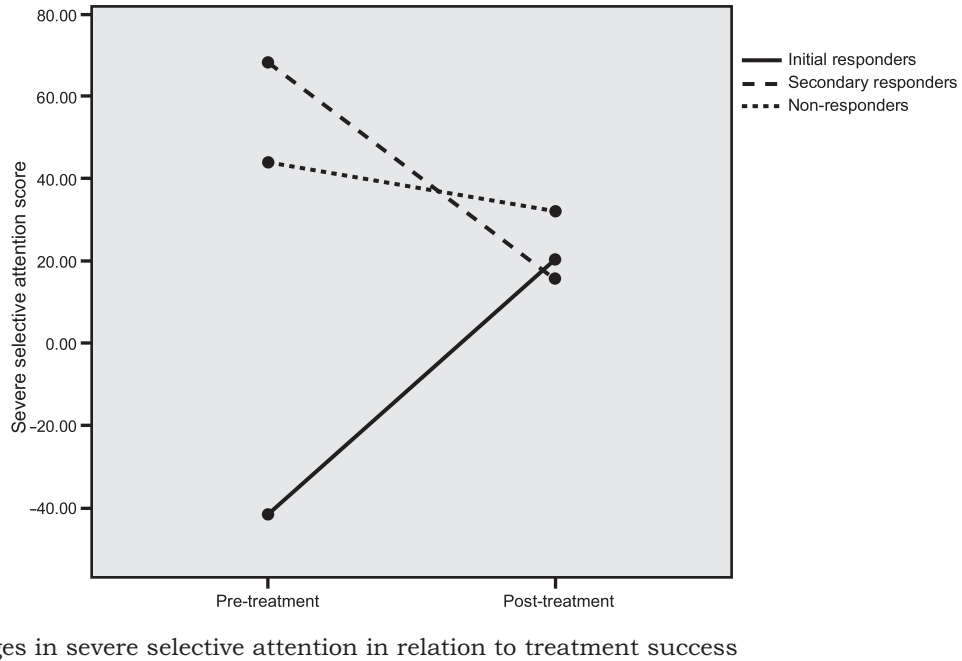

Figure 1 Changes in severe selective attention in relation to treatment success

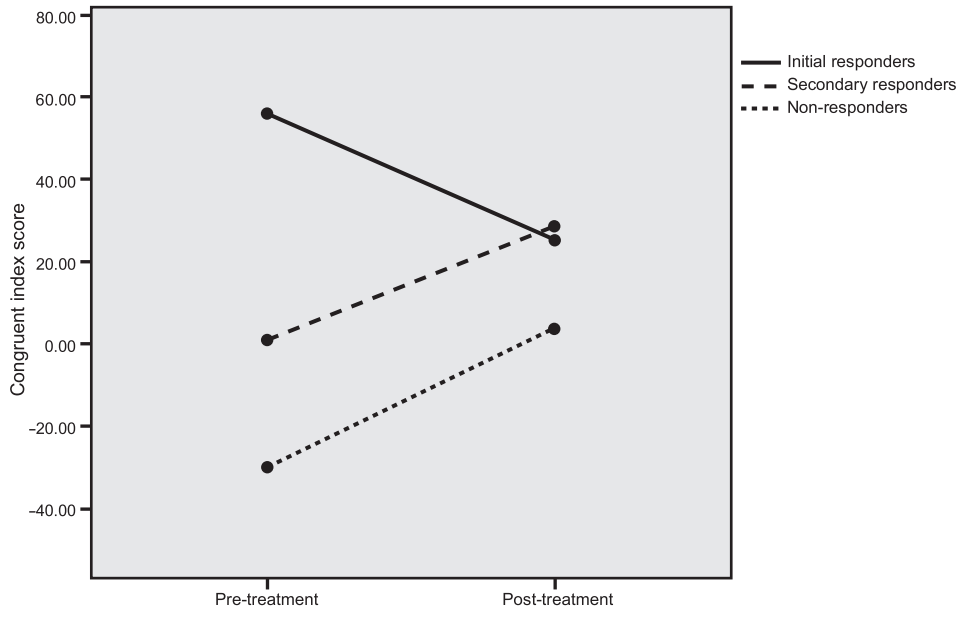

Figure 2 Changes in the congruent index score in relation to treatment success

treatment responders did not significantly differ from zero ($t(35) = .78$, $p = .44$), indicating that they did not show selective attention after the stepped-care CBT. For treatment non-responders the severe selective attention score both at pre-treatment ($M = 43.37$, SD = 121.30; $t(12) = 1.29$; $p = .22$) and post-treatment ($M = 32.51$, SD = 95.11; $t(11) = 1.18$; $p = .26$) did not significantly differ from zero. Treatment non-responders did not selectively attend to severely threatening pictures either before or after the stepped-care CBT.

Specific components of severe selective attention at pre-treatment and post-treatment assessment. For initial responders, the pre-treatment congruent index score was positive ($M = 56.58$, SD = 81.81) and differed significantly from zero ($t(33) = 4.03$, $p = .001$), indicating that initial responders showed a strategy of not engaging their attention toward severe threat at pre-treatment assessment. At post-treatment, the congruent index score did not significantly differ from zero ($t(36) = 1.72$, $p = .10$; $M = 26.08$, SD = 92.41), indicating that their tendency not to engage their attention toward severe threat was no longer present after the stepped-care CBT. The pre-treatment incongruent index score of initial responders did not significantly differ from zero ($t(33) = 1.99$, $p = .06$; $M = 25.47$, SD = 74.68), but at post-treatment assessment it was significantly larger than zero ($t(36) = 3.07$, $p = .04$; $M = 46.35$, SD = 91.73), indicating difficulties in disengaging attention away from severe threat at post-treatment, but not at pre-treatment assessment.

For secondary treatment responders, the pre-treatment congruent index score did not significantly differ from zero ($t(34) = .13$, $p = .90$; $M = 1.52$, SD = 70.74), but the incongruent index score was significantly larger than zero ($t(34) = 3.52$, $p = .001$; $M = 67.77$, SD = 114.03), indicating difficulties in disengaging attention away from severe threat at pre-treatment assessment. At post-treatment, the congruent index score ($t(31) = 2.68$, $p = .01$; $M = 28.95$, SD = 61.10) and the incongruent index score ($t(31) = 2.04$, $p = .05$; $M = 45.21$, SD = 125.58) were significantly larger than zero. Considering the *t*-values, secondary treatment responders particularly showed a strategy of not engaging attention toward severe threat after the stepped-care CBT. In summary, secondary responders had difficulties in disengaging their attention away from severe threat at pre-treatment, but after the stepped-care CBT they merely showed a strategy not to engage their attention toward severe threat.

For treatment non-responders, the congruent index score ($t(12) = -1.20$, $p = .27$; $M = -29.50$, SD = 92.12) and the incongruent index score ($t(12) = .54$, $p = .60$; $M = 13.88$, SD = 92.42) did not significantly differ from zero at pre-treatment, nor did the congruent ($t(11) = .23$, $p = .82$; $M = 3.43$, SD = 52.27) and incongruent index scores ($t(11) = 1.47$, $p = .17$; $M = 35.94$, SD = 84.68) significantly differ from zero at post-treatment. This indicates that treatment non-responders did not show selective attention either before or after the stepped-care CBT.

Discussion

The present study demonstrated that changes in selective attention to severe threat showed a significant association with treatment success, with a medium to large effect size (Cohen, 1988). Pre-treatment versus post-treatment changes in selective

attention to mild threat were not significantly related to treatment success. The present study adds to current knowledge that selective attention to severely threatening pictures is not only predictive of treatment success in anxiety-disordered children (Legerstee et al., 2009), but also shows differential changes over the course of CBT between different treatment response groups. The present study's results are in line with those of previous studies in clinically anxious adults (e.g., Lavy et al., 1993; Lundh & Öst, 2001; Mattia et al., 1993), indicating that selective attention diminishes over the course of CBT. The present study's results are, however, contradictory to those of Waters et al. (2008), who did not find any significant changes in threat-related selective attention over the course of CBT in anxiety-disordered children. The differential results between Waters et al.'s (2008) study and our study might be caused by differences in methodology. The picture presentation time, for instance, differed between both studies. Waters and colleagues seem to have assessed selective attention at a later stage of the attentional process as their picture presentation time (i.e., 1250 ms) was considerably larger than the picture presentation time in our study (i.e., 500 ms). The outcomes of their study and ours might therefore not be comparable, as previous studies (Mogg, Bradley, de Bono, & Painter, 1997; Koster et al., 2005) have shown that different picture presentation durations tap different stages in the temporal course of attentional processing. Another reason why the results differed is that Waters et al. (2008) were not able to differentiate between different treatment response groups. All children in their study were anxiety disorder free after CBT.

At pre-treatment assessment, initial treatment responders differed significantly from both secondary treatment responders and treatment non-responders regarding selective attention to severely threatening stimuli. After the stepped-care CBT, however, these three treatment response groups no longer differed as regards selective attention. Initial treatment responders showed a selective attention away from severe threat and a concomitant strategy not to engage attention toward severe threat at pre-treatment. Secondary treatment responders, on the other hand, showed a selective attention toward severe threat and concomitant difficulties in disengaging attention away from severe threat at pre-treatment. After the stepped-care CBT, however, initial treatment responders showed difficulties in disengaging attention away from severe threat, whereas secondary treatment responders showed a strategy of not engaging attention toward severe threat. Children that did not improve significantly over the course of phases one and two of the stepped-care CBT did not show changes in the allocation of attention to severe threat from pre-treatment to post-treatment. Both before and after the stepped-care CBT, treatment non-responders were not predisposed to selectively attend either toward or away from severe threat.

In a recent study (Legerstee et al., 2009), we demonstrated that child-focused CBT is particularly efficacious for children that show a strategy not to engage their attention toward severe threat. Child-focused CBT appeared to be significantly less efficacious for children with difficulties in disengaging their attention away from severe threat. Exposure, both in vitro and in vivo, was a key component of child-focused CBT. During the exposure interventions of child-focused CBT, children had to direct their attention toward threat. These exposure interventions might be particularly beneficial for children that show a strategy not to engage their attention toward severe threat. The redirection of their attention toward threat during child-focused CBT may have resulted in a decrement of their anxious feelings (habituation) in this specific group of anxiety-disordered children. Indeed, the present study's results showed that the children's strategy not to engage their attention toward severe threat had disappeared after the stepped-care CBT. These children even showed minor difficulties in disengaging their attention away from severe threat after the stepped-care CBT.

Child-focused CBT and its exposure interventions were, on the other hand, less beneficial for children that show difficulties in disengaging their attention away from severe threat. These children are already inclined to selectively attend toward severe threat and during child-focused CBT their tendency to 'focus on and stick to' frightening topics may not have been challenged. This study suggests that children with 'disengagement difficulties' need more CBT sessions to reduce their selective attention toward severe threat, or particularly benefit from child–parent-focused CBT. It might be important for children with 'disengagement difficulties' to specifically learn to redirect their attention away from threat and to focus more on neutral or pleasant aspects of a situation. These children might need extra help from their parents in redirecting their attention to positive stimuli. For children who do not show a predisposition to selectively attend toward or away from severe threat, both child and child–parent-focused CBT appeared not to be efficacious. Additionally, these children did not exhibit any changes in selective attention from pre- to post-treatment assessment.

One could argue that the fact that both initial and secondary treatment responders, and non-responders, did not differ in their attention to severely threatening stimuli after stepped-care CBT could be explained by regression to the mean in treatment responders. In contrast to this explanation, however, on the underlying components of selective attention in initial and secondary treatment responders opposite changes were found from pre-treatment to post-treatment and, more importantly, differ from each

other at post-treatment, which suggests that changes in selective attention are not (simply) attributable to regression to the mean. The fact that treatment responders and non-responders did not differ in selective attention after stepped-care CBT might be explained by the fact that attentional processing of severely threatening stimuli was distorted in treatment responders, but not in treatment non-responders, at pre-treatment. During treatment, treatment responders showed a reduction of their selective attention. Treatment non-responders did not show changes in selective attention, as they did not show any selective attention in the first place. Other factors might be related to the origin and maintenance of their anxiety disorders at pre-treatment.

The differential changes in selective attention between initial responders, secondary responders and treatment non-responders might be related to differences in individual brain functioning (Lau & Pine, 2008). It has been suggested that the amygdala facilitates the automatic pre-attentive processing of threat-related stimuli (Dolan & Vuilleumier, 2003), while the ventrolateral prefrontal cortex regulates amygdala activity by exerting control over the attentional processes (Bishop, 2008; Pine, 2007). Both the amygdala and the ventrolateral prefrontal cortex have been shown to function atypically in anxiety-disordered children (Bishop, 2008; Monk et al., 2008; Telzer et al., 2008). Although speculative at the present time, pre-treatment differences in selective attention and in changes in selective attention between the treatment response groups might be related to differences in these two specific subcortical regions. Current knowledge on the association between (changes in) selective attention and treatment success might be furthered when measures of underlying brain functioning, such as functional magnetic resonance imaging (fMRI) or electroencephalography (EEG), are incorporated.

Some limitations of the present study should be acknowledged. First, no statistical comparison could be made as to severe selective attention between treatment responders and non-anxious children. This makes it hard to conclude that initial and secondary treatment responders showed a normalization of threat-related selective attention and its specific components. Previous studies in non-anxious children, however, have demonstrated that non-anxious children do not show selective attention to threatening stimuli on a pictorial dot-probe task (Roy et al., 2008), which suggests a normalization of threat-related selective attention in treatment responders. A second limitation was that the stimulus exposure duration of 500 milliseconds in the pictorial dot-probe task probably tapped more voluntary and strategic attentional processes in response to stress as opposed to rapid and automatic attentional allocation processes (Koster, Verschuere, Crombez, & van Damme, 2005). The present study's results suggest that children who show selective attention for severely threatening stimuli at pre-treatment have gained more control over their attentional processes as they did not show any selectivity in their attentional processing after the stepped-care CBT. Based on the supraliminal picture presentation, it is unknown whether selective attention at a subliminal level has changed in treatment responders. A third limitation was that no conclusions could be drawn about the direction of causality based on the present findings. Changes in selective attention over the course of CBT might be a direct by-product of anxiety reductions during CBT (Mobini & Grant, 2007). On the other hand, changes in selective attention during CBT may facilitate reductions of anxious feelings in treatment responders. Studies on healthy adults (Mathews & MacLeod, 2002; MacLeod, Rutherford, Campbell, Ebsworthy, & Holker, 2002) have shown that induced alterations of selective attention can result in changes in anxiety problems, suggesting a causal effect of selective attention on anxiety. However, an association between selective attention training and anxiety changes has not been demonstrated in healthy children (Eldar, Ricon, & Bar-Haim, 2008). In anxiety-disordered adults, training programs to modify threat-related selective attention have been shown to reduce anxiety, as indicated by both self-report and interview measures (Amir, Beard, Burns, & Bomyea, 2009; Schmidt, Richey, Buckner, & Timpano, 2009). Overall, these studies tend to indicate that selective attention is a mechanism underlying anxiety. Future research will show whether changes in selective attention are unique to CBT or can also be achieved by other treatment modalities, such as pharmacotherapy. A fourth limitation was that threat-related selective attention and its components were not examined directly after phase one CBT.

Despite these limitations, this is the first study demonstrating differential changes in threat-related selective attention between different treatment response groups in a relatively large sample of anxiety-disordered children. These findings emphasize the importance of considering the pictorial dot-probe task as a potentially valuable tool in assigning children to appropriate treatment formats as well as in monitoring changes in selective attention over the course of CBT. We strongly encourage future studies to develop alternative treatment approaches for anxiety-disordered children that do not exhibit selectivity in the allocation of attention in response to severely threatening stimuli.

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Key points

- Childhood anxiety disorders have been associated with selective attentional processing of threatening stimuli.
- Studies on anxious adults, but not on anxious children, have shown that threat-related selective attention could be minimized or eliminated by cognitive-behavioural therapy (CBT).
- This is the first study on children with anxiety disorders demonstrating that treatment-success after a stepped-care CBT is related to changes in threat-related selective attention. Differential changes in selective attention for severely threatening stimuli were found between initial and secondary treatment-response groups. Treatment non-responders did not show any changes in selective attention.
- The dot-probe task can be considered a valuable tool when assigning children to appropriate treatment formats as well as for monitoring changes in selective attention during CBT.

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