The behavioral inhibition system in childhood and adolescent anxiety: an analysis from the information processing perspective

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STUDY 2: AUTOMATIC EVALUATIONS IN CLINICALLY ANXIOUS AND NON-ANXIOUS CHILDREN AND ADOLESCENTS

Abstract  Automatic threat-related information processes are involved in childhood anxiety (Bijttebier, Vasey, & Braet, 2003; Daleiden & Vasey, 1997). Automatic evaluations of clinically anxious and non-anxious children (n=40, aged 8-16, 18 girls) were compared using a pictorial Extrinsic Affective Simon Task (de Houwer, 2003a). Results showed a threat-related evaluation bias in clinically anxious, but not in non-anxious children. In anxious participants, automatic evaluations of anxiety-relevant stimuli were more negative than those of negative stimuli. In non-anxious participants, evaluations of negative and anxiety-relevant stimuli did not differ. Furthermore, anxious youth had stronger negative evaluations of anxiety-relevant stimuli than non-anxious children. Automatic evaluations of positive, neutral and negative stimuli did not differ between groups. Threat-related evaluations were predictive of parent-reported, but not child-reported anxiety. The present study shows an automatic threat-related evaluation bias in youth anxiety, thus increasing evidence for information processing theories of childhood anxiety.

The way a stimulus is evaluated, determines how it is processed and how it affects behavior (De Houwer, Thomas, & Baeyens, 2001; Zajonc, 1984). Initial evaluations play a major role in anxiety related information processing and therefore in the etiology and maintenance of internalizing psychopathology (e.g., Beck & Clark, 1997; Bjittebier et al., 2003; Daleiden & Vasey, 1997; Mogg & Bradley, 1998). Information processing models describe the stepwise processing and modification of information from stimulus to response (Massaro & Cowan, 1993). Most information processing models are dual process models, differentiating between strategic and automatic processing (e.g., Gawronski & Bodenhausen, 2006; Strack & Deutch, 2004). Strategic processes are assumed to be slow, controllable and available for conscious awareness. Automatic processes are fast, unintentional, uncontrollable and occurring outside of awareness. Most cognitive processes involve both automatic and strategic aspects (e.g., Moors & De Houwer, 2006). For instance, although a process can be initiated unintentionally, that does not imply that it cannot become available for conscious awareness. Due to their presumed unconscious and unintentional nature, automatic processes cannot be measured by direct or explicit self-report instruments. Instead, indirect or implicit performance based paradigms are used. Examples of indirect instruments are the Affective Priming Paradigm (e.g., Fazio, Jackson, Dunton, & Williams, 1995), the Implicit Association Task (IAT; Greenwald et al., 1998), or the Extrinsic Affective Simon Task (EAST, De Houwer, 2003a). Implicit instruments provide insight on the automatic, unintentional impact of cognitions on behavior, they are less vulnerable to deliberate response strategies and they are predictive for other types of behavior than direct self-report measures (e.g., De Houwer, 2003b, 2006). However, since automatic and strategic processes cannot be disentangled entirely, it is impossible to develop a measure that uniquely assesses automatic or strategic processes. Therefore, even in implicit measures that tap into automatic processes, there are influences of strategic processes (Conrey, Sherman, Gawronski, Hugenberg, & Groom, 2005).

Both automatic and strategic processes, or a combination of both, are involved in fear and anxiety disorders (e.g., Beck & Clark, 1997; Mogg & Bradley, 1998; Ouimet, Gawronski, & Dozois, 2009). The differentiation between the two modalities can be observed in the asynchrony between automatic (e.g., physiological) fear reactions and more strategic and controlled (e.g., self-reported or behavioral) fear responses. In Beck and Clark’s cognitive model of anxiety (1997) automatic and strategic processes are of different importance in the subsequent steps of information processing. The first step involves the recognition of valence and personal relevance of a stimulus. The automatic evaluation in this stage encompasses the fast, unintentional valence identification and
threat appraisal of a stimulus. Once a stimulus is recognized as threatening, a threat schema is activated in the second step of information processing. In this second stage, a mixture of automatic and strategic processing aims at minimizing danger and maximizing safety. In the third stage, more strategic processing takes place, judging the availability and effectiveness of one's coping capacities. The activation of the threat schema results in threat-related, cognitive biases. Crick and Dodge (1994) have proposed a model with six subsequent information-processing stages, from encoding (including evaluative and attentional aspects) and interpretation of information, via goal and response construction to response decision and behavioral enactment. Anxiety-related cognitive biases may occur in all stages and in both automatic and strategic modality. Most evidence for cognitive biases, however, exists in the first two stages, encoding and interpretation (Daleiden & Vasey, 1997; Muris & Field, 2008).

The majority of studies on automatic information processing in anxiety has focused on the attentional aspect of the encoding stage (Bar-Haim et al., 2007; Puliafico & Kendall, 2006) and suggest that both anxious children and adults tend to selectively attend to potentially threatening stimuli. Far less is known about the evaluative aspect of encoding in anxiety. Mogg and Bradley (1998) explicitly state that not only attentional processing, but also the initial processing of valence information is of crucial importance since it determines subsequent behavioral and cognitive responses. According to their cognitive-motivational view on anxiety, anxiety is associated with an increased threat appraisal. Anxious individuals assign a higher threat value to negative aversive (thus threat-related) stimuli than non-anxious individuals, and they have more negative evaluations of threat-stimuli. Empirical evidence for the evaluation bias in anxiety mainly stems from studies on dysfunctional explicit evaluations showing that high anxious individuals tend to interpret ambiguous stimuli as more negative and more threatening as opposed to non-threatening (e.g., Mogg, Baldwin, Brodrick, & Bradley, 2004; Taghavi, Moradi, Neshat-Doost, Yule, & Dalgleish, 2000). Less is known about automatic evaluation bias in anxiety. In adult anxiety research, disorder specific biased automatic evaluations have been found in social anxiety and in fear of spiders (for review see Huijding, 2006).

Research on automatic evaluations in childhood anxiety is scarce. So far, no studies have found evidence for an association between automatic evaluations and anxiety in children (Huijding et al., 2010). Using an IAT, Sportel and colleagues (2007, July) studied automatic and self-reported evaluations of the self in a large sample of adolescents at risk for social phobia (n=770, aged 12-15). Although self-reported self-esteem was related to self-reported social anxiety, indirectly measured self-evaluations
were not. In addition, directly and indirectly measured self-esteem were not associated. Vervoort, Prins, Wolters, Hogendoorn, and de Haan (2007, July) adapted the EAST for use in younger participants and studied automatic evaluations of various types of pictorial stimuli, including anxiety-relevant pictures, in a population sample of children \(n=28\), aged 6-12), adolescents \(n=31\), aged 13-18) and adults \(n=23\), aged 19-26). Automatic evaluations of anxiety-relevant stimuli were negative in all age groups, but not related to self-reported anxiety. Spence and colleagues (2006) studied automatic processing of pleasant and threat-related pictorial stimuli with an affective priming paradigm. They failed to find a difference between threat processing in clinically anxious and matched non-anxious children \(n=50\), aged 7-14). As this overview shows, only a few studies have investigated automatic evaluative processes related to childhood anxiety, and so far, all have failed to find evidence for associations between automatic evaluations and anxiety.

Several explanations can be brought forward. In general, correlations between implicit and explicit self-report measures are weak. In a meta-analysis of 126 studies in different content domains, Hofmann, Gawronski, Gschwendner, Le and Schmitt (2005) found a corrected correlation of \(r=0.24\) between the Implicit Association Test (IAT) and self-report measures of related concepts. Therefore, it is not surprising that in previous studies on automatic evaluations in anxiety only low correlations have been found between implicit instruments assessing an anxiety-related process and explicit self-report instruments assessing anxiety symptoms. The same validity issue emerges in studies using indirect measures to assess automatic anxiety-related attentional biases. Anxiety-related group differences in attentional bias are frequently found, but correlations with anxiety measures are seldom reported or have been contradictory (Bar-Haim et al., 2007; Puliafico & Kendall, 2006). Another factor contributing to the low correlations between anxiety and automatic evaluations relates to the reliability of the assessments. Even when used in adult samples, indirect instruments often suffer from low internal reliability (e.g., De Houwer & De Bruycker, 2007; Schmukle & Egloff, 2006). Little is known about reliability of implicit instruments in children (Vasey et al., 2003). Since the validity of an instrument is related to its reliability (e.g., Carmines & Zeller, 1979), poor internal reliability can be one reason why previous studies with children failed to find associations between automatic evaluations and anxiety. Another factor relates to the sensitivity of indirect instruments when used with children. It is possible that these instruments do not yield the same effects and effect sizes for children as they do for adults (Vasey et al., 2003). Perhaps, the effects found in previous studies with young participants are too small to be associated meaningfully
with anxiety. Related to this, with exception of the Spence et al. (2006) study, all studies used non-clinically anxious participants. It might be expected that in studies including participants with anxiety disorders, the association between anxiety and automatic evaluations would become apparent. In the Spence et al. (2006) study, however, no differences were found in the information processing of clinically anxious and non-anxious children. According to Huijding et al. (2010), this could be due to the fact that in the clinically anxious group children had different diagnoses (e.g., social phobia, separation anxiety, specific phobias) and no disorder specific stimuli were used. However, anxiety is related with a general threat-related cognitive vulnerability factor, suggesting that in addition to distorted processing of disorder specific material, there is also a bias in the processing of generally threatening stimuli. Although different anxiety disorders vary in their specific content, there is also a common general cognitive vulnerability (Beck & Clark, 1997; Mineka, Watson, & Clark, 1998; Mogg & Bradley, 1998). Consistent with this notion, attentional bias is not only found with specific fear related stimuli in children with spider fear (e.g., Kindt, van den Hout, de Jong, & Hoekzema, 2000) but also in samples with different anxiety diagnoses, using threatening stimuli with a broad variety in content (e.g., Waters et al., 2008). Therefore, we assume that disorder specific stimuli are not needed to tap automatic threat-related evaluation biases.

The present study examined automatic evaluations in clinically anxious and non-anxious children and adolescents using the Extrinsic Affective Simon Task (EAST, de Houwer, 2003a). The EAST is a performance-based measure of automatic affective associations or evaluations. Previous studies showed that, based on performance accuracy, a pictorial EAST is sensitive to valence differences of generally affective stimuli and differentiates between high and low spider fearful individuals regarding their evaluations of spider pictures (Huijding & de Jong, 2005a). Compared to other implicit measures, reliability of the pictorial EAST is acceptable, possibly because pictures are ecologically more valid and seem to have a more direct access to emotional information in memory, thereby increasing the chances of the stimulus valence to be activated and to influence performance (Huijding & de Jong, 2005a, b). In addition, studies with participants of different age groups indicate that the EAST can be used in children and adolescents as in adults (Huijding & De Jong, 2005b; Vervoort et al., 2007, July). Therefore, a pictorial EAST is a well-suited instrument for the assessment of the automatic evaluations of interest in the present study (see Method Section for a detailed description of the task). It was hypothesized that anxious participants would show a threat-related automatic evaluation bias, not present in non-anxious
participants. More precisely, threat-related automatic evaluations were expected to be more negative in clinically anxious compared to non-anxious children. Additionally, a difference between the automatic evaluations of negative and anxiety-relevant stimuli was expected in the anxious, but not in the non-anxious group. Furthermore, it was hypothesized that the evaluation bias would be limited to anxiety-relevant stimuli, and automatic evaluations of mere positive, neutral and negative stimuli would not differ between clinically anxious and non-anxious children.

We expected threat-related automatic evaluations to be predictive of anxiety. Associations between threat-related automatic evaluation bias and both self-reported and parent-reported anxiety were investigated. Parent-report was included because in childhood anxiety research, the use of multiple informants has been advocated (e.g., Kazdin & Weisz, 1998). This is based on the idea that each informant provides information about different aspects of anxiety. Furthermore, self-reported anxiety in children is often influenced by self-presentational strategies that could result in children underreporting their anxiety level [Klein & Pine, 2002]. Therefore, looking at information of different informants might yield a more complete picture of anxiety severity.

**Method**

**Participants**

Forty participants between 8 and 16 years of age ($M=12.75$, $SD=2.11$; 22 girls) took part in this study. First, 20 clinically anxious children (age: $M=12.70$, $SD=2.25$; 11 girls) were recruited who were referred to one of two outpatient child psychiatric units for anxiety problems in the Netherlands. All children in this group (ANX) were clinically diagnosed with at least one anxiety disorder, based on the Anxiety Disorders Interview Schedule for DSM-IV – Child and Parent Version (ADIS-IV-C/P, Silverman & Albano, 1996; Siebelink & Treffers, 2001), a semi-structured interview developed to assess major psychological disorders in children and adolescents, with a main focus on internalizing problems. Good to excellent test-retest reliability and inter-rater reliability are reported [e.g., Reuterskiöld, Öst, & Ollendick, 2008; Silverman, Saavedra, & Pina, 2001]. Children and parents were interviewed separately by experienced interviewers who followed a training provided by Dr. Siebelink’s team. Combining information of both interviews, a clinical diagnosis with clinician severity rating (CSR, range 1 - 8) was provided. Following ADIS guidelines, diagnoses and CSR was established using clinical judgment. In addition, to standardize CSR, a scoring algorithm was developed, taking into account the number of domains in which the problems interfere, the frequency of
the problems and the intensity of the complaints. Diagnoses were discussed during diagnostic team sessions. Interviews were videotaped. Inter-rater reliability was calculated from a random selection of 20% of the interviews and agreement for the primary diagnoses was satisfactory [Cohen's kappa=0.73] [Cohen, 1960].

Children were included in the ANX group when their CSR was 4 or more on at least one anxiety diagnosis [e.g. separation anxiety, social anxiety, specific phobias, generalized anxiety disorder]. There was considerable anxiety comorbidity: 11 children received 2 or more anxiety diagnoses.

Second, an age- and gender matched group (CON) of 20 children [age: $M=12.80$, $SD=2.02$; 11 girls] was formed by recruiting children and adolescents from primary and secondary schools in the Amsterdam area [the Netherlands]. Children were included in the CON group, if no [sub]-clinical internalizing problems were reported by the parents on the Child Behavior Checklist [CBCL; Achenbach & Rescorla, 2001] and children had no treatment history for internalizing or externalizing problems. Furthermore, children were only included in the CON-group if their decile score on the trait scale of the State Trait Anxiety Inventory [for children] [STAI, Spielberger et al., 1983; STAI-C, Spielberger, Edwards, Lushene, Montuori, & Platzerk, 1973] did not exceed 6, which is far below the cut-off score for clinical anxiety [Kain, Mayes, Cicchetti, Bagnall, Finley, & Hofstadter, 1997].

The study design was reviewed and accepted by the ethics committee of the University of Amsterdam and by the medical ethics committee of the participating clinics. Written informed consent was obtained from all the children and their parents.

**Measures and Materials**

**State Trait Anxiety Inventory (for Children) [STAI-(C)].** Participants, aged fifteen and older [n=11], filled out the Dutch translation of the State Trait Anxiety Inventory [STAI, Spielberger et al., 1983; van der Ploeg, 2000]. Younger participants [n=29] completed the child version of this questionnaire [STAIC, Spielberger, et al., 1973; Bakker, van Wieringen, van der Ploeg, & Spielberger, 1989]. Only the trait scale of the questionnaire was used, which consists of 20 items that have to be rated on a 4-point scale [1=almost never, 2=sometimes, 3=often, 4=almost always] in the STAI version and on a 3-point scale [1=almost never, 2=sometimes, 3=often] in the STAI-C version. Higher scores represent higher levels of anxiety. To control for age and gender differences, decile scores, based on normative scores, are reported. Both the STAI and the STAI-C, have been found to be meaningfully related with measures of anxiety, to have good internal consistency and acceptable test-retest reliability [e.g., Barnes, Harp,
& Jung, 2002; Muris, Merckelbach, Ollendick, King, & Bogie, 2002; Holmbeck et al., 2008). Internal consistency for the trait scores was good in the present study (α = .90 for the STAI; α = .84 for the STAI-C).

Child Behavior Checklist 6-18 (CBCL). Parents filled out the Dutch translation of the Child Behavior Checklist (CBCL; Achenbach & Rescorla, 2001; Verhulst & Van der Ende, 2001). The scale consists of 113 items, rated on a 3-point scale (0 = not true, 1 = somewhat true, 2 = very or often true) and assesses emotional and behavioral problems. Item scores are summed up to form eight narrow-band syndrome scales that are summed up to two broad-band scales (Internalizing Problems and Externalizing Problems). Only the Internalizing Scale was used in the analyses. Higher scores represent higher levels of internalizing problems. To control for age and gender differences, T-scores, based on normative scores, are reported. Convergent and construct validity, internal consistency and short and long-term test-retest reliability are reported to be good to excellent (Achenbach & Rescorla, 2001). Internal consistency of the scale in the present study was high (α = .93).

Extrinsic Affective Simon Task (EAST). The EAST is developed as an indirect instrument for the assessment of automatic evaluations (de Houwer, 2003a). Participants have to discriminate stimuli based on valence (positive or negative) or form (portrait or landscape) (Huijding & de Jong, 2005 a, b; Vervoort et al., 2007, July). Reliability or validity information on the pictorial EAST in youth samples is unavailable up to now, but studies with adults suggest that a pictorial EAST might be a reliable and valid measure of automatic evaluations (De Houwer & De Bruycker, 2007; Huijding & de Jong, 2005 a, b).

The task consists of three phases. In the attribute phase, each of 12 stimuli (6 positive and 6 negative, with a yellow border, see below) is presented three times. Stimuli in this phase (i.e. attribute stimuli) have to be sorted according to their valence. Participants have to press the L-key when the stimulus is positive and the A-key when the stimulus is negative. In this phase, both keys are assumed to become extrinsically valenced due to the consistent pairing of each key with either a positive or a negative stimulus. To remind participants which key to press and to strengthen the extrinsic valence of the keys, a happy smiley 😊 was placed on the L-key and a sad smiley 😞 on the A-key. In the target phase, 24 pictures (6 positive, 6 negative, 6 neutral and 6 anxiety-relevant, with a grey border, see below), are presented in either portrait or landscape format. Stimuli in this phase (i.e. target stimuli) have to be sorted according to their format. Participants have to press the 😊-key in response to a portrait picture and the 😞-key in response to a landscape picture. All 24 target pictures are presented.
once: half of the pictures are presented in portrait, half in landscape format. In the test phase, all attribute and target stimuli are presented intermixed in a fixed randomized order. When an attribute stimulus [with yellow border] is presented, participants have to respond according to valence [positive:JECTION-<key>, negative:RESSED-<key>]. When a target stimulus [with grey border] is presented, valence has to be ignored and a response to form has to be made [portrait: STIMULUS-<key>, landscape: STIMULUS-<key>]. In the test phase, there are four blocks. In each block, all attribute stimuli are presented 5 times and all target stimuli are presented once in portrait format and once in landscape format. Before each phase and before each block, instructions appear on the screen. Each phase and each block is followed by feedback ('Congratulations, you have completed this level!) and a self-paced pause. All trials have the same structure. A fixation cross (+) is presented for 750 ms, followed by the [attribute or target] stimulus that stays on the screen until a response is made. After the response, feedback (green thumbs up after correct response, red cross after incorrect response) is displayed under the stimulus for 500 ms. The next trial starts immediately after feedback. Participants are asked to respond as quick and as accurate as possible.

**EAST-stimuli.** Stimuli for the EAST were pictures, selected from the International Affective Picture Systems (IAPS) based on the ratings (ranging from 1 to 9) provided in the technical manual (Lang et al., 2005). The IAPS has been validated for use in Dutch adolescents (Kolman, 2009). The selected stimuli were all considered suitable for children according to experienced child therapists. Attribute stimuli were square pictures [375 x 375 pixels] with a yellow border [12 pixels] (Figure 5.1). There were 6 positive attribute stimuli and 6 negative attribute stimuli. Target pictures were rectangular and had a grey border [12 pixels]. They were presented in either landscape or portrait format [respectively 375 x 328 pixels and 328 x 375 pixels]. There were four types of target pictures: positive, negative, neutral and anxiety-relevant. All positive, negative and neutral stimuli were selected from the IAPS (Lang et al., 2005). Anxiety-relevant stimuli were related to the five factors of the 'Fear Survey Schedule for Children - Revised': Failure/Criticism, the Unknown, Minor Injury/Small Animals, Danger/Death, and Medical Fears (Ollendick, King, & Frary, 1989). All but one were selected from the IAPS-database. Because the IAPS contains no suitable picture covering Failure/Criticism, one was custom made [a woman showing disapproval, Figure 5.1c]. IAPS-numbers, mean valence and arousal ratings from the IAPS manual are shown in Table 5.1 (p.66).
**EAST-scores.** To calculate EAST-scores, responses on target trials in the combined test phase were used. Although stimulus valence is irrelevant for the target discrimination task (based on format), it is assumed that responding is facilitated on trials when stimulus valence is congruent with the correct response (e.g. on a portrait target with positive valence) compared to on incongruent trials (e.g. on a portrait target with negative valence). This facilitation effect allows for the evaluation of the target to be inferred. Error percentages\(^4\) of target trials on which the correct response was extrinsically positive (i.e. portrait trials, to which participants had to respond with the \(\ominus\)-key) were subtracted from trials on which the correct response was extrinsically negative (i.e. landscape trials, to which participants had to respond with the \(\ominus\)-key), separately for each target category. This way, positive EAST-scores indicate positive evaluations of the target category, while negative EAST-scores indicate negative evaluations. EAST-scores that do not differ from zero, indicate neutral evaluations.

**Apparatus.** The experiment was conducted on a laptop computer (Dell Inspiron I9300), running on Microsoft Windows XP, with a 17’ LCD display. The EAST is programmed using E-Prime v1.1 software (Psychology Software Tools, Inc., Pittsburgh, USA; www.pstnet.com/eprime). Responses are collected by pressing one of two keys (L and A) on the qwerty-keyboard of the computer.

**Results**

**Internalizing Problems and Anxiety**

Table 5.4 shows means and standard deviations on the anxiety measures. Independent sample t-tests indicate that parent reported anxiety was higher in the ANX group than in the CON group, mean difference=20.95, \(t(36)=6.36, p<.001\) (one-tailed).

\(^4\)Although consistent RT-based and EP-based EAST-effects have been reported in the original EAST-study (de Houwer, 2003), it is not unusual that EAST-effects are most prominent with EP-based scores (Huijing & de Jong, 2005a). Research in our own group showed that meaningful RT-based scores can be obtained with the pictorial EAST-version by focusing instruction on speed, and not, as in the original instructions and in the present study, on both speed and accuracy (Vervoort, 2009, March). For reasons of clarity and brevity, we choose not to report RT-based EAST-scores.
Self-reported trait anxiety did not differ between the two groups, mean difference = .70, \( t(36) = .79, p > .05 \) (one-tailed).

**Table 5.4** Mean (and SD) for parent reported CBCL Internalizing Problems (T-scores) and self-reported STA(-C) Trait Anxiety (decile) scores for Anxiety and Control groups

<table>
<thead>
<tr>
<th>Anxiety Measure</th>
<th>Anxiety Group (n=19)</th>
<th>Control Group (n=19)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CBCL Internalizing Problems</td>
<td>69.00( _a ) (9.87)</td>
<td>48.05( _b ) (10.42)</td>
</tr>
<tr>
<td>STA(-C) Trait Anxiety</td>
<td>6.50( _c ) (3.20)</td>
<td>5.80( _c ) (2.14)</td>
</tr>
</tbody>
</table>

**Note**: Means with different subscript differ significantly at \( p < .001 \) (one-tailed).

**EAST: Error Percentages and Reaction Times**

To explore possible group differences in overall performance, independent samples \( t \)-tests were performed on error percentages (EP) and reaction times (RT). Results showed that both groups performed equally accurate (EP for ANX: \( M = 10.08, SD = 7.02 \) vs. EP for CON: \( M = 11.09, SD = 7.77 \); \( t(38) = -0.43 \), and were equally fast (RT for ANX: \( M = 1132.82, SD = 281.51 \) vs. RT for CON: \( M = 1046.59, SD = 224.75 \), \( t(38) = 1.06 \), both \( p > .05 \), two-tailed).

Data from two participants (1 girl, aged 9 from the CON group and 1 boy, aged 10 from the ANX group) were excluded from further analyses, because of too many errors on target trials (EP ≥ 30%) [Huijding & de Jong, 2005b].

**EAST-scores**

Table 5.5 shows EAST-scores for each target category, separately for each group and for the total sample. To test whether EAST-scores differed from zero in the total sample, directional one sample \( t \)-tests were performed using Bonferroni-correction for multiple testing (\( \alpha \) was set at 0.0125). EAST-scores for negative (\( t(37) = -5.85 \)) and anxiety-relevant stimuli (\( t(37) = -6.127 \), both \( p < .001 \), one-tailed) were significantly smaller than zero. EAST-scores for positive (\( t(37) = -1.25 \)) and neutral stimuli (\( t(37) = 0.07 \), both \( p > .05 \), one-tailed) did not differ from zero.

To test whether there were group differences in the evaluations of the different stimulus categories, we performed a 2 (group: ANX vs. CON) x 4 (stimulus valence: positive, neutral, negative, anxiety-relevant) mixed design ANOVA with repeated measures on the last variable and EAST-score as dependent variable. Generalized eta squared (\( \eta^2_g \)) is reported as index of effect size of significant effects [Bakeman, 2005; Olejnik & Algina, 2003].
Table 5.5 Mean EAST-scores [and SD] as a function of group and target category

<table>
<thead>
<tr>
<th>Target Category</th>
<th>Total Sample (n=38)</th>
<th>Anxiety Group (n=19)</th>
<th>Control Group (n=19)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M (SD)</td>
<td>M (SD)</td>
<td>M (SD)</td>
</tr>
<tr>
<td>Positive</td>
<td>-2.52 (12.43)</td>
<td>0.00a (9.52)</td>
<td>-5.04a (14.61)</td>
</tr>
<tr>
<td>Neutral</td>
<td>0.11 (10.37)</td>
<td>-1.32a (12.27)</td>
<td>1.54a (8.12)</td>
</tr>
<tr>
<td>Negative</td>
<td>-9.65 (10.16)</td>
<td>-10.53a (9.95)</td>
<td>-8.77a (10.57)</td>
</tr>
<tr>
<td>Anxiety-relevant</td>
<td>-13.71 (13.80)</td>
<td>-17.98a (14.37)</td>
<td>-9.43a (12.09)</td>
</tr>
</tbody>
</table>

Note: Bold scores are different from zero at $p<.001$ [one-tailed]. Columns not sharing a subscript indicate group differences at $p<.05$, one-tailed. Rows not sharing a superscript indicate a within group difference between EAST-scores for negative and anxiety-relevant stimuli at $p<.05$ [one-tailed].

There was no significant main effect for group, $R(1,36)=0.56$, $p>.05$. The significant main effect for stimulus valence, $R(3,108)=17.59$, $p<.001$, $\eta_g^2=.28$, was qualified by a significant interaction with group, $R(3,108)=3.38$, $p<.05$, $\eta_g^2=.07$. This interaction effect was caused by the significant group difference on EAST-scores for anxiety-relevant stimuli [mean difference=-8.55, $R(1,36)=3.94$, $p<.05$, one-tailed, $\eta_g^2=.10$]. There were no group differences on EAST-scores for the other stimulus valence categories (all $p_s > .05$). Further, in the ANX-group, EAST-scores for anxiety-relevant stimuli were significantly more negative than those for negative stimuli [mean difference=-7.46, $p<.05$, one-tailed]. In the CON-group, this difference was absent [mean difference=-0.66, $p>.05$, one-tailed].

**Using EAST-scores to predict anxiety scores**

Simple linear regression analyses are used to test whether automatic evaluations are predictive of anxiety. EAST-score for anxiety-relevant stimuli was a significant predictor of parent-reported anxiety, $\beta =.36$, $R^2=.13$, $R(1,36)=5.08$, $p<.05$, but not self-reported anxiety, $R(1,35)=1.46$, $p>.05$.

**Internal Reliability of EAST-scores**

To assess the internal (split-half) reliability, EAST-scores for the different target categories were calculated, separately for each test half. Spearman-Brown corrected correlations between the first and the second test half were significant for all target categories (positive: $r_{sb}=.59$, neutral: $r_{sb}=.49$, negative: $r_{sb}=.52$, anxiety-relevant: $r_{sb}=.76$, all $p_s < .01$).

**Discussion**

In the present study, we tested the prediction of information processing models of
anxiety (e.g., Beck & Clark, 1997; Mogg & Bradley, 1998) that early automatic evaluations are biased in children and adolescents with clinical anxiety. Group differences in threat-related information processing were studied by comparing automatic evaluations of neutral and affective stimuli by clinically anxious and non-anxious children and adolescents using a pictorial version of the Extrinsic Affective Simon Task (EAST, de Houwer, 2003a; Vervoort, Hogendoorn, Wolters, Prins et al., submitted). In the present study, internal reliability of the EAST was acceptable. As hypothesized, clinically anxious children showed an automatic threat-related evaluation bias that was not present in non-anxious children. Compared to control children, anxious children evaluated anxiety-relevant stimuli more negatively than negative stimuli in general. Furthermore, evaluations of anxiety-relevant stimuli were more negative in anxious than in control children. Although self-reported trait anxiety was not predicted by automatic threat-related evaluations, parent-reported internalizing problems were. Taken together, the present study provides initial evidence for an automatic specific threat-related evaluation bias in children and adolescents associated with anxiety, which extends the evidence for cognitive biases as described by information processing theories of anxiety. Until recently, most studies have focused on biased attentional processes associated with anxiety (for reviews, see Daleiden & Vasey, 1997; Muris & Field, 2008), leaving the evaluation component of encoding largely unstudied. In adult anxiety research, there is evidence for an automatic threat-related evaluation bias in social phobia and spider fear (for review, see Huijding, 2006). However, studies that have addressed automatic evaluations in children, did not find anxiety-related differences in automatic evaluations (for review, see Huijding et al., 2010). The present findings provide preliminary support for the notion that the early stages of threat-related information processing are biased in clinically anxious, but not in non-anxious children and adolescents. Results should be interpreted with caution, however, since the effects found were small and replication with larger samples is needed.

The anxiety-relevant stimuli were of a general nature and not associated with a specific anxiety disorder. Participants in the anxiety group received different anxiety diagnoses. Our results suggest that there would be no need to use disorder specific stimuli to tap an automatic evaluation bias in anxious youth. This is in line with models of anxiety stating that anxiety is related with a general cognitive vulnerability factor biasing several steps of information processing, including initial evaluations (Beck & Clark, 1997; Mineka et al., 1998; Mogg & Bradley, 1998).

Automatic evaluation of anxiety-relevant stimuli predicted parent-reported anxiety. The more anxious the parents reported their child to be, the more negative their child
evaluated anxiety-relevant stimuli. Automatic evaluations, however, did not predict self-reported anxiety. The low self-reported anxiety scores in the anxiety group could explain the lack of association between self-reported trait anxiety and automatic evaluations. The anxious participants in the present study may have underreported their anxiety. This is supported by the observation that although the participants were clinically diagnosed with an anxiety disorder, their mean decile score lay well below the clinical cut-off score for clinical anxiety on the STAI(-C) (Kain, et al. 1997). Furthermore, although the STAI(-C) has been found to be an adequate instrument to discriminate between youth with and without anxiety disorders (Seligman, Ollendick, Langley, & Baldacci, 2004), trait scores in the present study did not differ between groups. Although the low anxiety scores in our clinical anxious sample are unexpected, underreporting anxiety has frequently been observed in childhood anxiety literature (Klein & Pine, 2002). Clinically anxious children may underreport anxiety for various reasons. First, self-report is often influenced by self-presentational strategies, including social desirability and need for reassurance. Children may be reluctant to show their vulnerability or may be afraid to look stupid (Di Bartolo, Albano, Barlow, & Heimberg, 1998). Anxious children typically have a preference for a favorable self-presentation, which could lead to inaccurate reports of their own feelings and behavior (Kendall & Flannery-Schroeder, 1998). Second, anxious children may underreport anxiety symptoms because they avoid threatening situations themselves, or their parents protect them from negative experiences. Thus, the child may not fully or often experience the negative consequences of his or her anxiety. Therefore, when asked to report their usual anxiety level, chances are high that anxious children will report low levels of anxiety. Although underreporting seems a probable explanation for the low self-reported anxiety scores in the anxious group, it remains a tentative one.

Recently, questions have been raised about the EAST as a reliable and valid instrument for assessing individual differences. Although the EAST has been reported to be a useful instrument for assessing group differences with adult participants, its reliability and validity are often found to be insufficient for assessing individual differences (e.g., De Houwer, 2003a; De Houwer & De Bruycker, 2007; Schmukle & Egloff, 2006). Internal reliability of the EAST-scores in the present study ranged between .49 (for neutral stimuli) and .76 (for anxiety-relevant stimuli). These coefficients are consistent with the values reported by De Houwer and De Bruycker (2007) to be acceptable. Moreover, the values in the present study are higher than those in studies with adults using other indirect paradigms, such as affective priming (Banse, 2001). The increased reliability of the present version of the EAST could be due to the use of
pictorial instead of verbal stimuli (De Houwer & De Bruycker, 2007; Huijding & de Jong, 2005a). In addition to this improved reliability, the group difference in automatic evaluation of anxiety-relevant stimuli and the significant association between parent-reported internalizing problems and threat-related automatic evaluations suggest that this version of the pictorial EAST is a promising instrument for assessing individual differences in anxiety-related evaluations.

Some limitations should be taken into account. First, the participants were of a broad age range (between 8 and 16). Considering that major developmental changes occur in this period, it is important to consider automatic evaluations in different age groups in future studies using larger samples. Related to this, the stimuli used in the present study may not have been appropriate for the whole age range (8-16). Stimulus selection for the anxiety-relevant stimuli was based on the 'Fear Survey Schedule for Children - Revised', which is developed for use with 6 to 12 year olds. Future studies should use age-appropriate stimuli for each age level thereby increasing the possibility for larger EAST-effects. Second, practical constraints prevented us from conducting ADIS-C/P interviews in the CON-group. However, we asked parents to report if their children had any psychological problems or received any form of psychological treatment. We included children in the CON-group only if parents answered 'no' to both these questions, and if they reported no (sub-)clinical internalizing problems on the CBCL. Therefore, we can be fairly confident, that participants in the CON-group were free of major emotional problems. Third, positive stimuli failed to produce EAST-effects. Following theories emphasizing the importance of arousal in the relation between valence and information processing (e.g., Lang, 1995), stimulus valence may determine the direction of the EAST-effect, while arousal levels determine the magnitude of the effect. Evidence for the interaction of arousal and valence in the evaluation of stimuli has been found in previous studies (e.g., Robinson, Storkbeck, Meier, & Kirkeby, 2004; Eder & Rothermund, 2009). The arousal component of the negative and anxiety-relevant stimuli in the present study was strong, resulting in EAST-scores differing significantly from zero, while the arousal component of the positive stimuli was weak, resulting in a lack of EAST-effect on this category. The idea that positive stimuli yield only small effects is consistent with the finding that in a study with large sample of school children [thus with more power] EAST-scores for positive stimuli did differ significantly from zero (Vervoort, 2009, March).

To summarize, in the present study we have found differential automatic evaluations between clinically anxious and non-anxious youth, more specifically for anxiety-related stimuli. Clinically anxious youngsters evaluated anxiety-relevant stimuli as more negative
compared to their non-anxious peers. Moreover, in the clinically anxious group, evaluations of anxiety-relevant stimuli were more negative than evaluations of mere negative stimuli. Automatic evaluations of anxiety-relevant stimuli were associated with parent reported anxiety in the clinically anxious but not in the non-anxious group. These results add to the evidence for biased information processing in child and adolescent anxiety, suggesting an automatic threat-related evaluation bias, associated with anxiety. Knowledge of automatic processing in anxiety can increase our theoretical understanding of psychopathology by providing information on possible causal or maintaining factors of anxiety. Knowledge of automatic biases in children provides additional information of etiological factors for psychopathology. Apart from these theoretical aspects, knowledge on information processing also has potential implication for the identification of vulnerability and resilience factors, and for the prediction of treatment outcome and relapse. At present, however, the clinical use of paradigms to assess automatic biases is still limited and awaits further research.