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Emotional reactivity and cognitive regulation in anxious children

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ABSTRACT

Recent models of anxiety disorders emphasize abnormalities in emotional reactivity and regulation. However, the empirical basis for this view is limited, particularly in children and adolescents. The present study examined whether anxious children suffer both negative emotional hyper-reactivity and deficits in cognitive emotion regulation. Participants were 49 children aged 10–17 with generalized anxiety disorder, social anxiety, or separation anxiety disorder as their primary diagnosis, as well as 42 age- and gender-matched non-anxious controls. After completing a diagnostic interview and self-report questionnaires, participants were presented with pictures of threatening scenes with the instructions either to simply view them or to use reappraisal, a cognitive emotion regulation strategy, to decrease their negative emotional response. Emotion ratings, content analysis of reappraisal responses, and reports of everyday use of reappraisal were used to assess negative emotional reactivity, reappraisal ability, efficacy and frequency. Relative to controls, children with anxiety disorders (1) experienced greater negative emotional responses to the images, (2) were less successful at applying reappraisals, but (3) showed intact ability to reduce their negative emotions following reappraisal. They also (4) reported less frequent use of reappraisal in everyday life. Implications for the assessment and treatment of childhood anxiety disorders are discussed.

Anxiety disorders are among the most common forms of psychopathology in children and adolescents (Costello, Egger, & Angold, 2005). Anxious children and adolescents characteristically display excessive levels of fear, worry, physical complaints, and avoidant behaviors, and these symptoms usually persist unless treated. In the short term, anxiety disorders are associated with impairment in psychosocial functioning and academic performance (Last, Hansen, & Franco, 1997). Over time, anxiety disorders are linked to lower self-esteem, decreased well-being, and increased risk for physical illnesses, substance abuse, and other types of psychopathology, especially clinical depression (Woodward & Fergusson, 2001).

Anxious children and adolescents often report experiencing intense, unpleasant negative emotions and say that they find it difficult to calm themselves down once they are upset. These clinical observations, along with substantial progress in emotion research (Gross & Thompson, 2007), and the growing understanding of the role of emotion regulation in healthy development (Zeman, Cassano, Perrt-Parrish, & Stegall, 2006), have encouraged the development of models that suggest anxious individuals suffer both greater negative emotional reactivity and deficits in emotion regulation (Hannesdottir & Ollendick, 2007; Mennin, Holaway, Fresco, Moore, & Heimberg, 2007; Suveg & Zeman, 2004; Thompson, 2001). While recent research on adult anxiety has begun to examine these claims empirically, the nature of emotional abnormalities in childhood anxiety is less well understood.

Emotional reactivity in anxiety disorders

There is a striking variability across individuals in the quality and intensity of emotional reactions to similar stimuli, as manifested in experiential, behavioral, and physiological response systems. *Emotional reactivity* refers to the characteristics of the emotional response, including the threshold of stimuli needed to generate emotional response and the intensity of emotional response once emotion is generated (Davidson, 1998).

Anxious individuals seem to show emotional hyper-reactivity, manifested as relatively *intense and frequent negative emotional responses to perceived threat*. This hyper-reactivity is thought to emerge from biased processing of threat-related information (Beck, Emery, & Greenberg, 1985; Wilson, MacLeod, Mathews, & Rutherford,

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2006) that characterizes anxious children, adolescents, and adults (e.g., Bogels & Zigterman, 2000; Chorpita, Albano, & Barlow, 1996; Richards & French, 1992). Consequently, since anxious individuals appraise potentially threatening stimuli as dangerous, they experience frequent and intense negative emotions.

Evidence of emotional hyper-reactivity in anxious adults has taken the form of a) greater self-reported emotional responding in retrospective descriptions (Salters-Pedneault, Roemer, Tull, Rucker, & Mennin, 2006; Turk, Heimberg, Luterek, Mennin, & Fresco, 2005) and in real-time emotional activation (Goldin, Manber, Hakimi, Canli, & Gross, 2009; Mauss, Wilhelm, & Gross, 2004; Mennin, Heimberg, Turk, & Fresco, 2005), and b) heightened physiological responses to threatening stimuli. Specifically, in several studies, anxious individuals reacted with increased heart rate to threatening stimuli or situations compared with non-anxious controls (e.g., Beidel, Turner, & Dancu, 1985). Additionally, in multiple studies that have compared socially anxious with non-anxious controls, socially anxious participants showed hyper-activation in the amygdala, a brain area believed to be involved in threat detection (Liddell et al., 2005), in response to harsh faces (Goldin et al., 2009; Phan, Fitzgerald, Nathan, & Tancer, 2006; Stein, Goldin, Sareen, Zorrilla, & Brown, 2002; Stein, Simmons, Feinstein, & Paulus, 2007).

Fewer studies have examined emotional reactivity in anxious children and adolescents. However, those studies that do exist are consistent with the adult literature: amygdala hyper-activation has been observed in anxious adolescents in response to fearful faces (Killgore & Yurgelun-Todd, 2005; Thomas et al., 2001), increased heart rate was found in anxious children in response to a socially threatening situation (Beidel, 1991) and to a scary video clip (Weems, Zakem, Costa, Cannon, & Watts, 2005). In addition, anxious children report greater negative emotional intensity than non-anxious controls to vignettes that elicited worry and anger (Suveg & Zeman, 2004) and to ambiguous situations with potentially threatening meanings (Carthy, Horesh, Apter, & Gross, in press).

Emotion regulation in anxiety disorders

These accumulating findings of negative emotional hyper-reactivity in anxious individuals suggest down-regulating (decreasing) their negative emotion is a relatively more frequent and demanding challenge than for non-anxious people. Emotion regulation refers to the processes that influence the intensity, duration, and expression of emotions (Gross & Thompson, 2007), and effective emotion regulation can reduce the intensity of negative emotional responses in anxiety-provoking situations.

Indeed, emotion dysregulation is thought to be a core feature of anxiety disorders (e.g., Mennin et al., 2007). Evidence of emotion dysregulation in anxiety disorders comes from studies of generalized anxiety disorder and social anxiety disorder in both analog and clinical samples. These studies have found that anxious individuals *report* difficulty applying emotion management strategies when experiencing negative emotions and that they are less efficient in repairing negative mood states (e.g., Mennin et al., 2005; Salters-Pedneault et al., 2006; Turk et al., 2005). However, these studies primarily used measures assessing anxious individuals' general beliefs about their regulation ability (e.g., "When I'm upset, I believe that there is nothing I can do to make myself feel better"). While these beliefs are relevant to habitual emotion regulation practices (John & Gross, 2007), they do not give information about specific regulation deficits in real-time emotional activation.

Less is known about emotion regulation in anxious children and adolescents. Several studies have examined attention-control (i.e., the ability to pay attention to a task over an extended time and the ability to voluntarily move attention from one stimulus to another). According to self-reports, anxious children appear to be less skilled in flexible control of attention, a crucial element in the ability to regulate emotions (Lonigan, Vasey, Phillips, & Hazen, 2004; Muris, Meesters, & Rompelberg, 2007). In addition, they report more dysregulated expression of worry, sadness, and anger compared with non-anxious children (Suveg & Zeman, 2004). Similar to anxious adults, anxious children report being significantly less efficacious in regulating negative emotions than non-anxious children (Suveg & Zeman, 2004). However, because previous studies used general self-report measures that do not distinguish actual and perceived regulatory abilities, and do not distinguish among emotion regulation strategies (e.g., "I try to calmly deal with what is making me feel sad"), it is not clear whether these findings represent actual impairment of emotion regulation abilities or simply perceived impairment (Suveg & Zeman, 2004). One way to clarify this is to focus on specific emotion regulation strategies and examine them in real-time, when negative emotions are activated.

Among the wide range of emotion regulation strategies, reappraisal seems to be of particular relevance for children with anxiety disorders. Reappraisal is a cognitive regulation strategy that involves construing an emotion-eliciting situation or stimulus in a way that changes its emotional impact (e.g., looking at the positive outcome of a scary experience). According to the process model of emotion regulation (Gross, 2001), emotion may be regulated at different points of time in the emotion generative process. Reappraisal may take place at the situation as its meaning is formed (e.g., upon seeing her boss with an angry face, a reappraiser might conjecture that he simply had a bad day instead of the immediately interpreting his expression as a sign that he is angry with the reappraiser), or sometime after the threatening situation/stimulus has been encountered for the first time (e.g., recasting a dreaded medical examination as a brief and salutary intervention).

Reappraisal is considered an efficient emotion regulation strategy, as previous studies have shown it decreases negative emotion experience and expression in the moment (e.g., Goldin et al., 2009). Reappraisal is also considered an adaptive emotion regulation strategy, as it is associated with greater experience and expression of positive emotion and with higher levels of well-being (Gross, 2002; John & Gross, 2007). As anxious individuals display biases towards threatening interpretations, a tendency believed to lead to negative emotional hyper-reactivity (Wilson et al., 2006), reappraisal is expected to be a relatively difficult but especially important emotion regulation strategy for anxious individuals.

Indeed, the most common treatment for anxiety disorders, cognitive-behavior therapy (CBT), involves an extensive work on facilitating cognitive change in different level of cognitions including automatic negative thoughts as well as more complex distorted perceptions (e.g., self-perception). The implied assumption is that anxious individuals lack a sufficient ability to change their biased/distorted appraisals or apply cognitive change in real-time emotional situations. However, this assumption has not been tested empirically, as previous studies on anxious individuals have not addressed the question whether anxious children suffer (a) a real deficit in the ability to down-regulate negative emotions via reappraisal, (b) heightened negative emotional reactivity which challenges intact reappraisal abilities, or (c) both reactivity and cognitive regulation abnormalities.

The present study

The primary goal of the present study was to examine abnormalities in emotional reactivity and in cognitive emotion

regulation in children and adolescents[1] with anxiety disorders. To address these goals, we developed a computerized age-appropriate task that presents emotion-inducing images and enables examination of individual differences in negative emotional reactivity and in cognitive regulation via reappraisal. Specifically, the task started with a presentation of images with threatening scenes (one image at a time) instructing the participants to simply view them and report their immediate thoughts, than rate the intensity of their negative emotional response to each image. Next, the concept of reappraisal was introduced and practiced, followed by a new set of images presented with the instruction to reappraise them aloud so they will become less threatening and than rate the intensity of their negative emotion. In addition, a self-report questionnaire was used to assess the participants' frequency of everyday use of reappraisal.

We expected that relative to non-anxious controls (NAC), children with anxiety disorders (AD) would manifest (1) greater intensity of negative emotional response to the images (2) lesser cognitive regulation ability (i.e., lower proportion of successfully reappraised images) and efficacy (lower decrease in negative emotion upon using reappraisal), and (3) less frequent use of reappraisal in everyday life.

Methods

Participants

Ninety-one Israeli children aged 10–17 participated in this study (44 girls and 47 boys). General inclusion criteria were fluency in Hebrew and normal intelligence. General exclusion criteria were reading disability, psychotic symptoms, current anti-anxiety psychological or pharmacological treatment, and a major life stressor within the past six months. All participants and their parents provided informed consent. The study was approved by the Helsinki committee of the Schneider's Children Medical Center of Israel.

Of these 91 participants, 49 (21 girls and 28 boys) were recruited from an anxiety disorder clinic at Schneider's Children Medical Center, a university-affiliated children's hospital in Israel. All had a primary diagnosis of either generalized anxiety disorder ($n = 21$), social anxiety disorder ($n = 16$), or separation anxiety disorder ($n = 12$). Thirty seven of the anxiety disorders group (AD) had another anxiety disorder (e.g., specific phobias), and 21 had more than one of the three main diagnoses. Eight had an additional diagnosis of major depression disorder, four had attention-deficit disorder, and one had attention-deficit hyperactivity disorder. These three conditions were selected for study because they (1) share the same underlying construct of anxiety; (2) constitute a distinct group from other anxiety disorders such as obsessive-compulsive disorder (OCD) and posttraumatic stress disorder (PTSD); and (3) exhibit strong co-occurrence with each other (Velting, Setzer, & Albano, 2004).

An additional 42 age- and gender-matched non-anxious controls (NAC) were recruited (23 girls and 19 boys) via advertisements posted in numerous locations (e.g., schools internet bulletin boards, university boards). NAC participants had no current or past anxiety disorder according to a diagnostic interview (ADIS-C: Silverman & Albano, 1996). One child in the NAC group had attention-deficit hyperactivity disorder.

Assessing clinical symptoms

The Anxiety Disorders Interview Schedule for Children (ADIS-C; Silverman & Albano, 1996) was administered by two psychologists specifically trained in its administration. During the training phase, 20 children from the anxiety disorders clinic were interviewed with both interviewers present. Each interviewer made independent diagnoses and subsequently consulted with a senior clinical psychologist. Before consulting with the senior psychologist, the agreement rate for the primary diagnosis was 85%. In each case of disagreement, consensus was reached after consultation. Following the training interviews, each interviewer administered the ADIS-C individually with a senior clinical psychologist serving as a consultant. The ADIS-C is a widely used clinical interview based on the DSM-IV and assesses anxiety disorders as well as differential diagnoses for common childhood difficulties. The ADIS-C has acceptable reliability and validity (Silverman, Saavedra, & Pina, 2001).

The Screen for Anxiety and Related Emotional Disorders (SCARED-C; Birmaher et al., 1997) was used to assess severity of anxiety symptoms. The 41-item self-report measure for children and adolescents has been extensively used in studies of anxiety with demonstrated high reliability and validity in both clinical and non-clinical populations (Birmaher et al., 1997). Participants completed the child form, and parents completed the parent form (SCARED-P). Internal consistency of the SCARED-C and the SCARED-P in the current study was evaluated. Cronbach's α was .92 for the SCARED-C and .80 for the SCARED-P.[2]

To assess depressive symptoms over the past two weeks, participants younger than 13 completed the Children's Depression Inventory (CDI; Kovacs, 1992), which includes 27 items. The CDI has good internal consistency and test–retest reliability (Smucker, Craighead, Craighead Wilcoxon, & Green, 1986). Participants who were 13 or older completed the Beck Depression Inventory (BDI-II; Beck, Steer, & Brown, 1996), which includes 21 items and has good internal consistency (Osman, Kopper, Guttierez, Barrios, & Bagge, 2004). Internal consistency of the BDI-II in the current study was .89.

Illness severity was assessed by the Clinical Global Impression (CGI-I; Guy, 1976) a widely used scale comprised of seven descriptions starting from 1('not ill at all') to 7 ('very much ill compared with other patients').

Assessing cognitive and reading abilities

The vocabulary section of the Wechsler Intelligence Scale for Children–IV (Wechsler, 2003) was administered to ensure normal intelligence. A popular measure of reading speed and accuracy that includes age norms (Shani, Lachman, Shalem, Bahat, & Zeiger, 2006) was administered to ensure normative reading abilities in Hebrew.

Assessing baseline negative affect

To assess baseline negative affect, we administered the state form of the State-Trait Anxiety Inventory for Children (STAI-C; Spielberger, 1973). The state anxiety scale includes 20 items that assess the intensity of a child's feelings of tension, nervousness, and worry at a given time. Each state anxiety item begins with the stem "I feel," followed by three alternative endings containing a key descriptive term, e.g., "worried." The child responds by checking

[1] Our study includes pre-adolescents and adolescents. However, to simplify our presentation, we use the term 'children' throughout based on a definition of childhood as including ages 0–18 years.

[2] For several self-report questionnaires including the SCARED-C, SCARED-P, BDI-II, CDI and ERQ, item-level data was not available for the full sample. Hence internal consistency was evaluated for available data of 20 participants.

the alternative that best describes how he/she feels "right now, at this very moment," for example (Item 9): "I feel-very worried/worried/not worried." The scale has acceptable internal consistency (Papay & Spielberger, 1986). Internal consistency of the STAI-C in the current sample was .75.

Assessing emotional reactivity and regulation

To assess negative emotional reactivity and cognitive regulation, we developed the Reactivity and Regulation-Images (REAR-I) Task. This task consists of two conditions: 'view' and 'reappraise'. As shown in Fig. 1, each 20 s trial included the following components: instruction ('view' or 'reappraise', 2 s), image presentation (8 s), emotion rating (8 s), and relaxation (tropical beach with the word 'relax' printed at the top, 2 s). Twenty-eight negative pictures were assigned to the 'view' and 'reappraise' conditions (14 different pictures in each condition). For each participant, the pictures were presented in a randomized order, with the first fourteen pictures comprising the 'view' condition. Stimuli were presented using E-prime software running on a Windows XP laptop with a 15″ screen.

Before starting, participants had three practice 'view' trials in which they viewed one image at a time (the images presented in the practice phases were not presented in later phases), imagined themselves in the scene presented, and verbalized their immediate appraisals upon seeing the image. They also practiced using the emotion rating scale to rate the extent of their negative emotions. The scale included the question: "How negative do you feel now?" with a 1–8 visual scale (in which 1 = not at all, 4–5 = moderately and 8 = extremely). The practice phase was followed by 14 'view' trials.

After a resting phase, the concept of reappraisal was introduced. First, the notion that sometimes people try to change their emotional experiences (e.g., when sad or afraid), was introduced. Next, the method of decreasing one's negative emotion by changing the way one thinks of a situation (reappraisal) was described. Specifically, participants were encouraged to consider possible positive outcomes (e.g., a happy ending to a scary scene), alternative meanings that are less negative, or the possibility that the images do not reflect real events (e.g., part of a movie). Participants then went through four 'reappraise' practice trials in which they practiced re-interpreting the content of the picture in response to the instruction to rethink the image so it will become less threatening. The experimenters asked for a quick, subjective and honest response and participants were instructed to recite their reappraisal aloud. The practice phase was followed by 14 'reappraise' trials.

The images for the task were selected from the International Affective Picture System (IAPS; Lang, Bradley, & Cuthbert, 1999). All pictures were in color with high figure-ground contrast to facilitate discrimination of relevant features. Except for two neutral images (one for the relaxation instruction and one for the 'view' practice phase), all images presented some kind of threatening content (e.g., violence, dangerous animals, angry faces, accidents). Six parents of children in the sample's age group independently reviewed the images for age appropriateness.

Data reduction

We obtained one index of negative emotional reactivity and three indices of cognitive regulation (reappraisal ability, reappraisal efficacy, and reappraisal frequency).

Negative emotional reactivity

To derive an index of *negative emotional reactivity*, we used the mean rating for all images in the 'view' condition.

Reappraisal ability

To derive an index of reappraisal ability, the verbal responses to the instruction to reappraise were first broken down into thought units by a trained coder who was blind to study hypotheses. Thought units were classified into positive, negative, or neutral statements, following the definitions of Cacioppo and Petty (1981). Negative statements were statements that mentioned specific undesirable attributes, negative meaning, or negative affect (e.g., responses to an image of a snake: "scary snake", "I don't like snakes"). Positive statements were statements that mentioned desirable attributes or positive meaning, acknowledged the value of the content presented (e.g., "this treatment will make his teeth healthy"), or included positive affect (in response to an image of a big spider on a man's shoulder: "This is this man's pet. I love spiders"). Neutral statements were statements that involved neutral interpretation of the image content, interpretation that neither favored nor opposed the content presented and did not involve clear negative or positive attributes or meaning (e.g., in response to an image of an angry face "he just pretends to be angry", or "he is an actor in a movie").

As the 'reappraise' instruction directed participants to rethink aloud the images so they will become less threatening, for a response to be regarded as reappraisal, it could have included a negative statement, but it had to include at least one positive or

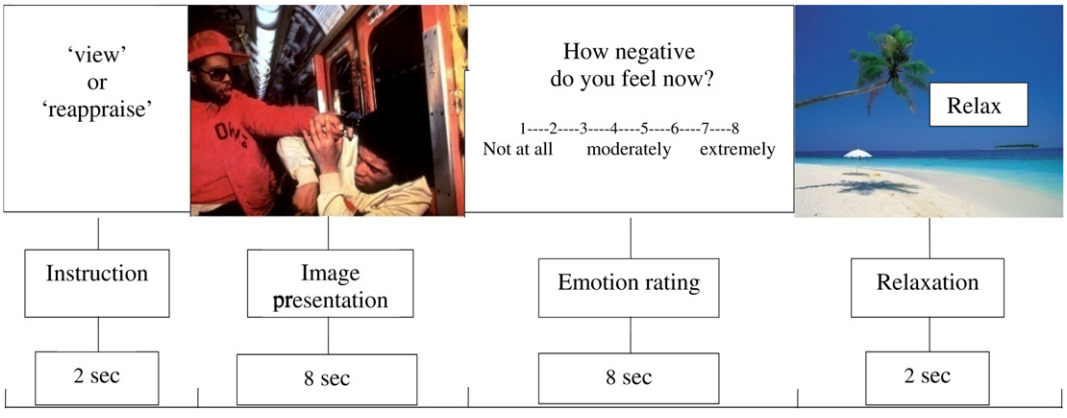

Fig. 1. Trial structure in the reactivity and regulation-images (REAR-I) task.

neutral statement (e.g., "something bad might happened, but this policeman is here to protect us" or "this guy just makes faces in front of a mirror"). Responses that included either (1) only negative statements, (2) the notion one can't think of a less threatening way to view the images, or (3) no verbal response to the instruction were considered as failures to apply reappraisal. The individual score in the reappraisal ability index referred to the proportion of successful reappraisals and was calculated as the number of images the participant managed to reappraise divided by the total number of images presented in the reappraise condition. One type of response was treated specially, namely responses consisting solely of a statement that image shown was not scary. As in these cases (1.02% of total responses) the lack of reappraisal response indicated that the specific image was not threatening for the participant in the first place, the specific image was not included in the reappraisal efficacy calculation.

Reappraisal efficacy

The second cognitive regulation index was reappraisal efficacy. In order to assess reappraisal efficacy, we subtracted the mean emotion rating in the 'reappraise' condition from the mean emotion rating in the 'view' condition for each participant. This difference score represented the reduction in negative emotion that each participant was able to achieve using reappraisal. Not surprisingly, this index was correlated with emotional reactivity, $r(89) = .61$, $p < .001$. Because our study called for separate assessment of reactivity and reappraisal, we used linear regression to predict the difference score based on negative emotional reactivity index scores. The residuals from this regression served as our index of reappraisal efficacy. A positive score indicates that the participant was able to use reappraisal to decrease her negative emotion *more* than would be expected in the total sample based on her level of negative emotional reactivity while a negative score indicates the use of reappraisal reduced negative emotion *less* than would be expected based on her level of negative emotional reactivity.

Reappraisal frequency

The Emotion Regulation Questionnaire (ERQ; Gross & John, 2003) was used to assess emotion regulation frequency. The ERQ has acceptable reliability and construct validity (Gross & John, 2003). It includes 10 items, of which six measure reappraisal frequency and 4 expressive suppression frequency. For the purpose of the study we were interested in the level of reappraisal use in everyday life, which was assessed by the average score of the reappraisal subscale of the ERQ (e.g., "I control my emotions by changing the way I think about the situation I'm in"). Average scores in this study were 4.59, $SD = 1.35$, for the reappraisal subscale. Internal consistency for the ERQ subscales in the current study was .87 for the reappraisal subscale and .79 for the suppression subscale.

Procedure

Parents briefly described their child's overall functioning and potential difficulties. Then, each child was tested individually for 3–4 h with several rest periods. A diagnostic interview and self-report questionnaires (described above) assessed clinical status. Participants completed an affective and cognitive assessment including the questionnaires and tasks described above as well as several additional tasks not reported here. Participants received a $20 value gift and were offered feedback regarding their clinical assessment in appreciation of their participation.

Results

Participant characteristics

Participants in the AD and NAC did not differ significantly in gender, $\chi^2(1, N = 91) = .09$, $p > .75$, or in age, ($M = 13.74$, $SD = 1.93$, $M = 13.42$, $SD = 2.38$ in the NAC and AD accordingly), $t(89) = .69$, $p > .49$. All participants' scores on reading and vocabulary tests were within normal range. The three AD subgroups did not differ in clinical symptoms (i.e., severity of anxiety, severity of depression and overall severity of illness), however the SAD subgroup was younger than the other two subgroups, $F(2,46) = 8.34$, $p < .01$. Correlation between parent report on child's anxiety severity (SCARED-P) and the severity of anxiety according to child (SCARED-C) in our sample was high, $r = .75$, $p < .001$ for the whole sample. In the AD group, parent report on child's anxiety severity positively correlated not only with child's report on anxiety severity, $r(46) = .40$, $p < .01$ but also interviewer's rating of global illness severity, $r(47) = .30$, $p < .05$. In addition interviewer rating's of global illness was positively correlated with child's report of anxiety severity, $r(48) = .69$, $p < .01$. Table 1 shows the clinical characteristics of the two groups.

Manipulation checks

The images provoked mild-to-moderate negative emotional responses in our participants, as evidenced by a mean negative emotional rating for the whole sample of 3.5, $SD = 1.7$ for the images in the 'view' condition. When prompted to reappraise, participants generated reappraisals to 90% of the images on average, $SD = 10.7\%$. As expected, the mean intensity of negative emotion in the 'reappraise' condition, following the instruction to reappraise, ($M = 2.39$, $SD = 1.33$) was lower than in the 'view' condition (mentioned above). This decrease in negative emotion was significant, $t(88) = 8.74$, $p < .001$, suggesting a reappraisal effect on participants' intensity of negative emotional response.

One possible consequence of presenting 'view' and 'reappraise' conditions in a fixed order is that habituation might be responsible for the observed decrease in negative emotion ratings in the second (reappraise) block. To address this possibility, we performed several post hoc analyses examining the pattern of decreases in negative emotion ratings across the task. We began by splitting our 14-trial blocks for each condition into two blocks of seven, based on trial order. This yielded four blocks: view-early (the first seven trials),

Table 1
Clinical characteristics of participants.

Variable	Anxious group ($n = 49$)		Non-anxious control group ($n = 42$)		Difference	
	M	*SD*	*M*	*SD*	*df*	*t*
1. Severity of anxiety-child report	34.44	14.42	9.30	6.76	86	−10.43***
2. Severity of anxiety-parent report	35.29	15.23	6.33	5.33	88	−11.69***
3. Severity of depression	59.00	9.93	43.75	4.95	89	−9.02***
4. Global illness severity	4.85	.95	1.19	.39	89	−23.15***

Note. Severity of anxiety-child and parent reports are the scores in the Screen for Anxiety and Related Emotional Disorders questionnaire (SCARED-C and SCARED-P, respectively). Severity of depression is the T-score calculated for the Children's Depression Inventory (CDI) and the Beck Depression Inventory (BDI-II). Global illness severity is the score in the Clinical Global Impression scale (CGI). Two AD participants' scores in the SCARED-C, were removed from analyses as they were more than 2.5 SD lower than parents' equivalent reports and were lower than would be expected based on the ADIS-C. * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

view-late (the second half of the view condition), reappraise-early (the first seven trials of the reappraise block), and reappraise-late (the second half of the reappraise block). We then calculated average negative emotion ratings for each of these four blocks. Negative emotion ratings decreased from view-early to view-late, $t(73) = 2.8$, $p < .007$, in the absence of any change in instruction, suggesting habituation. However, the decrease from view-late to reappraise-early is highly significant, $t(73) = 5.8$, $p < .001$ and is significantly greater in magnitude than the first decrease, $t(73) = 2.1$, $p < .05$. This result suggests that habituation alone cannot explain the reduction in negative emotion associated with the use of reappraisal in the second (reappraise) block.

We used Pearson correlations to assess inter-correlations among emotional reactivity and cognitive regulation indices. Across all participants, reappraisal frequency was negatively correlated with emotional reactivity, $r(89) = -.25$, $p < .05$, meaning that individuals who reported greater everyday use of reappraisal showed lower levels of negative emotional reactivity in the task. Negative emotional reactivity was not correlated with the ability to generate reappraisals. Emotional reactivity was also not correlated with reappraisal efficacy; however, this lack of correlation is a necessary consequence of our strategy for operationalizing reappraisal frequency and should not be interpreted as a substantive finding. Reappraisal ability was correlated with reappraisal efficacy, $r(86) = .21$, $p < .05$, meaning that individuals who managed to reappraise more images showed greater decreases in negative emotion upon using reappraisal. Reappraisal ability in the task however, did not correlate significantly with reappraisal frequency in everyday life. Importantly, reappraisal efficacy was positively correlated with reappraisal frequency, $r(89) = .27$, $p < .01$, meaning that individuals who reported greater everyday use of reappraisal showed greater benefits from reappraisal in the laboratory.

Baseline negative affect and negative emotional reactivity

As expected, compared to the NAC group, AD participants reported higher levels of negative affect in the STAI-C before the REAR-I task started, ($M = 24.95$, $SD = 3.95$, $M = 31.1$, $SD = 6.86$), $t(89) = 5.2$, $p < .001$, $d = 2.7$. Also as hypothesized, the AD presented higher negative emotional response to the images in the 'view' condition, $t(87) = 4.0$, $p < .001$, $d = .89$, as presented in Fig. 2. The group difference in negative emotional response in 'view' remained significant after controlling for baseline negative affect, $F(1,89) = 6.1$, $p < .05$, $\eta_p^2 = .06$, suggesting that the observed group difference is not explained by the AD's higher baseline negative affect.

Reappraisal ability, efficacy, and frequency

As shown in Fig. 2, compared to the NAC group, AD participants were able to reappraise fewer of the images, $t(85) = 3.0$, $p < .01$, $d = 0.64$.[3] Even so, both groups were able to successfully generate reappraisals for the great majority of the pictures shown (87% for AD and 93% for NAC). With respect to reappraisal efficacy, there was no difference between the groups, $t(87) = .4$, $p > .5$. This result indicates that when reappraisal scores are adjusted for differences in emotional reactivity, the use of reappraisal was followed with similar decrease in negative emotion for the anxious and non-anxious children.[4] Finally, compared to the NAC group AD participants reported significantly less frequent use of reappraisal in everyday life according to the ERQ, $t(88) = 3.6$, $p < .01$, $d = 77$. Group differences in reappraisal ability and in reappraisal frequency persisted after controlling for baseline negative affect and emotional reactivity, ($F(1,89) = 6.0$, $p < .05$, $\eta_p^2 = .06$[5] and $F(1,86) = 5.2$, $p < .03$, $\eta_p^2 = .05$, respectively).

Secondary analyses

Age effects on emotional reactivity and reappraisal

Although not the primary focus of the present investigation, one interesting question is whether there are age-related differences in emotional reactivity and cognitive regulation. Using simple regressions, age did not predict reappraisal ability, efficacy or frequency, but it did predict emotional reactivity. Specifically, age was negatively correlated with negative emotional reactivity, $r(89) = -.36$, $p < .001$, meaning that younger participants reacted with higher negative emotion to the threatening images. Importantly, when age was used as a covariate in group comparisons, AD and NAC still differed in negative emotional reactivity, reappraisal ability, and reappraisal frequency ($p = .001$, $.004$, $.002$ accordingly).

Emotional reactivity, reappraisal, and symptom severity

To examine whether symptom severity was related to emotional reactivity or to reappraisal indices, we correlated each of these measures with symptom severity in the AD group. Table 2 shows that negative emotional reactivity was positively correlated with of anxiety, depression and global illness. Reappraisal ability was not correlated with any of the clinical measures, reappraisal efficacy was not correlated with anxiety or depressive symptoms, but it was negatively correlated with global severity of illness. Everyday use of reappraisal was negatively correlated with severity of anxiety and depressive symptoms.

Discussion

In this study, we tested the hypothesis that anxiety disorders in childhood involve negative emotional hyper-reactivity and deficits in reappraisal, a major cognitive regulation strategy. The study produced four key findings. First, compared to age- and gender-matched non-anxious controls, children with anxiety disorders experienced exaggerated negative emotional response to images with threatening scenes. Second, reappraisal effectively reduced negative emotion for both anxious and non-anxious children, and its efficacy did not differ between the two groups. Third, the anxious children were less capable to generate reappraisal when cued but still managed to reappraise the great majority of the images. Fourth, anxious children reported less frequent everyday use of reappraisal compared to non-anxious children.

Distinct patterns of negative emotional reactivity and reappraisal in children with anxiety disorders

Anxious children reacted with greater emotional intensity upon viewing images of threatening scenes compared with non-anxious controls, and this group difference remained after controlling for baseline differences in negative affect. This emotional hyper-reactivity in the anxious group is consistent with previous work with

[3] Two reappraisal ability scores in the AD were not included in analysis as they were more than 2.5 SD lower than group's mean.

[4] The group difference in the percentage decrease in negative emotional ratings between 'view' and 'reappraise' conditions was also not significant, $t(87) = -.92$, $p > .3$.

[5] In secondary analyses we tested whether the three anxiety subgroups differed in negative emotional reactivity, reappraisal ability, efficacy and frequency; findings showed no significant differences ($F(2,47) = .21$, $p > .80$, $F(2,46) = 1.2$, $p > .29$, $F(2,47) = 1.3$, $p > .26$ and $F(2,47) = 1.2$, $p > .28$, accordingly).

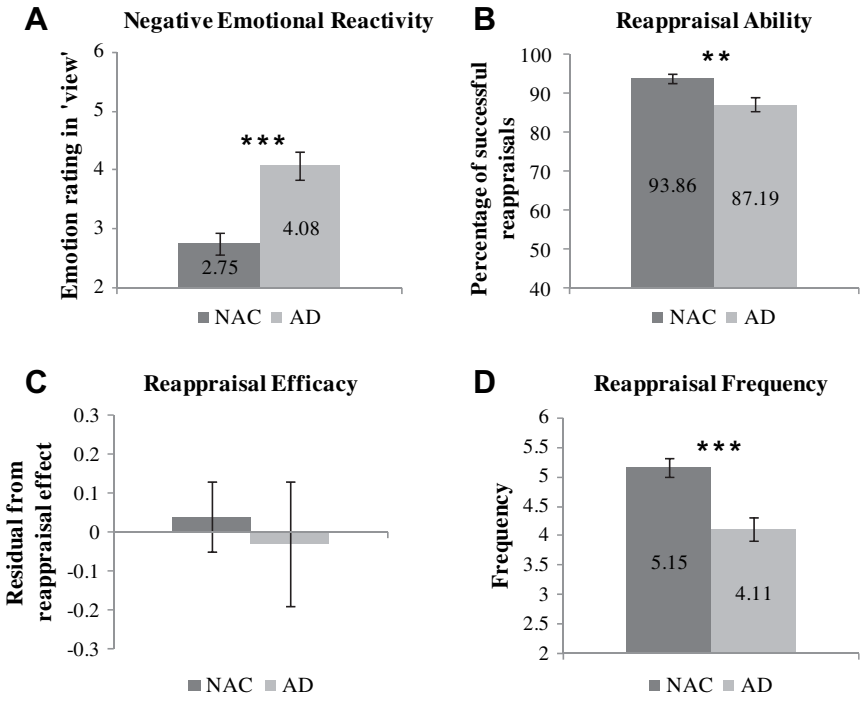

Fig. 2. Negative emotional reactivity (A), reappraisal ability (B), reappraisal efficacy (C), and reappraisal frequency (D) in anxious (AD) and non-anxious (NAC) participants. $^{*}p < .05$. Error bars = standard errors of the means.

anxious adults as well as with children and adolescents (e.g., Mennin et al., 2005; Suveg & Zeman, 2004; Thomas et al., 2001). As this finding was detected in a laboratory context with mild-to-moderate level of threatening stimuli, it suggests that in real-life, anxious children may suffer even more intense experiences of negative emotion which according to previous research may be accompanied with increased threat appraisals. It is therefore not surprising that among anxious children, the intensity of experiential emotional reactivity predicted symptom severity as assessed by both self-report and interviewer measures.

Contrary to our expectations, when instructed to reappraise, anxious and non-anxious participants achieved similar decrements in their levels of negative emotion. This finding converges with a recent study of adults with generalized social anxiety by Goldin et al. (2009), which reported similar reductions in negative emotion following instructed reappraisal in patients with social anxiety and healthy controls.

There was a significant difference between the groups in reappraisal ability, with the AD displaying lower ability to reappraise the images. Still, AD participants managed to reappraise a large percentage (87%) of the images. This is consistent with our results from a separate report, which found that anxious children were less able to generate reappraisals of ambiguous situations with potentially threatening meanings, yet overall, they managed to reappraise most of the situations (Carthy et al., in press).

There was also a clear difference between groups in reappraisal frequency, with the AD reporting less frequent use of reappraisal in everyday life. Our finding that children with anxiety disorders display relatively intact reappraisal efficacy and only mild deficits in reappraisal ability in real-time emotional activation but nonetheless report less frequent use of reappraisal, extends previous research which has found low reappraisal frequency to be linked with negative affect, fearfulness, and worries in non-clinical samples (Garnefski, Rieffe, Jellesma, Terwogt, & Kraaij, 2007; Gross, 2002). At the same time it presents an interesting puzzle: Why do children with anxiety disorders use reappraisal less frequently than controls?

Table 2
Correlation matrix of emotional reactivity, cognitive regulation indices and clinical symptoms within the anxious group.

Subscale	1	2	3	4	5	6	7
1. Severity of anxiety–child report	–						
2. Severity of depression	.59**	–					
3. Global illness severity	.69**	.33**	–				
4. Negative emotional reactivity	.40**	.37**	.25*	–			
5. Reappraisal ability	.10	.18	−.10	.02	–		
6. Reappraisal efficacy	−.11	−.00	−.35**	−.03	.29*	–	
7. Reappraisal frequency	−.28*	−.38**	−.20	−.14	.07	.28*	–

Note. $N = 49$. * = $p < .05$, ** = $p < .01$, *** = $p < .001$.

Explaining anxiety-related differences in reappraisal

One possibility is that the mild reappraisal deficit found under the task's condition predicts more severe deficit in more intense emotional contexts. Our task presented mild-to-moderate threatening images with limited self-relevance for a short duration (i.e., 8 s) in a laboratory context that granted safety. In real-life situations, stimuli may be more threatening and applying reappraisal may become more challenging. Modifying an existing threatening interpretation through reappraisal demands staying in contact with the threatening meaning (and with the negative emotion it provokes) longer than some other emotion regulation strategies require, such as avoidance (e.g., deciding not to take a party) or distraction (e.g., playing a computer game to calm one self down). Furthermore, the cognitive demands imposed by reappraisal may be difficult to meet in the context of intense negative emotions.

Another factor that may contribute to the anxious' lower use of reappraisal in everyday life situations, is low regulation self-efficacy, or specifically low reappraisal self-efficacy. While our task did

not examine the participants' perception of their regulation efficacy in general or in regard to reappraisal specifically, previous reports suggest anxious individuals suffer relatively low regulation self-efficacy (Suveg & Zeman, 2004; Weems & Silverman, 2006). Moreover, recent work by Tamir, John, Srivastava, and Gross (2007) supports the link between perceived regulation efficacy and actual patterns of regulation, finding that perceived regulation efficacy is positively related to reappraisal frequency according to the ERQ. It may be that for anxious children, because of their increased negative emotional reactivity, reappraisal does not provide sufficient emotional relief. For example, in the present study, while AD participants were able to use reappraisal to considerably decrease their levels of reported negative emotion, the AD group mean in the reappraise condition was still significantly higher than the mean negative emotion rating for the NAC ($M = 2.76$, $SD = 1.54$, $M = 1.93$, $SD = .83$), $t(87) = -3.04$, $p < .01$. This residual distress after employing reappraisal may lead to the perception that it is an ineffective emotion regulation strategy and contribute to a general perception of insufficient ability to handle their anxiety. Together with the emotional demand involved in applying reappraisal in the first place, this may lead to less frequent use of it in everyday life and further increase the reliance on regulatory strategies that are less effortful and provide significant emotional relief from the aversive experience of anxiety (e.g., avoidance, distraction and relying on others to calm them).

Finally, another potential contributor to the lower reappraisal frequency in everyday life while relatively high reappraisal ability in the task, is the lack of internal cues for reappraisal. As cues were provided in the task they may have enabled the anxious children to better implement their ability in the laboratory context.

Implications for assessment and treatment

We believe that our findings have important implications for the assessment and treatment of anxiety disorders in childhood. In terms of assessment, they suggest that a differentiated and detailed evaluation of both emotional reactivity and regulatory processes may provide a useful means of understanding patients' difficulties (Rottenberg & Gross, 2003) and can clarify the emotional dynamics leading to emotion dysregulation.

In terms of treatment implications, our view suggests a distinction between less directly controlled aspects of anxiety (i.e., negative emotional hyper-reactivity), and aspects that may be more subject to volition (e.g., emotion regulation). This distinction may assist individuals and therapists in mapping the types of situations and stimuli that provoke intense negative emotional reactivity as well as the typical patterns of regulation employed, serving as a first step towards improving the capacity to handle negative emotional situations.

The notion that under specific conditions cognitive regulation can be applied by anxious children and bring substantial emotional relief, but may not be applied often enough in everyday life has several implications. First, it underscores the importance of improving the accessibility of this regulation strategy. We believe that devoting effort in developing internal cues for reappraisal may lead to more frequent use of this strategy. Second, it may suggest that reappraisal may be a better choice when emotional intensity is not overwhelming. Reappraisal as instructed in the task targeted immediate thoughts regarding a specific stimulus and can be compared to a commonly used cognitive work on automatic thoughts in CBT, with the difference of focusing on external emotional provocative stimuli in an interactive computerized setting. We believe recreating similar conditions in clinical setting may allow anxious children practice and improve their ability to change their automatic appraisals, initially in the clinical setting and later in gradually more threatening real-life situations. This type of practice may also facilitate more challenging cognitive work targeted at complex cognitive structures.

The possibility that implicit beliefs about emotions and their regulation (e.g., regulation self-efficacy) may be associated with actual regulatory responses is suggested by our findings and supported by others (e.g., Tamir et al., 2007). If so, becoming aware of these implicit perceptions and their impact may be an initial step towards consideration of alternative perceptions. For example, it may be important to address beliefs about the functionality of negative emotions in order to introduce the concept that while anxiety is an internal alarm system for an upcoming danger, this 'threat detection system' may be overly sensitive and provides false alarms. This type of work can enhance tolerance for the unpleasant nature of anxious experiences and encourage try out of new regulatory responses.

Limitations and future directions

Our task aimed to assess real-time emotional reactivity and regulation. However, because emotion generation and regulation are intertwined processes, it is not possible to entirely isolate each process from the other. This means we can't eliminate the possibility that to some extent, the children's ratings of their negative emotional response upon viewing the images have already included spontaneous use of reappraisal. Future studies will be needed to clarify whether anxious and non-anxious children differ in their use of spontaneous emotion regulation.

Another limitation of the present study is that we – like others before us – used affective pictures to probe emotional reactivity. While these provocative stimuli are potent, well-characterized, and convenient, it is not clear how well responses to these stimuli generalize to everyday emotional situations. Moreover, younger children displayed higher levels of negative emotional reactivity. This age difference is intriguing and future research may further examine whether this finding has to do with younger children being exposed to fewer frightening images (e.g., through electronic media) and therefore having fewer opportunities to habituate, or whether there are age-related differences in emotional reactivity. Complementing this task with other types of threatening stimuli may address this question.

Interestingly, our findings using the REAR-I task and the ERQ questionnaire, suggest that age does not affect reappraisal ability, efficacy, or frequency within the range examined. While age-related difference in emotion reactivity and regulation were not the main study questions, this lack of association between age and reappraisal ability or frequency is surprising as previous studies suggest cognitive control develops in close relationship with the development of the prefrontal cortex (Bunge, Dudukovic, Thomason, Vaidya, & Gabrieli, 2002). Future research should clarify whether and under what conditions reappraisal is related to cognitive development.

To our knowledge, the present study is the first to include content analyses of reappraisal. Previous studies in the field have commonly used affective images, detailed instructions and emotional ratings to assess reappraisal, however, no other studies have tracked reappraisal content on a trial-by-trial basis. Future research should use more fine-grained content analysis in order to examine potential subtle group differences in reappraisal (e.g., sophistication, valence, generalization of reappraisal responses).

In this study, we focused on one important type of emotion regulation, namely reappraisal. The study's exclusion of other forms of emotion regulation is another limitation. In future work, it will be important to assess other cognitive and non-cognitive emotion regulation strategies (e.g., extrinsic regulation, avoidance) in childhood anxiety disorders.

Another limitation of this study regards specificity. Our sample was selected to broadly capture pathologies that share the underlying construct of anxiety. As such, the high rates of co-morbidity between diagnoses in our sample reflects the patterns of co-morbid anxiety disorders in this age group, (Kendall & Brady, 1995), maximizing generalizability of these findings anxiety disorders as a category. However, future research should investigate the unique characteristics of emotional reactivity and regulation in specific diagnostic entities. On a related note, it should also be noted that we allocated children to groups based on self-report. While our study included parent and interviewer ratings and these ratings broadly agreed with child self-report, the tendency of young people to underreport certain types of symptoms due to social desirability should be kept in mind (Comer & Kendall, 2004).

Finally, our study examined a single time-point. One important direction for future research is to examine whether and how emotional reactivity and regulation change in response to treatment and are predictive of treatment outcome. We believe that such studies will fill out our emerging understanding of the joint contributions of emotional reactivity and emotion regulation to childhood anxiety and other affective disorders.

References

Beck, A. T., Emery, G., & Greenberg, R. L. (1985). *Anxiety disorders and phobias: A cognitive perspective*. New York: Basic Books.

Beck, A. T., Steer, R. A., & Brown, G. K. (1996). *Manual for the Beck Depression Inventory-II*. San Antonio: Psychological Corporation.

Beidel, D. C. (1991). Determining the reliability of psycho-physiological assessment in childhood anxiety. *Journal of Anxiety Disorders, 5*, 139–150.

Beidel, D. C., Turner, S. M., & Dancu, C. V. (1985). Physiological, cognitive, and behavioral aspects of social anxiety. *Behaviour Research and Therapy, 23*, 109–117.

Birmaher, B., Khetarpal, S., Brent, D., Balach, C., Kaufman, J., & Neer, S. (1997). The screen for child anxiety related emotional disorders (SCARED): scale construction and psychometric characteristics. *Journal of the American Academy of Child and Adolescent Psychiatry, 36*, 545–553.

Bogels, S. M., & Zigterman, D. (2000). Dysfunctional cognitions in children with social phobia, separation anxiety disorder, and generalized anxiety disorder. *Journal of Abnormal Child Psychology, 28*, 205–216.

Bunge, S. A., Dudukovic, N. M., Thomason, M. E., Vaidya, C. J., & Gabrieli, J. D. (2002). Immature frontal lobe contributions to cognitive control in children: evidence from fMRI. *Neuron, 33*, 301–311.

Cacioppo, J. T., & Petty, R. E. (1981). Social psychological procedures for cognitive response assessment: the thought listening technique. In T. V. Merluzzi, C. R. Glass, & M. Genest (Eds.), *Cognitive assessment* (pp. 309–342). New York: Guilford Press.

Carthy, T., Horesh, N., Apter, A., & Gross, J. J. Patterns of emotional reactivity and regulation in children with anxiety disorders. *Psychopathology and Behavioral Assessment*, in press.

Chorpita, B. F., Albano, A. M., & Barlow, D. H. (1996). Cognitive processing in childhood: relation to anxiety and family influences. *Journal of Clinical Child Psychology, 25*, 170–176.

Comer, J. S., & Kendall, P. C. (2004). A symptom-level examination of parent-child agreement in the diagnosis of anxious youths. *Journal of American Academy of Child and Adolescent Psychiatry, 43*, 878–886.

Costello, E. J., Egger, H. L., & Angold, A. (2005). The developmental epidemiology of anxiety disorders: phenomenology, prevalence, and comorbidity. *Child & Adolescent Psychiatric Clinics of North America., 14*, 631–648.

Davidson, R. J. (1998). Affective style and affective disorders: perspectives from affective neuroscience. *Cognition and Emotion, 12*, 307–330.

Garnefski, N., Rieffe, C., Jellesma, F., Terwogt, M. M., & Kraaij, V. (2007). Cognitive emotion regulation strategies and emotional problems in 9–11-year-old children. The development of an instrument. *European Child and Adolescent Psychiatry, 16*, 1–9.

Goldin, P. R., Manber, T., Hakimi, S., Canli, T., & Gross, J. J. (2009). Neural bases of social anxiety disorder: emotional reactivity and cognitive regulation during social and physical threat. *Archives of General Psychiatry, 66*, 170–180.

Gross, J. J. (2001). Emotion regulation in adulthood: timing is everything. *Current Directions in Psychological Science, 10*, 214–219.

Gross, J. J. (2002). Emotion regulation: affective, cognitive, and social consequences. *Psychophysiology, 39*, 281–291.

Gross, J. J., & John, O. P. (2003). Individual differences in two emotion regulation processes: implications for affect, relationships, and well-being. *Journal of Personality and Social Psychology, 85*, 348–362.

Gross, J. J., & Thompson, R. A. (2007). Emotion regulation: conceptual foundations. In J. J. Gross (Ed.), *Handbook of emotion regulation* (pp. 3–24). New York: Guilford.

Guy, W. (1976). *ECDEU assessment manual for psychopharmacology*. Unpublished manuscript, Rockville, MD.

Hannesdottir, D. K., & Ollendick, T. H. (2007). The role of emotion regulation in the treatment of child anxiety disorders. *Clinical Child and Family Psychological Review, 10*, 275–293.

John, O. P., & Gross, J. J. (2007). Individual differences in emotion regulation strategies: links to global trait, dynamic, and social cognitive constructs. In J. J. Gross (Ed.), *Handbook of emotion regulation* (pp. 351–372). New York: Guilford Press.

Kendall, P. C., & Brady, E. U. (1995). Comorbidity in the anxiety disorders of childhood. In K. D. Craig, & K. S. Dobson (Eds.), *Anxiety and depression in adults and children* (pp. 3–36). Newbury Park, CA: Sage.

Killgore, W., & Yurgelun-Todd, D. (2005). Social anxiety predicts amygdale activation in adolescents viewing fearful faces. *Neuroreport, 16*, 1671–1675.

Kovacs, M. (1992). *The children's depression inventory manual*. New York: Multi-Health Systems.

Lang, P. J., Bradley, M. M., & Cuthbert, B. N. (1999). *International affective picture system (IAPS): Instruction manual and affective ratings*. Gainesville, FL: The Center for Research in Psychophysiology, University of Florida.

Last, C. G., Hansen, C., & Franco, N. (1997). Anxious children in adulthood: a prospective study of adjustment. *Journal of American Academy of Child and Adolescent Psychiatry, 36*, 645–652.

Liddell, B. J., Brown, K. J., Kemp, A. H., Barton, M. J., Das, P., Peduto, A., et al. (2005). A direct brainstem-amygdala-cortical 'alarm' system for subliminal signals of fear. *Neuroimage, 24*, 235–243.

Lonigan, C., Vasey, M., Phillips, B., & Hazen, R. A. (2004). Temperament, anxiety, and the processing of threat-relevant stimuli. *Journal of Clinical Child and Adolescent Psychology, 33*, 8–20.

Mauss, I. B., Wilhelm, F. W., & Gross, J. J. (2004). Is there less to social anxiety than meets the eye? Emotion experience, expression, and bodily responding. *Cognition and Emotion, 18*, 631–662.

Mennin, S. D., Heimberg, R. G., Turk, C. L., & Fresco, D. M. (2005). Preliminary evidence for an emotion dysregulation model of generalized anxiety disorder. *Behaviour Research and Therapy, 43*, 1281–1310.

Mennin, S. D., Holaway, R. M., Fresco, D. M., Moore, M., & Heimberg, R. G. (2007). Delineating components of emotion and its dysregulation in anxiety and mood psychopathology. *Behavior Therapy, 38*, 284–302.

Muris, M., Meesters, C., & Rompelberg, L. (2007). Attention control in middle childhood: relations to psychopathological symptoms and threat perception distortions. *Behaviour Research and Therapy, 45*, 997–1010.

Osman, A., Kopper, B. A., Guttierez, P., Barrios, F., & Bagge, C. (2004). Reliability and validity of the Beck Depression Inventory-II with adolescent psychiatric inpatients. *Psychological Assessment, 16*, 120–132.

Papay, J. P., & Spielberger, C. D. (1986). Assessment of anxiety and achievement in kindergarten and first- and second-grade children. *Journal of Abnormal Child Psychology, 14*, 279–286.

Phan, K. L., Fitzgerald, D., Nathan, P. J., & Tancer, M. (2006). Association between amygdala hyperactivity to harsh faces and severity of social anxiety in generalized social phobia. *Biological Psychiatry, 59*, 424–429.

Richards, A., & French, C. C. (1992). An anxiety-related bias in semantic activation when processing threat/neutral homographs. *Quarterly Journal of Experimental Psychology, 45*, 503–525.

Rottenberg, J., & Gross, J. J. (2003). When emotion goes wrong: realizing the promise of affective science. *Clinical Psychology: Science and Practice, 10*, 227–232.

Salters-Pedneault, K., Roemer, L., Tull, M. T., Rucker, L., & Mennin, D. S. (2006). Evidence of broad deficits in emotion regulation associated with chronic worry and generalized anxiety disorder. *Cognitive Therapy and Research, 30*, 469–480.

Shani, M., Lachman, L., Shalem, C., Bahat, A., & Zeiger, T. (2006). *Single words reading test manual*. Tel-Aviv: Sfarim.

Silverman, W. K., & Albano, A. M. (1996). *The anxiety disorders interview schedule for DSM-IV: Child interview schedule*. San Antonio, TX: Psychological Corporation.

Silverman, W. K., Saavedra, L. M., & Pina, A. A. (2001). Test–retest reliability of anxiety symptoms and diagnoses with the anxiety disorders interview schedule for DSM-IV: child and parent versions. *Journal of the American Academy of Child and Adolescent Psychiatry, 40*, 937–944.

Smucker, M. R., Craighead, E. W., Craighead Wilcoxon, L., & Green, B. J. (1986). Normative and reliability data for the children's depression inventory. *Journal of Abnormal Child Psychology, 14*, 25–39.

Spielberger, C. (1973). *Manual for the state-trait anxiety inventory for children*. Palo-Alto, CA: Consulting Psychologists Press.

Stein, M. B., Goldin, P. R., Sareen, J., Zorrilla, L., & Brown, G. G. (2002). Increased amygdala activation to angry and contemptuous faces in generalized social phobia. *Archives of General Psychiatry, 59*, 1027–1034.

Stein, M. B., Simmons, A. N., Feinstein, J., & Paulus, M. (2007). Increased amygdala and insula activation during emotion processing in anxiety-prone subjects. *American Journal of Psychiatry, 164*, 318–327.

Suveg, C., & Zeman, J. (2004). Emotion regulation in children with anxiety disorders. *Journal of Clinical Child and Adolescent Psychology, 33*, 750–759.

Tamir, M., John, O. P., Srivastava, S., & Gross, J. J. (2007). Implicit theories of emotion: affective and social outcomes across a major life transition. *Journal of Personality and Social Psychology, 92*, 731–744.

Thomas, K. M., Drevets, W., Dahl, R. E., Ryan, N., Birmaher, B., Eccard, C., et al. (2001). Amygdala response to fearful faces in anxious and depressed children. *Archives of General Psychiatry, 58*, 1057–1063.

Thompson, R. A. (2001). Childhood anxiety disorders from the perspective of emotion regulation and attachment. In M. W. Vasey, & M. R. Dadds (Eds.), *The developmental psychopathology of anxiety* (pp. 160–183). New York: Oxford.

Turk, C. L., Heimberg, R. G., Luterek, J. A., Mennin, D. S., & Fresco, D. (2005). Emotion dysregulation in generalized anxiety disorder: a comparison with social anxiety disorder. *Cognitive Therapy and Research, 29*, 89–106.

Velting, O. N., Setzer, N., & Albano, A. M. (2004). Update on and advances in assessment and cognitive–behavioral treatment of anxiety disorders in children and adolescents. *Professional Psychology: Research and Practice, 35*, 42–54.

Wechsler, D. (2003). *Wechsler intelligence scale for children–IV*. San Antonio, TX: Psychological Corporation.

Weems, C, & Silverman, W. K. (2006). An integrative model of control: implications for understanding emotion regulation and dysregulation in childhood anxiety. *Journal of Affective Disorders, 91*, 113–124.

Weems, C. F., Zakem, A., Costa, N. M., Cannon, M. F., & Watts, S. E. (2005). Physiological response and childhood anxiety: association with symptoms of anxiety disorders and cognitive bias. *Journal of Clinical Child and Adolescent Psychology, 34*, 712–723.

Wilson, J. E., MacLeod, C., Mathews, A., & Rutherford, E. (2006). The causal role of interpretive bias in anxiety reactivity. *Journal of Abnormal Psychology, 115*, 103–111.

Woodward, L. J., & Fergusson, D. M. (2001). Life course outcomes of young people with anxiety disorders in adolescence. *Journal of the American Academy of Child and Adolescent Psychiatry, 40*, 1086–1093.

Zeman, J., Cassano, M., Perrt-Parrish, C., & Stegall, S. (2006). Emotion regulation in children and adolescents. *Developmental and Behavioral Pediatrics, 27*, 155–168.