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Patterns of Emotional Reactivity and Regulation in Children with Anxiety Disorders

Tal Carthy · Netta Horesh · Alan Apter · James J. Gross

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Abstract Emotion dysregulation is believed to be a key factor in anxiety disorders. However, the empirical basis for this view is limited, particularly in children and adolescents. This study aimed to examine whether anxious children display negative emotional hyper-reactivity and deficits in emotion regulation, using a new task that presents ambiguous situations with potentially threatening meanings. Forty-nine children diagnosed with either generalized anxiety disorder, social anxiety, or separation anxiety disorder, were compared with 42 non-anxious controls. Relative to controls, anxious children demonstrated (a) greater intensity and frequency of negative emotional responses, (b) deficits in using reappraisal in negative emotional situations and corresponding deficits in reappraisal self-efficacy, and (c) greater reliance on emotion regulation strategies that increase the risk of functional impairment, intense negative emotion, and low emotion regulation self-efficacy. Implications for the assessment and treatment of childhood anxiety are discussed.

Keywords Anxiety disorders · Childhood · Adolescence · Emotion · Emotion regulation

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T. Carthy · N. Horesh
Department of Psychology, Bar-Ilan University,
Ramat-Gan, Israel

A. Apter
Schneider Children Medical Center of Israel and Shackler School of Medicine, Tel-Aviv University,
Tel Aviv, Israel

J. J. Gross (✉)
Department of Psychology, Stanford University,
Jordan Hall, Bldg. 420,
Stanford, CA 94305-2130, USA
e-mail: gross@stanford.edu

Anxiety disorders in childhood are associated with significant impairments in social and academic functioning, and usually cause substantial distress for both patients and their families (Lyneham and Rapee 2005). Unless treated, anxiety disorders tend to persist, and increase the risk for medical illnesses, impaired well being, and other psychiatric disorders including clinical depression and substance abuse (Last et al. 1997; Woodward and Fergusson 2001).

Two clinical features stand out across the anxiety disorders: heightened negative emotional experience (centered on themes of threat), and a relative inability to effectively decrease this emotion, despite a recognition that the emotion is excessive. These clinical features, together with the growing understanding of the role emotion and emotion regulation play in healthy and in abnormal development (Zeman et al. 2006), have led to the widespread view that emotion dysregulation is a fundamental feature of anxiety disorders (e.g., Farach and Mennin 2007; Suveg and Zeman 2004; Thompson 2001). Although a growing body of research on adult anxiety disorder has begun to test these claims, the empirical basis for such claims—particularly in child and adolescent anxiety disorders—is still relatively modest.

Emotional Reactivity and Regulation—Conceptual Definitions

On our view, the emotion-generative process begins when an external or internal event signals to the individual that

something important may be at stake (e.g., an upcoming separation from parent through the eyes of a child). When attended to and evaluated in certain ways (e.g., something bad will happen to both self and parent following separation), these emotional cues trigger a coordinated set of response tendencies that involve experiential (e.g., feeling anxious), behavioral (e.g., crying and clinging to parent), central (e.g., amygdale activation), and peripheral physiological systems (e.g., increased heart rate) (Gross et al. 2006). People vary significantly in the quality and intensity of their emotional responding to similar stimuli and situations (Davidson 1998). The concept of *emotional reactivity* refers to the characteristics of emotional responding including the threshold of stimuli needed to generate emotional response and the intensity of the various components of the emotional response (Davidson 1998).

As negative emotions are generated, emotion regulation processes are often activated to modulate emotional responses. Following prior literature (Lonigan et al. 2004; Rottenberg and Gross 2003), we distinguish between emotional reactivity and emotion regulation, and believe that an examination of these separable processes may improve current understanding and treatment of psychopathology, even though we are aware of the ongoing interplay between these two types of processes. *Emotion regulation* refers to attempts individuals make to influence which emotions they have, when they have them, and how these emotions are experienced or expressed. Emotion regulation may be automatic or controlled, conscious or unconscious, and may involve the up or down-regulation (i.e., increase or decrease) of various aspects of negative or positive emotions (Parrott 1993). Emotion regulation is a subtype of *affect regulation;* other subtypes include coping and mood regulation (Gross et al. 2006). *Coping* refers to efforts to manage one's relations with an environment that taxes its ability to respond (Lazarus and Folkman 1984). Coping and emotion regulation overlap, but coping includes non-emotional actions taken to achieve non-emotional goals, while emotion regulation is concerned with emotions in whatever context they may arise. *Mood regulation* refers to attempts to alter affective responses, which, compared to emotions, are typically of longer duration, lesser intensity, and are less likely to involve responses to specific "objects" (Parkinson et al. 1996).

Emotional Reactivity and Regulation in Anxious Adults

Initial conceptions suggested that anxious individuals show general *hyper-arousal*, or heightened physiological responses to emotional stimuli (e.g., Clark and Watson 1991). However, studies of peripheral physiological hyperarousal (e.g., increased heart rate, respiratory rate, sweating) provided mixed support for this claim (e.g., Beidel et al. 1985; Edelmann and Baker 2002; Mauss et al. 2004). Moreover, different physiological measures tend not to correlate highly with one another (Mauss et al. 2004), and researchers have suggested physiological arousal is not a unitary phenomenon (Barrett et al. 2007). Evidence for central physiological hyper-activation in anxious individuals was recently demonstrated in functional magnetic resonance measures of blood oxygen level dependent responses in the amygdala (which is thought to be involved in threat detection) when anxious participants were shown threatening images (Phan et al. 2006; Stein et al. 2002, 2007).

Domain-specific assessments suggest that anxious individuals do report greater subjective experience of emotion, based on (a) self-reports of emotional responding (Salters-Pedneault et al. 2006; Turk et al. 2005), and (b) real-time negative emotional ratings in response to threatening stimuli (Goldin et al. 2009; Mennin et al. 2005).

The anxious' emotional hyper-reactivity is thought to emerge from a biased processing of threat-related information (Beck et al. 1985; Wilson et al. 2006). Consequently, as anxious children and adults have the tendency to appraise ambiguous stimuli as threatening (e.g., Chorpita et al. 1996; Richards and French 1992) they are vulnerable to frequent and intensified experiences of threat and negative emotion.

This vulnerability, not surprisingly, is believed to increases the risk for difficulties in emotion regulation. Indeed, recent models suggest anxious individuals suffer emotion dysregulation (e.g., Hannesdottir and Ollendick 2007; Mennin et al. 2005). Consistent with this view, several studies have shown that anxious adults report greater difficulty repairing negative mood states and accessing strategies for regulation (Mennin et al. 2005; Salters-Pedneault et al. 2006). One important limitation of research to date is a reliance on self-report measures that assess general regulatory abilities (e.g., "When I'm upset, I believe that there is nothing I can do to make myself feel better") which do not: (a) determine the specific characteristics of regulation difficulties, and (b) distinguish between actual and perceived regulatory deficits.

Interestingly, several studies have claimed that beliefs regarding the ability to control or regulate one's anxiety is an important predictor of anxiety severity (Landon et al. 2007; Weems et al. 2003, 2007). Moreover it has been suggested that the impairment may be in the anxious' perceived regulation efficacy and not necessarily in their actual regulation abilities (Suveg and Zeman 2004). This suggestion is born out by a recent study in which adults with social anxiety showed comparable ability to decrease negative emotions to images of social and physical threat using cognitive reappraisal, compared with non-anxious participants (Goldin et al. 2009).

Although these initial findings are promising, it has not yet been determined whether anxious individuals suffer actual and/or perceived emotion regulation disabilities. Moreover, the basic patterns of use of emotion regulation strategies in anxious versus non-anxious individuals have not been mapped yet.

According to the process model of emotion regulation (Gross 1998), five families of emotion regulation strategies may be distinguished based on the point at which each strategy has its primary impact on the emotion-generative process. *Situation selection* determines whether the emotional situation is avoided or selected in the first place and avoidance is a strategy that fits this family (e.g., reading in class at recess time to avoid social threatening interactions). *Situation modification* involves active attempts to modify the stimuli/situation in order to alter its emotional impact. Specific strategies that fit into this family are problem-solving (e.g., checking the source of a noise in one's house in the middle of the night) and seeking help from others (e.g., calling a friend to join one's visit in the mall as one is scared of crowded places). *Attention deployment* involves shifting one's focus and attention to alter responses to emotionally evocative stimuli and a specific strategy in this family is distraction (e.g., watching television). *Cognitive change* involves modifying one's thoughts and beliefs about a situation in order to alter its emotional impact and one of the specific strategies in this family is reappraisal (e.g., thinking that a threatening job interview is manageable based on past experience). Finally, *response modulation* involves attempts to alter the emotional responses themselves. Examples include suppressing the expression of one's emotion (not showing that one feels sad), venting one's emotion (i.e., expressing one's emotion in order to change how one feels) and relaxing (i.e., decreasing one's physiological reactivity).

Even though it is unlikely that any emotion regulation strategy is either always good or always bad (Gross and Thompson 2007), frequent use of some forms of regulation such as reappraisal, has been associated with positive social and affective outcomes, whereas frequent use of other forms of emotion regulation such as suppression, has been associated with negative social and affective outcomes (Gross 2002; Gross and John 2003).

In the context of anxiety disorders, it has been suggested that the frequent use of avoidance (Mineka and Zinbarg 2006) is an important factor in the development of these disorders. Interestingly, Olatinji et al. (2007) suggested that it is the rigid use of emotion regulation strategies that increases the risk for anxiety disorders. Surprisingly, only a few studies have examined specific emotion regulation strategies in anxiety. One study in adults with mood and anxiety disorders found greater use of emotion suppression (operationalized by one item "I tried to hold back or suppress my emotional reactions") in response to a scary film (Campbell-Sills et al. 2006). In another study, adults suffering panic attacks reported using more experiential avoidance of their emotions while watching a negative emotion-eliciting film clip (Tull and Roemer 2007). A recent study by Decker et al. (2008) investigated the self-reported use of a range of emotion-regulation strategies in students with clinical generalized anxiety disorder (GAD) scores, compared with low anxious students. High anxious individuals used more avoidance as well as distraction, soothing feeling (similar to relaxing) and emotion suppression.

Emotional Reactivity and Regulation in Anxious Children and Adolescents

Compared to research on adult anxiety, fewer studies have investigated emotional reactivity in anxious children and adolescents. There is some support for physiological hyper-reactivity in anxious children, with greater activation of anxious' amygdala in response to fearful faces (Thomas et al. 2001). In another study, anxious children reacted with greater increase in heart rate to a video clip of a mild phobic stimulus (Weems et al. 2005). Greater experiential emotional reactivity was found in anxious children in response to vignettes that elicited either sadness, worry or anger (Suveg and Zeman 2004) and in response to threatening images (Carthy et al. 2009).

Empirical evidence for abnormalities in emotion regulation in anxious children and children is scarce. Anxious children report they are less capable of flexible control of attention (i.e., the ability to pay attention to a task over time and the ability to voluntarily move attention from one stimulus to another), a crucial element in emotion regulation (Muris et al. 2006). In a study by Suveg and Zeman (2004), anxious children reported lower self-efficacy in regulating either sadness worry or anger compared with non-anxious children. They also reported less use of adaptive regulation methods and more dysregulated expression of sadness, worry, and anger. However, the self-report measure used to assess emotion regulation included general statements on regulation (e.g., "I try to calmly deal with what is making me feel sad") that do not specify the regulation strategies that are used to down-regulate negative emotions nor distinguish between actual and perceived regulation difficulties (e.g., "I can stop myself from losing control over my sad feelings"). In another study that examined discussions with a parent on prior situations in which they felt either anxious or worried, anxious children reported less constructive ways of dealing with their feelings and more maladaptive responses, however no systematic categorization of regulation strategies was made (Suveg et al. 2008).

In a recent report on children with anxiety disorders (Carthy et al. 2009), participants' real-time emotional reactivity and regulation were probed using pictures of threatening scenes and specific instructions to just view or to regulate negative emotion. Compared with non-anxious participants, anxious children demonstrated greater negative emotional responses to the stimuli and difficulty activating cued reappraisal in order to decrease their negative emotion. However, once applied, this strategy was equally successful in reducing negative emotion for both groups.

To our knowledge, no prior study of anxious children has mapped their relative use of emotion regulation strategies. According to previous literature, anxious individuals seem to share a combination of factors that may influence their typical pattern of emotion regulation, including: a) heightened emotion reactivity, which challenges emotion regulation processes, b) difficulties in generating specific regulation strategies (e.g., reappraisal) (Carthy et al. 2009), and c) a family environment that encourages maladaptive strategies in negative emotional situations (e.g., avoidance) (Barrett et al. 1996). Hence, anxious individuals may be suffering not only negative emotional hyper-reactivity, but also maladaptive regulatory responses.

The Present Study

To examine emotional reactivity and regulation in anxious children, we developed a novel task that presents ambiguous situations with potentially threatening meanings. While previous studies have used pictures to probe emotional activation, this task aims to provoke real-time emotional activation using stimuli that resemble real-life situations in childhood, in order to provide quantitative and qualitative assessment of individual differences in emotion reactivity and regulation.

We expected that relative to non-anxious controls (NAC), children with anxiety disorders (AD) would manifest (1) greater intensity and frequency of emotional-reactivity, and (2) general deficits in the ability to apply emotion regulation strategies in real-time activation of negative emotion. While most previous studies did not use consistent definitions or methodologies to assess emotion regulation strategies, we chose the process model of emotion regulation as an organizing conceptual system, and hypothesized that anxious children would display an emotion regulation profile characterized by (a) greater use of avoidance (situation selection), (b) greater use of seeking help of others, and lesser use of problem solving (situation modification), (c) lesser use of reappraisal (cognitive change), and (e) greater use of emotion suppression and relaxing (response modulation). As there seem to be mixed findings in regard to use of distraction and as no prior study examined any strategy that is similar to venting, we have no specific predictions in regard to the relative use of these regulation strategies in anxious children.

A special interest in further characterizing anxious children's difficulties in reappraisal guided our examination following recent findings of deficits in reappraisal in anxious children (Carthy et al. 2009). As anxious children seem to be biased towards threat appraisals and as this bias seem to lead to intense emotional reactivity, this strategy may be more difficult, however especially important for anxious individuals to employ. We hypothesized anxious children will show 1) lesser spontaneous and cued reappraisal, 2) lower reappraisal perceived efficacy.

Method

Participants

Participants were 49 children (28 boys and 21girls) who presented for assessment and treatment at an Anxiety Disorders Clinic in 'Schneider's Children Medical Center', a university affiliated children's hospital in Israel, as well as 42 (19 boys and 23 girls) age- and gender-matched children, who had no current or past anxiety disorder. Participants' ages ranged between 10 and 17, and all were Israeli. 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 6 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.

The key inclusion criterion for the anxiety disorders (AD) group was a primary diagnosis of either generalized anxiety disorder (GAD), (n=21), social anxiety disorder (SOP), (n=16), or separation anxiety disorder (SAD), (n=12). Seventy seven percent of the anxious group had two or more anxiety disorders, 16% had an additional diagnosis of major depression disorder (MDD), and 10% had attention deficit disorder (ADD or ADHD). Specific exclusion criterion for the non-anxious control (NAC) group was anxiety disorder (current or past).[1] None of the NAC participants had another psychiatric disorder according to the ADIS-C and parents' brief report, however one participant had ADD. All participants and their parents provided informed consent.

[1] All assessment instruments were administered in Hebrew.

Procedure

After parents described their children's overall functioning and potential difficulties, each child was tested individually for 3–4 h with several rest periods. A 1.5–2 h clinical interview and self-report questionnaires (described below), were used to assess clinical status. After a break, participants completed 1–2 h of affective and cognitive assessment.[2] This assessment included the vocabulary section of the Wechsler Intelligence Scale for Children—IV (Wechsler 2003) to ensure intact intelligence and vocabulary, a measure of reading speed and accuracy (Shani et al. 2006) to ensure age-appropriate reading abilities, an experimental task to assess emotional reactivity and regulation (REAR-Situation), and several additional tasks not reported here. At the end, participants and parents were given feedback regarding the participant's clinical status as well as an appreciation gift valued at about $20.

Assessment of Clinical Status

The Anxiety Disorders Interview Schedule for Children (ADIS-C; Silverman and Albano 1996) is based on the DSM-IV and provides a systematic assessment of anxiety disorders as well as differential diagnoses for common childhood difficulties. It was administered by two psychologists specifically trained in its administration. In the first 20 interviews, both interviewers were present and diagnoses were made separately by each interviewer and then discussed under the supervision of a senior clinical psychologist. The agreement rate for the primary diagnosis in these interviews was 85%. In the later interviews, each interviewer administered the ADIS-C individually with a senior clinical psychologist serving as a consultant. The ADIS-C has acceptable reliability and validity (Silverman et al. 2001).

To assess the severity of anxiety symptoms, participants completed the Screen for Anxiety and Related Emotional Disorders (SCARED-C; Birmaher et al. 1997) and a parent completed the parent form of this measure (SCARED-P). The SCARED has been widely used in studies of anxiety and has demonstrated high reliability and validity in both clinical and non-clinical populations (Birmaher et al. 1997, 1999). Internal consistency of the SCARED-C and the SCARED-P in the current study was evaluated in a random subsample of 20 participants. Cronbach's α was .92 for the SCARED-C and .80 for the SCARED-P.

To assess depressive symptoms, participants younger than 13 completed the Children's Depression Inventory (CDI; Kovacs 1992), which has acceptable internal consistency and test–retest reliability (Smucker et al. 1986). Internal consistency of the CDI in the current study using Cronbach's α was .91. Participants who were 13 and older completed the Beck Depression Inventory (BDI-II; Beck et al. 1996), which also has good internal reliability and test–retest reliability (Beck et al. 1996; Osman et al. 2004). Internal consistency of the BDI-II in the current study was evaluated in a random subsample of 20 participants. Cronbach's α was .89.

Assessment of Emotional Reactivity and Regulation

To assess emotional reactivity and regulation, we developed the Reactivity and Regulation (REAR)-Situation Task. This computerized task assesses emotional reactivity and emotion regulation in the context of ambiguous everyday-life situations with potentially threatening meanings. Of the 16 situations used, 12 were created by the authors and four adopted from the Ambiguous Situation Questionnaire (ASQ; Chorpita et al. 1996). All situations were one sentence long, in present time and in second person to encourage self-reference (e.g., "Your mother was supposed to return home from work but she is late"). Situations had potentially threatening meanings related to family (e.g. "Your mom tells you she has to do medical tests"), social ("You're sitting in a group and your turn to introduce yourself is coming"), performance ("Your teacher hands you back your test and says she is surprised") or physical ("On your way to school you feel strange in your tummy") contexts.

The task comprised two blocks of trials. The first block began with three practice trials. In these practice trials—as in the actual trials—participants were presented with a written situation on a computer screen, read it aloud, imagined themselves in the scene presented, and verbalized aloud their immediate thoughts. They also practiced using a negative emotion rating scale to report 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=moderate and 8=extreme). Finally, they were asked to think and report what they would do in this situation to calm themselves down. Once they were comfortable with the procedures, participants were presented with 16 trials that had the same structure as the practice trials (practiced situations were not presented in the real trials): Each trial included the following screens: (1) The situation written in the center of the screen, with the question "what are your first thoughts?", written below. (2) The situation written in the center of the screen, with the negative emotion rating scale presented below, and (3) The question: "What would you do to calm yourself down in this situation?". As a general instruction, participants were asked to imagine themselves in the situations presented and to provide their immediate subjective responses.

[2] Three children were excluded from the NAC, two for being diagnosed with specific phobia and one for being diagnosed with anxiety disorder not otherwise specified (NOS).

Before starting the second block, the concept of reappraisal was briefly explained. Starting with the notion that sometimes we try to change our emotion (e.g., when we're sad or afraid), the idea of the ability to decrease one's negative emotion by changing the way one thinks of a situation was introduced, followed by few examples (e.g., thinking of a good ending to a scary situation). Participants then went through three practice trials in which they practiced re-interpreting aloud the content of a situation so it will become less negative. They also practiced responding to the question whether using reappraisal would improve their feeling, by pressing the '1' key if reappraisal would decrease their negative emotion in the situation, '2', if it would not decrease their negative emotion, and '3' if the question was not relevant as the specific situation was not distressing in the first place, (i.e., in Block 1).

Once participants were comfortable with the procedures, the second block began. This block consisted of the same situations as in Block 1, presented in a pseudo-random fixed order. For each of the 16 trials in Block 2, the following screens were included: (1) A written situation, with the instruction to reappraise it, and (2) The question: "Would re-interpreting the situation improve your feeling?". All participants' responses were recorded verbatim by the interviewer.

Data Reduction

To calculate emotional reactivity and regulation indices, the free responses were first broken down into units of cognitive response, according to the criterion that a stated idea constitutes a unit (Cacioppo and Petty 1981). Cognitions were rated according to valence (positive, negative, neutral) following the definitions of Cacioppo and Petty (1981). Negative appraisals were statements that mentioned specific undesirable attributes or negative associations, or reflected negative affect (e.g., in response to the situation of receiving a test form: "I am very nervous, I'm going to fail").

Positive appraisals were statements that mentioned desirable attributes or positive associations, acknowledged the value of the situation or stimulus, or included positive affect (in response to a situation of dad's unexpected travel overseas: "that's cool, he's going to bring me presents"). Neutral appraisals were statements that neither favored nor opposed the situation and involved no negative or positive attributes, associations or affect (in response to the situation of introducing oneself in a group:"I am planning what I'll say"). A graduate student in psychology was trained to rate the children's cognitions. The rater was blind to the hypotheses of the study.

Emotional Reactivity Indices The index *intensity of negative emotion reactivity* referred to the participant's extent of negative emotional response. To derive this index we used the average negative emotion rating in Block 1 (for all situations). The index *frequency of negative emotional reactivity* referred to the frequency of negative emotional response. To derive this index we calculated the proportion of negatively appraised situations (i.e., situations that provoked at least one negative appraisal) out of the total number of situations presented in Block 1 (i.e., 16). For example, a participant who responded with negative appraisal to eight situations had a score of .50 in this index.

Reappraisal Indices Three indices of reappraisal were derived: Uninstructed reappraisal, Cued reappraisal, and Reappraisal Self-efficacy. *Uninstructed reappraisal* referred to the extent of spontaneous use of reappraisal. To derive this index we calculated the proportion of situations in which a positive or neutral appraisal was spontaneously given by the participant together with a negative appraisal, out of the total negatively appraised situations in Block 1. For example, in response to the situation of seeing unfamiliar person at the door: "It may be someone who wants to hurt me, however it may be a neighbor I did not meet before". *Cued reappraisal* was defined as the ability to reappraise in response to instruction. To derive it we calculated the proportion of situations that participants managed to reappraise when directly instructed in Block 2, out of all the situations in Block 1 that provoked negative appraisal however no act of spontaneous reappraisal (e.g., uninstructed reappraisal or as a strategy of choice to calm oneself down). For example, in response to mom's medical tests, one participant provided the initial appraisal: "They will find something bad", however when instructed to reappraise in Block 2, his response was: "My mom does lots of sport and eats healthy so probably her tests will be fine". *Reappraisal self-efficacy* referred to the participant's perceived reappraisal efficacy. It was defined as the proportion of times participants thought the use of reappraisal would reduce their negative emotion, out of the total number of reappraised situations.

Emotion Regulation Profile Indices An emotion regulation profile was derived using participants' responses to the question regarding how they would calm themselves down in each situation. It comprised the relative use of eight emotion regulation strategies, as well as the frequency of regulation failure (explained in the following section). Each response was classified by a graduate student in psychology, trained in the classification system and blind to the study hypotheses. The conceptual framework for classification was the process model of emotion regulation (Gross 1998) and its five categories of regulation strategies. Further directions for classification were derived from

Parkinson's classification of emotion regulation strategies (Parkinson and Totterdell 1999).

The five categories were: (1) Situation selection, operationalized here as *Avoidance* (e.g., "I will go to the bathroom so I'll miss my turn to introduce myself"), (2) Situation modification, operationalized here as *Problem solving* (i.e., in response to a situation of getting the test form: "I will go over all the questions and start with those I know") and *Seeking help or comfort from others* (e.g., "I will ask my mom to come and take me home"), (3) Attention deployment, operationalized here as *Distraction* (e.g., "I will play a computer so I will not think of it"), (4) Cognitive change, operationalized here as *Reappraisal*, (e.g., "Even if I fail this test, I can still do better in the next one"); and (5) Response modulation, operationalized here as *Emotional suppression*, (e.g., "I will not let them see that I am nervous"), *Relaxing* (i.e., "I will take deep breaths and drink water") and *Venting* (e.g., "I will shout at him"). In addition, an index of *regulation failure* was obtained when the participant either could not think of a way to calm herself down in the distressing situation, or proceeded with the situation as one typically would using no distinct act of regulation (e.g., "I can't think of anything that will calm me down, it's too distressing").

An emotion regulation profile was created by calculating the proportion of each type of response (e.g., avoidance, regulation failure), out of the total negative emotional situations in Block 1 (i.e., situation with emotion rating > = 2). In addition, the number of different strategies used constituted the index *Variety of strategies*.

Psychometric Assessments of the REAR-Situation Task

Internal Consistency and Inter-rater Reliability We assessed internal consistency for quantitative indices using Cronbach's α. We assessed inter-rater reliability for indices that involved content analysis (i.e., frequency of emotion reactivity, uninstructed reappraisal, cued reappraisal, regulation failure and all specific strategies). Inter-rater reliability was assessed in a random sub-sample of 20 participants by correlating independent judgments made by two raters who were blind to study hypotheses. For one measure, reappraisal self-efficacy, neither of these reliability assessments was applicable and it was not included in this analysis. Results of internal consistency and inter-rater reliability are presented in Table 1. The internal consistency of the reactivity indices was good. The inter-rater reliability ranged from adequate to high.

Inter-correlations Between Measures of Reactivity and Regulation Internal correlations between the two indices of emotional reactivity were assessed, as well as correlations between indices of reappraisal. As expected, the two reactivity indices were significantly correlated, r (89)=.73, $p<.001$. Also as expected, uninstructed reappraisal was positively correlated with the frequency of reappraisal (i.e., as a strategy of choice to decrease negative emotion in the situation), $r(88)=.33$, $p<.003$. Reappraisal self-efficacy was positively correlated with cued reappraisal, $r(80)=.39$, $p<.001$ and with uninstructed reappraisal, $r(88)=.21$, $p<.05$. For all correlations a two-tailed test of significance was used.

Table 1 Internal-consistency and inter-rater reliability of the reactivity and regulation (REAR)-situation task

Index	Internal consistency[a]	Inter-rater agreement[b]
Intensity of emotion reactivity	.89	
Frequency of emotion reactivity	.79	.92
Uninstructed reappraisal		.86
Cued reappraisal		.93
Frequency of regulation failure		.75
Frequency of avoidance		.74
Frequency of seeking help		.86
Frequency of problem solving		.76
Frequency of distraction		.79
Frequency of reappraisal		.93
Frequency of relaxing		.81
Frequency of venting		–[c]
Frequency of suppression		.68

[a] Internal consistency was calculated for quantitative indices in the full sample, N=91

[b] Inter-rater reliability was calculated for indices based on content analysis, as a correlation between two raters in a random sub-sample of 20 participants

[c] The random sub-sample included no cases of venting

Results

Participants Characteristics

The two groups did not differ in age (M_{NAC}=13.74, SD=1.93, M_{AD}=13.42, SD=2.38), $t(89)=.69$, $p>.49$ or in gender, $X^2(1, N=91) = .09$, $p>.75$. All participants' scores on reading and vocabulary tests were within normal range. Table 2 presents the clinical characteristics of the two participant groups. As expected, the AD had greater anxiety according to child and parent reports, and higher self-report depression scores than the NAC. Two AD participants' scores in the SCARED-C, the self-report questionnaire used to evaluate severity of anxiety symptoms, were removed from analyses as they were more than 2.5 SD lower than parents' equivalent reports and were lower than would be

Table 2 Clinical characteristics of the anxious and non-anxious control groups

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***

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)

*p<.05, **p<.01, ***p<.001.

expected based on the ADIS-C. While the three AD subgroups did not differ in clinical symptoms, the separation anxiety disorder (SAD) subgroup was younger than the other two subgroups, $F(2, 46)=8.34$, $p<.01$.

Group Differences in Emotional Reactivity

Comparisons between the two groups are shown in Fig. 1. As expected, the AD participants manifested greater negative emotional reactivity, demonstrated by higher intensity and frequency of negative emotional responses to the stimuli. Specifically, as shown in Fig. 1a, the AD participants had significantly higher average rates of negative emotion in response to the situations than NAC participants, $t(72)=-7.03$, $p<.001$, $d=-1.44$. In addition, as shown in Fig. 1b, the AD negatively appraised higher proportion of the situations compared with the NAC participants, $t(87)=-4.61$, $p<.001$, $d=-0.99$.

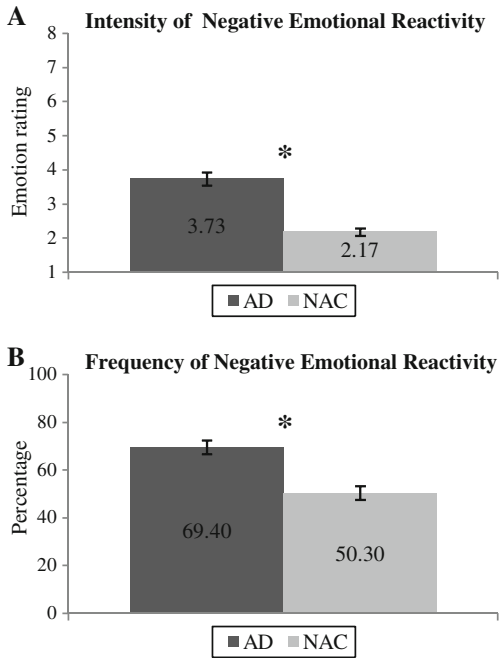

Fig. 1 Intensity (**A**) and frequency (**B**) of negative emotional reactivity in anxious (AD) versus non-anxious (NAC) participants. * p<.05. *Error bars* = standard errors of the means

Group Differences in Reappraisal

As presented in Fig. 2a, compared with the NAC participants, AD participants demonstrated less uninstructed (spontaneous) reappraisal, $t(67)=3.26$, $p<.003$, $d=0.72$. Figure 2b shows that the AD participants also had lower ability to reappraise under cue, $t(79)=2.71$, $p<.009$, $d=0.62$. Finally, as shown in Fig. 2c, the AD participants rated a substantially lower proportion reappraisals as having the ability to improve their feeling in the situation, compared with the NAC participants, $t(78)=6.74$, $p<.001$, $d=1.03$.

Group Differences in Emotion Regulation Profile

A two-ways ANOVA with 2(group) × 8(strategy) yielded as expected a significant interaction effect, $F(7, 711)=8.40$, $p<.001$, partial eta-squared (ηp^2)=.07. We continued with *t*-tests to further examine our specific hypotheses. As shown in Fig. 3, AD participants used avoidance more than NAC participants, $t(77)=-3.71$, $p<.001$, $d=-0.75$. In regard to situation modification, AD participants used more seeking help from others, $t(87)=-2.20$, $p<.04$, $d=-0.47$, and less used problem solving compared with the NAC, $t(87)=2.77$, $p<.008$, $d=0.59$. No significant difference was found in the use of attention deployment strategies (i.e., distraction). The groups differed in the use of cognitive change, as the AD participants used significantly less reappraisal than the NAC participants, $t(87)=2.88$, $p<.006$, $d=0.62$. There was no difference between the groups in the use of strategies for response modulation.

In addition, the AD participants had a higher proportion of regulation failure $t(87)=-2.27$, $p<.03$, $d=-0.48$. Unexpectedly, the AD participants used a greater number of different strategies in effort to down-regulate their emotions compared with the NAC, $t(87)=-2.11$, $p<.04$, $d=-0.45$.

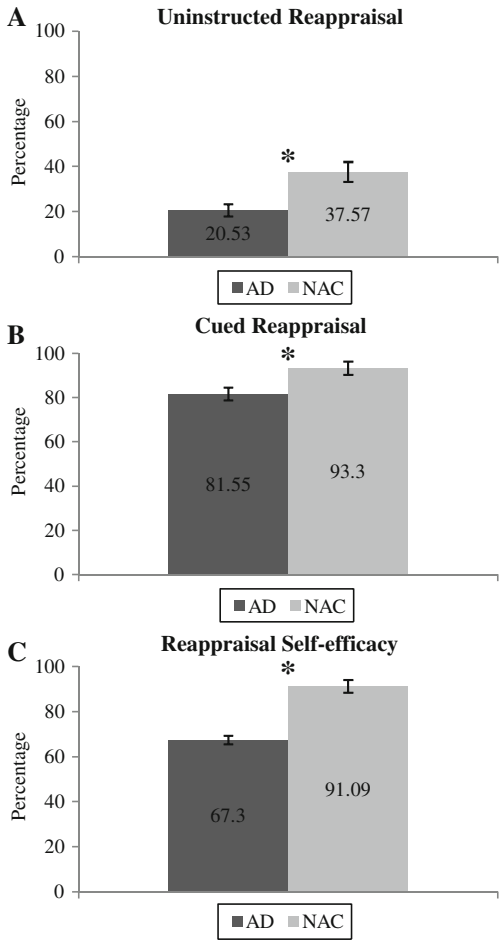

Fig. 2 Uninstructed reappraisal (**A**), cued reappraisal (**B**), and reappraisal self-efficacy (**C**) in anxious (AD) and non anxious (NAC) participants. * $p<.05$. *Error bars* = standard errors of the means

Emotional Reactivity, Regulation, and Symptom Severity

In secondary analyses, we examined whether indices of emotional reactivity predicted symptom severity in the AD group. As we expected significant positive correlations, we used one-tailed test of significance. Indeed, both intensity and frequency of negative emotion positively correlated with anxiety severity according to child, ($r(46)=.59$, $p<.001$, $r(46)=.53$, $p<.001$, respectively) and according to parent ($r(47)=.28$, $p<.03$, $r(47)=.24$, $p<.05$ respectively). In addition, positive correlation was found between intensity and frequency of negative emotion and depression severity ($r(48)=.40$, $p<.005$, $r(48)=.31$, $p<.02$, respectively). We also tested whether indices of emotion regulation predicted symptom severity and used two-tailed test of significance for these correlations: Uninstructed reappraisal was negatively correlated with the severity of child report anxiety, $r(46)=-.29$, $p<.05$. The frequency of avoidance, seeking help and problem=solving were correlated with anxiety severity. Specifically, anxious individuals who had greater use of problem solving were less anxious according to both child and parent reports ($r(48)=-.40$, $p<.003$, $r(47)=-.27$, $p<.03$, respectively), however those who had greater use of seeking help were more anxious according to child and parent ($r(46)=.26$, $p<.04$, $r(48)=.24$, $p<.05$, respectively). Similarly, positive correlation was found between the frequency of avoidance and severity of anxiety symptoms according to parent report, $r(48)=.40$, $p<.003$.

Discussion

The current study compared anxious and non-anxious children, aiming to empirically address the nature of emotion dysregulation in childhood anxiety. Specifically, we aimed to examine whether anxious children suffer negative emotional hyper-reactivity and whether they display distinct emotion regulation difficulties in emotional situations that resemble real-life situations in childhood.

Emotional Reactivity in Childhood Anxiety Disorders

Our findings support the idea that anxiety disorders are characterized by negative emotional hyper-reactivity, operationalized as frequency of negative emotional activation and intensity of emotional response. Compared with non-anxious controls, anxious participants appraised a higher proportion of the stimuli as negative and threatening. For example, in response to the situation, "You walk in the street and a car slows down beside you," anxious participants responded with appraisals such as "Someone is going to kidnap me," while the non-anxious participants had appraisals such as "Someone wants to ask for directions." This result is consistent with previous findings showing interpretation bias in anxious adults, children and adolescents (Barrett et al. 1996; Bogels and Zigterman 2000; Chorpita et al. 1996; Richards and French 1992). Given that appraisals of threat are believed to activate negative emotions, and that the stimuli used in the REAR-Situation task resemble situations children confront in everyday life, this finding suggests that anxious children may be more vulnerable to frequent experiences of negative emotions than non-anxious individuals.

Indeed, we found that anxious participants responded with greater intensity of negative emotion. This result extends previous findings in anxious adults of greater self-reported emotion (Mennin et al. 2005; Turk et al. 2005), as well as greater responses in real-time emotional activation (Goldin et al. 2009; Mennin et al. 2005). This finding is also consistent with previous findings of higher intensity of emotional reactivity in anxious children and adolescents (Carthy et al. 2009; Killgore and Yurgelun-Todd 2005;

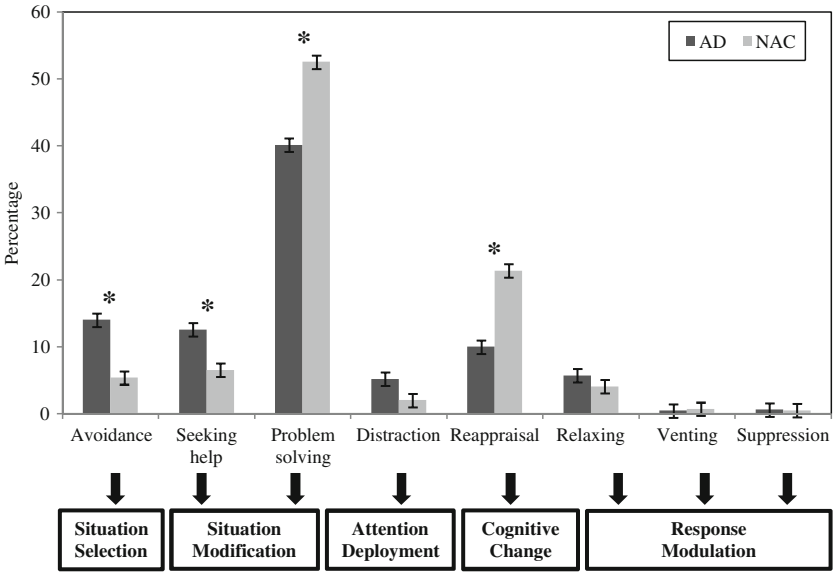

Fig. 3 Emotion regulation profile for anxious (AD) and non-anxious (NAC) participants. Each emotion regulation strategy assessed in the task is connected with arrow to the family of emotion regulation strategies it belongs to according to the process model of emotion regulation (Gross 1998). * $p<.05$. *Error bars* = standard errors of the means

Suveg and Zeman 2004; Thomas et al. 2001). Our finding of heightened experienced negative effect in a laboratory context with mild-to-moderate level of threatening stimuli suggests that in real-life, anxious children may suffer even more intense experiences of negative emotion.

Reappraisal Deficits in Anxious Children

Our REAR-Situation task provided an assessment of several aspects of reappraisal. A first point of difference between anxious and non-anxious participants was that anxious participants were less likely to spontaneously use reappraisal. Importantly, this ability to apply reappraisal without an external cue seems to predict severity of anxiety symptoms: participants who were able to spontaneously apply reappraisal more often reported lower anxiety scores. This finding is consistent with prior empirical evidence which showed reappraisal is a particularly effective form of emotion regulation.

We also found that anxious participants had difficulty applying reappraisal when they were directly cued to do so, though overall they did manage to reappraise a large proportion of the situations. These findings are consistent with our prior finding that anxious participants had greater difficulty using reappraisal with threatening pictures however, did manage to reappraise high proportion of images (Carthy et al. 2009). It is interesting that there were no significant correlations between cued-reappraisal and severity of anxiety symptoms. One potential interpretation of this finding is that the anxious participants have an impaired ability to reappraise, however the crucial deficit is in the ability to apply this strategy in natural setting when no external cues for regulation exist. It is also worth mentioning that these deficits were demonstrated in the 'safe' environment of the lab, implying that in real-life situations, the deficits might be more substantial.

Given these difficulties in reappraisal, and the anxious participants' emotional hyper-reactivity, it is not surprising that anxious participants had lower levels of reappraisal self-efficacy than non-anxious participants. This finding is consistent with prior reports that anxious individuals say they have difficulty with emotion regulation (Mennin et al. 2005; Salters-Pedneault et al. 2006; Suveg and Zeman 2004) and with findings of lower perception of control over anxiety (Weems et al. 2003), as well as overall lower sense of control in anxious people (Muris et al. 2003; Weems and Silverman 2006). Taken together, these findings suggest that anxiety disorders involve a combination of actual and perceived deficits in regulation ability.

The Emotion Regulation Profile in Childhood Anxiety Disorders

Children with anxiety disorders had an emotion regulation profile characterized by relatively higher reliance on avoidance and on seeking help of others, while lower use of problem-solving and of reappraisal. In addition, this profile involved a relatively higher frequency of failures to apply any regulation strategy in negative emotional situations.

Anxious participants' relatively high use of avoidance may be the result of their efforts to prevent the emergence of intense experiences of anxiety. This finding is consistent with overt avoidance behaviors that are a salient clinical feature in anxiety disorders, as well as with previous findings in anxious adults (e.g., Tull and Roemer 2007). Anxious participants' lower use of reappraisal is consistent with the lower cued reappraisal, the lower use of uninstructed reappraisal, and lower reappraisal self-efficacy demonstrated

by the AD participants in the task. It is also in line with previous finding of lower use of reappraisal in everyday life, according to anxious children' self-report (Carthy et al. 2009). Anxious participants' lower use of problem solving and of reappraisal may reflect lower ability or motivation to engage in a self-directed change of the negative emotional stimuli, either practically (i.e., via situation modification) or cognitively (i.e., via cognitive change). One potential reason for this may be their negative emotional hyper-reactivity that especially in highly emotional contexts may overwhelm the cognitive resources necessary for these regulation strategies.

No only our findings suggest anxious children's regulatory processes do not typically include some of the most effective emotion regulation strategies, two of the three most used strategies by the anxious participants were avoidance and seeking help of others. Moreover, together with their relative high regulation failure, these responses represent 38.39% of their regulatory acts, twice the 18.85% of the non-anxious participants' use of avoidance, seeking help and regulation failure. This combination makes the anxious more vulnerable for maladaptive outcomes. Specifically, frequent failures to regulate may lead to overwhelming negative experience, early termination or impaired performance in the emotional situation. Thompson and Calkins (1996) used the term 'two-edged' sword strategies, for strategies such as avoidance that are efficient in reducing anxiety in the short term however, lead to more anxiety and functional impairments in the long-term. Another potential negative outcome of frequent use of these strategies is further decreasing regulation self-efficacy (e.g., reliance on help of others or avoiding the emotional stimuli, may promote perception of limited ability to regulate one's negative emotion).

While it has long been suggested anxious individual suffer impaired sense of self-efficacy and control (for detailed review: Weems et al. 2007), recent studies narrowed their examination and demonstrated anxious' suffer impaired feeling of control over their anxiety, also named emotional self-efficacy (Landon et al. 2007; Weems et al. 2003). This subjective experience is not at all surprising considering the unpleasantness of anxiety and the fact anxious people experience it more often and more intensely than non-anxious individuals. Interestingly, this specific sense of self-efficacy in controlling or regulating one's emotional experience was found to predict actual frequency of regulation strategies in Tamir et al. (2007) and in the current study (i.e., uninstructed reappraisal). It also predicted the ability to reappraise under cue according to our findings. Moreover, regulation self-efficacy was an important predictor of the severity of anxiety symptom in Landon et al. (2007) and in Weems et al. (2003). These findings suggest impaired regulation self-efficacy may have a significant contribution to anxious' emotional difficulties.

The fact anxious children used more regulation strategies overall than the non-anxious children may reflect their regulation difficulties. Our plausible interpretation for this finding is that the more anxious children feel they are less capable to regulate, the more they try other strategies in search for something that would decrease their negative emotion.

Implications for Assessment and Treatment

The REAR-Situation task is a psychometrically sound instrument for the assessment of emotional reactivity and regulation. It evaluates two aspects of emotional reactivity (frequency and intensity), three aspects of reappraisal, including uninstructed reappraisal, cued reappraisal and reappraisal self-efficacy. In addition, the REAR-S permits an evaluation of the extent and variety of use of a wide range of emotion regulation strategies in everyday-life emotional situations. It has shown good internal consistency as well as inter-rater reliability. The significant internal correlations between emotional reactivity measures as well as between different aspects of regulation (uninstructed reappraisal, cued reappraisal and reappraisal self-efficacy) support the construct validity of the REAR-Situation task.

In addition to its quantitative indices of emotional reactivity and regulation, the REAR-S task provides rich qualitative information. It provides a structured context in which to observe the ways an individual appraises situations, the contents that provoke significant threat (e.g., social, performance), and how this threat is handled. Hence, the REAR-S conveys diagnostic information regarding emotional vulnerability that is not possible with current self-report measures. As emotional reactivity seems to be a substantial predictor of severity of anxiety symptoms according to our findings and other report (Carthy et al. 2009), the scores of emotional reactivity in the REAR-Situation task may serve as indirect indication of clinical severity and may enhance other direct forms of clinical assessment. As current treatments devote significant effort helping patients increase their ability to handle negative situations and regulate negative emotions, the task may be administered before and after treatment in order to evaluate clinical change.

In terms of treatment implications, our findings support the importance of, 1) increasing patients' awareness of their emotional reactivity (e.g., which objects or situations trigger intense negative emotional response and why) and, 2) Enhancing understanding of the functionality of emotions (including negative emotions) and amplify tolerance to negative emotional experiences (e.g., by reappraising one's emotional reactivity as an internal 'threat detection system' that is sometimes overly sensitive and prone to providing

false alarms), 3) increasing awareness of regulatory style (i.e., what type of regulation strategies are employed in negative emotional situations) and 4) facilitating rehearsal of less-used regulation strategies (e.g., reappraisal, problem-solving, relaxing), with the goal of expanding the repertoire of healthy emotion regulation strategies and improving these strategies' accessibility in real time situations (e.g., developing cues for regulation). In addition to strengthening actual regulation abilities, addressing regulation self-efficacy may be crucial to therapeutic success. Progress here may involve enhancing regulation self-efficacy in other and relatively easier emotional fronts (e.g., anger, sadness), and reinforcing the belief that patterns of emotional reactivity and regulation are changeable.

Limitations and Future Directions

Despite its strengths, the REAR-Situation task has limitations. The fact that it involves different types of threatening contents ensures generalization of findings across different classes of threatening stimuli and fits the characteristics of our sample that included several anxiety disorders, as well as the natural high co-morbidity of anxiety disorders at this age group. However, it limits our ability to address content specificity of reactivity or regulation processes. In addition, the focus on threatening situations limits our ability to address the characteristics of reactivity and regulation in other emotional responses (e.g., anger, sadness) or in other clinical conditions (e.g., depression).

A second important limitation of the present study is its setting. Even though the task provoked substantial negative emotional responses, this task took place in a laboratory context. This fact may have decreased the level of emotional reactivity, limiting our ability to generalize our findings to contexts in which higher levels of emotional reactivity are evident. It may be that real life situations would reveal more severe deficits in regulation abilities and a more distinct profile of emotion regulation than we found. One of the ways to address this potential ecological limitation can be using a similar procedure to assess current situations in the patient's life.

Finally, the study's sample raises the question of generalization to different cultures. Our study represents a unique sample of Israeli children and it will be important to examine whether cultural differences as well differences in environmental threat are related to differences in emotional reactivity and regulation. Such studies will extend the present findings, allowing for a more comprehensive understanding of the role of emotional reactivity and regulation in psychopathology, preparing the way for more effective and targeted forms of assessment and intervention.

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