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Threat is in the eye of the beholder

De Hullu, Eva

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Threat is in the Eye of the Beholder

Cognitive Bias Modification in the Prevention of Adolescent Social Anxiety

Eva de Hullu

2012

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Threat is in the Eye of the Beholder

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Promotores:	Prof. dr. P.J. de Jong
	Prof. dr. R.B. Minderaa
Copromotor:	Dr. M.H. Nauta
Beoordelingscommissie:	Prof. dr. E.A. Holmes, University of Oxford
	Prof. dr. P.E.H.M. Muris, Maastricht University
	Prof. dr. R.W.H.J. Wiers, University of Amsterdam

Contents

Chapter 1

General Introduction

Outline of the current thesis

The research project presented in this thesis concerns a preventive intervention for adolescent social anxiety. In this introduction, I will first focus on social anxiety disorder in adolescents: what characterizes socially anxious adolescents and why is social anxiety such a persistent disorder? One of the answers to these questions is that socially anxious people tend to process emotional information in a way that increases and maintains anxiety. The way in which these processes are involved in anxiety vulnerability is outlined in an integrative model that I will introduce in this first chapter and which will serve as a framework for this thesis. In this model, certain cognitive processes such as attention and interpretation are hypothesized to be dysfunctional or biased in socially anxious adolescents. These processes will be introduced in this first chapter, and in chapter 2, 3, and 4 we tested whether these processes are indeed differentially involved in adolescents with an elevated level of social anxiety.

Subsequently, we tested whether an intervention specifically designed to modify these cognitive biases was able to influence symptoms of social anxiety in high socially anxious adolescents at the short term and long term. The outcomes of this randomized controlled trial until one year follow-up are presented in chapter 5, while chapter 6 focuses on the long term effects at two year follow-up. In chapter 7 we tested whether we were really able to change cognitive biases as we intended, at both short term and long term. Finally, I will summarize the empirical findings in chapter 8 and discuss the implications of our findings for understanding adolescent social anxiety and the options for prevention.

Social Anxiety in Adolescence

Adolescence, as the transitional period between childhood and adulthood, is characterized by a vast number of developmental changes and challenges, including hormonal and sexual maturation, and expanding social networks and increasing social and academic expectations from the social environment. These developments render some young adolescents vulnerable to develop increased fear of negative evaluation and social rejection. The most common situations that provoke social anxiety in younger adolescents are unstructured social situations, such as being in the school hallways or cafeteria, joining in on conversations or attending parties. Older socially anxious adolescents usually fear structured and compulsory situations, such as public performances or speaking to authority figures (Hofmann et al., 1999). Some adolescents fear these situations to such an extent that they develop a social anxiety disorder. Social anxiety disorder, as defined by the DSM-IV (American Psychiatric Association, 2000) is characterized by a marked and persistent fear of one or more social or performance situations in which the person is exposed to unfamiliar people or to possible scrutiny by others. The individual fears that he or she will act in a way that will be humiliating or embarrassing. This feared social situation must almost invariably provoke anxiety and will be avoided or endured with intense anxiety or stress. The avoidance, anxious anticipation or distress in the feared social or performance situation interferes significantly with the adolescent's normal routine, academic functioning or social activities or relationships.

Social anxiety disorder is one of the most common mental disorders in adolescents, with about 9.5% of girls and 4.9% of boys facing social anxiety disorder in their adolescent period (14-24 years old; Wittchen & Fehm, 2003). Adolescents suffering from symptoms of social anxiety are more likely to experience difficulties in social interactions and the development of social skills, show poor self-esteem and academic underperformance (Stein & Kean, 2000). Since social anxiety is known to have a chronic course, symptoms during adolescence can persist into adulthood and lead to a full-blown social anxiety disorder or other anxiety disorders, depression and alcohol or drug misuse (Wittchen, Fuetsch, Sonntag, Müller, & Liebowitz, 2000).

Cognitive processes in the development and maintenance of social anxiety

Social anxiety is a very persistent and chronic condition, and although socially anxious people engage in many social situations, social anxiety does not disappear easily. One way of understanding this persistence is looking at information processing in socially anxious people, in particular the processing of information associated with their fears: signals of social evaluation or rejection. Current models of social anxiety include

cognitive information processing as a vulnerability factor (e.g., Clark & Wells, 1995; Heinrichs & Hofman, 2001; Kearney, 2005; Rapee & Heimberg, 1997; Rapee & Spence, 2004). When encountering an ambiguous social situation, socially anxious people are hypothesized to process the information in that situation in a way that confirms their fears and increases anxiety. A model that thoroughly describes the role of information processing in the development and maintenance of anxiety, is the multi-process model of cognitive vulnerability to anxiety by Ouimet, Gawronski and Dozois (2009), which integrates current dual system models (e.g., Strack & Deutsch, 2004) with available evidence on anxiety-related biases in attention and interpretation of threatening information. Since this model serves as a framework to link together the studies presented in this thesis, I will present this multi-process model of cognitive vulnerability to anxiety in the context of social anxiety (see figure 1.1) in the following section.

A multi-process model of cognitive vulnerability to anxiety

Increasing evidence in the social-cognitive literature (e.g., Gawronski & Bodenhausen, 2006; Strack & Deutsch, 2004) points towards the existence of two distinct systems that operate in tandem to process emotional information. The *associative* system is characterized by a rapid activation of associated concepts (associative processing) while the *rule-based* system involves the more 'rational' analysis of factual relationships between concepts (rule-based processing) (Ouimet et al., 2009). The associative system organizes mental representations on the basis of similarity and temporal contiguity, but does not consider the truth or accuracy of the links between concepts. The rule-based system on the other hand, can be described as the rational analysis of factual relations between concepts. Accordingly, one of the central characteristics of this system is its concern with validity; that is, evaluating whether a link between concepts is true or accurate. The actual behavioral response is assumed to be influenced by the interaction of the associative and rule-based system.

Current models of cognitive vulnerability to anxiety (e.g., Beck & Clark, 1997; Daleiden & Vasey, 1997) posit that individual differences in the processing of threat-relevant material contribute to the development and maintenance of anxiety disorders. Research in (social) anxiety has mainly focused on the function of selective attention to threatening stimuli (Cisler & Koster, 2010) or biased interpretation of ambiguous information (Heinrichs & Hofman, 2001; Hirsch & Clark, 2004). The model described by Ouimet et al. (2009) integrates individual differences in attention to threat and interpretive biases into the dual-system framework, as behavioral responses that are influenced by both the associative system and the rule-based system.

The multi-process model of cognitive vulnerability to anxiety assumes that upon encountering a given **stimulus** (e.g., during a presentation, looking into the audience and seeing one person yawning), corresponding concepts in the associative system will be activated (if one is socially anxious, the associations will likely be *I am boring, I am a failure*). If these **associations** are threat-related, safety-oriented behavioral schemata will be activated, which includes the immediate **orientation** toward the threatening stimulus. Thus, a central individual difference factor at this initial stage of processing is the strength of associations between a stimulus and threat-relevant concepts (e.g., *presentation – failure*).

A central assumption in this dual-system model is that the two systems operate in parallel. Thus, if a stimulus spontaneously activates corresponding concepts in the associative system, the rule-based system will immediately use the input from the associative system to **interpret and appraise** that stimulus. To the degree that these inputs include threat-related associations, the stimulus will be interpreted as threatening. In the case of social anxiety, an ambiguous social situation (*a person yawning in the audience*) will be interpreted as threat based on the strength of the associations between this situation and threat. Although a large part of this process occurs beyond intentional control, there is some room for strategic influence when there is strong additional information that marks the proposition as untrue.

Following the onset of orientation responses, threat-related associations in the associative system will enhance **attentional engagement** with the stimulus parallel to the process of interpreting that stimulus. This engagement in turn increases the activation of threat-related associations, implying a positive feedback loop

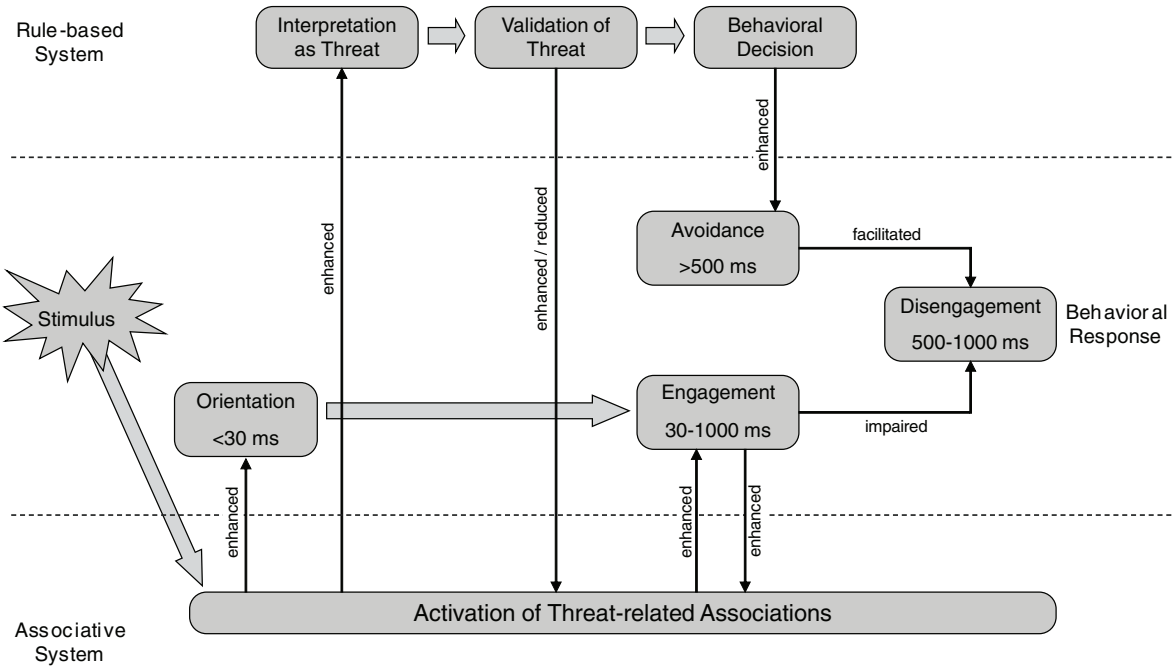

Figure 1.1. Multi-process model of cognitive vulnerability to anxiety by Ouimet, Gawronski and Dozois (2009).

with rather dysfunctional consequences. For example, the capture of attention distracts you from your task or anxiety increases while that is unnecessary in the current context.

If the stimulus is interpreted as threatening, this initial interpretation can be **validated** in the rule-based system and be either affirmed (*this person yawning means that my presentation is boring*), negated (*this person yawning does not mean that my presentation is boring*) or reappraised (*this person yawning means that it's too hot in this room*). Affirmation of threat enhances the activation of threat-related associations which in turn enhances attentional engagement with the stimulus. A behavioral decision made in the rule-based system that a stimulus is threatening will lead to attentional avoidance of the stimulus (*not looking at the person yawning*) in order to reduce the continuous activation of threat-related associations caused by the stimulus. This avoidance will facilitate disengagement but the associative system will simultaneously enhance engagement with the threatening stimulus (*is the person still looking bored?*), thus producing a response conflict. This conflict can be seen as impaired **disengagement**, when both systems have opposite effects on attentional disengagement.

The way out of this system is a challenge for the rule-based system. The positive feedback-loop in which threat-related associations are activated together with enhanced attentional engagement, can be disrupted by either directly deactivating threat-related associations in the associative system (through the validation process) or executing a behavioral response that moves the attention away from the threatening stimulus (attentional avoidance). Reappraising the stimulus as being a sign of something different than threat will deactivate threat-related associations, reduce attentional engagement and decrease anxiety. Negating may lead to ironic effects such that it enhances the link between stimulus and threat instead of reducing the associations (*presentation – not boring* still links *boring* to *presentation*) and thus will not decrease the strength of this association nor provide alternative and more beneficial links. Attentional avoidance is different from avoidance as usually known in the context of social anxiety, where the anxious person avoids encountering the threatening situation. By attentionally avoiding the particular threatening stimulus in a situation, threat-related associations will stop being activated, thus disrupting the cyclic process of increased or maintained anxiety.

According to dual-systems theories of behavior, the behavioral impact of rule-based processes is reduced under conditions of either low motivation or low cognitive capacity. Associative processes are likely to prevail over rule-based processes when the stimuli are highly arousing, because this impairs cognitive capacity. A threatening social situation will increase arousal in a socially anxious person, while at the same time working memory is occupied by the activity of processes in the associative and rule-based system. Thus, individual differences in working memory capacity will influence whether the associative system or rule-based system are stronger in determining behavior.

The model described above explains why social anxiety is such a persistent disorder. Under the condition that the associative system contains associations that link social situations with negative outcomes and a person does not have the cognitive resources or is not able to reappraise the situation in a positive way, social situations will invoke anxiety and strengthen the dysfunctional associations. This loop increases the chance that a second encounter with such an ambiguous social situation will invoke a similar reaction and thus increase symptoms of social anxiety.

The sources of cognitive vulnerability described in the model above can also be used as a target for clinical interventions. Threat-related associations may be reduced through exposure to a feared stimulus in a context that produces a positive or neutral outcome instead of the feared negative outcome. Exposure is a core component of current cognitive behavioral therapy (CBT) interventions for social anxiety. Repeated success in a previously feared environment disconfirms the negative expectations, and may even create a new link between the feared stimulus and positive emotion (e.g., pride; Teachman & Woody, 2003). Another target for intervention is the evaluation of threat-related associations in the rule-based system, where reappraisal of the stimulus as *safe* instead of *threatening* is assumed to be a way to strengthen positive associations and disrupt the attentional cycle. Cognitive restructuring as used in CBT interventions is one way of decreasing anxiety through the rule-based system; for example, through changing the dysfunctional cognition *If I fail this test I'm worthless* into a more functional *If I fail this test I'll be disappointed, but I am still a worthwhile person to my friends and family*.

A first hypothesis that could be derived from the model described above is that certain aspects of information processing represent vulnerabilities for developing anxiety disorders. Therefore, dysfunctional associations and biased information processing are hypothesized to be present in individuals without a current anxiety disorder, but with a high risk of developing social anxiety disorder. In the present thesis, this idea will be tested: do adolescents with an elevated level of social anxiety differ from adolescents with few or no symptoms of social anxiety? Do socially anxious adolescents show a stronger tendency to associate social information with negative outcomes; do they show a stronger tendency to point their initial attention to signs of social rejection and do they interpret ambiguous social information in a negative or less positive way?

Second, one important implication of this model is that dysfunctional cognitive processes that are the target of curative interventions can likewise be targeted in a preventive setting, such as in a high vulnerability group of adolescents with an elevated level of social anxiety. In the second part of this thesis, I will describe a study in which a preventive intervention aimed at decreasing symptoms of social anxiety directly targets information processing in high socially anxious adolescents.

Part I: Information processing in high socially anxious adolescents

Automatic Threat-related Associations

As described in the model above, associations between social situations and negative outcomes are at the basis of information processing biases in social anxiety. When a certain situation does not activate expectancies of a negative outcome, cognitive biases would not be enhanced and fearful responses would not arise. Recent dual process models emphasize the importance of differentiating between initial automatic associations elicited by a threatening stimulus and explicit associations, formed afterwards in the deliberate, rule-based memory system. For example, automatic associations show a differential predictive value in predicting rela-

tively automatic fear behaviors, in contrast with more controlled behavior (Egloff & Schmukle, 2002; Huijding & de Jong, 2006). Since people may be unaware of their automatic associations to certain cues, and/or may dismiss these associations as irrelevant or invalid, explicit self-report measures such as questionnaires are unable to tap into associative networks properly (Schnabel, Asendorpf, & Greenwald, 2008). Therefore, several reaction-time instruments have been developed to assess the relative strength of automatic associations. An instrument that is often used to tap into implicit attitudes is the Implicit Association Test (IAT; Greenwald, McGhee, & Schwartz, 1998). This task measures automatic associations to relevant stimuli by measuring response times and does not rely on explicit awareness of the association that is tested. Participants are instructed to sort stimuli that appear on the screen into one of four separate categories: two target categories and two attributes. Most commonly, the target categories represent two extremes of a concept, e.g., *self – other* and the attribute categories two extreme labels, e.g., *positive*, *negative*. The strength of the associations between target and attribute is measured by comparing the ease of sorting stimuli of the target category (e.g., *self*) when it shares a response button with a certain attribute category (e.g., *negative*), compared to the other attribute category (e.g., *positive*). In the studies described in this manuscript, we used a modification of the IAT (a single-target IAT, see figure 1.2), in which stimuli have to be sorted into a single category or two attribute categories. Unlike the IAT, the stIAT does not need to compare two contrasting target categories, such as self and other, and seems more suitable for measuring associations to targets without obvious contrast categories, such as school- or social activities (Wigboldus, Holland, van Knippenberg, den Hartog en Belles, 2002). We were primarily interested in the way socially anxious adolescents processed social anxiety-relevant associations, and the stIAT allows us to focus specifically on the automatic associations between social anxiety-relevant stimuli and expected outcomes of these situations.

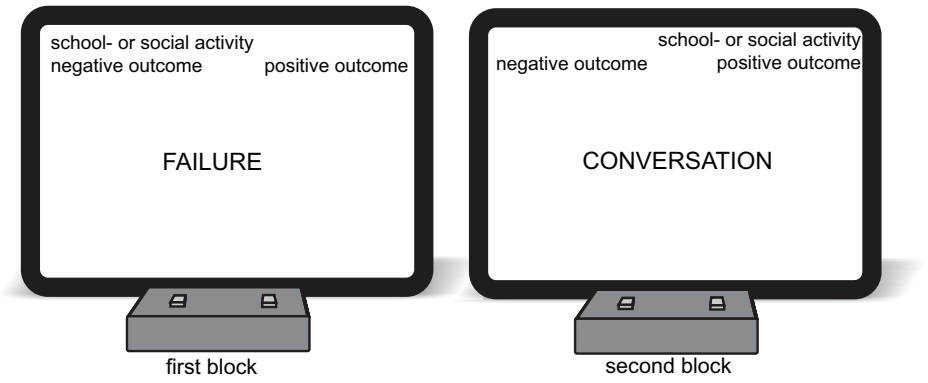

Figure 1.2. Presentation of target categories and attributes in the single-target IAT. In the first block, the target category and the negative outcome attribute share the left response button, and the positive outcome attribute label is always on the right side. Participants should respond in the first trial by pressing the left button, sorting failure into negative outcome. In the second block, the target category switches to the right side, now sharing the response button with the positive outcome attribute. In the second example, participants should respond by pressing the right button, sorting conversation into school- or social activity.

Literature on the role of automatic associations in social anxiety is still quite limited but there is some preliminary evidence that socially anxious adults show a more negative automatic attitude towards social stimuli, compared to low-anxious participants (de Jong, Pasman, Kindt, & van den Hout, 2001). Self-anxiety associations differ between clinically socially anxious people and healthy controls (Gamer, Schmukle, Luka-Krausgrill, & Egloff, 2008) and are correlated with trait social anxiety (Westberg, Lundh, & Jönsson, 2007). Also, automatic associations between self and anxiety have been shown to be reduced following treatment (Clerkin & Teachman, 2010; Gamer et al., 2008) or increased by a social stress task (Westberg et al., 2007). A recent study examining automatic affective associations in children and adolescents found that anxious children and adolescents had stronger automatic negative associations with anxiety-relevant stimuli than non-anxious children (Vervoort et al., 2010). Specifically in adolescent social anxiety, social anxiety-relevant

behavior (clinging behavior with peers) was predictive of subsequent implicit fear of negative evaluation (in an IAT with self-other categories and rejected-liked attributes) in a longitudinal design (Teachman & Allen, 2007). As implicated in the model of Ouimet et al. (2009) individuals with a high vulnerability for developing social anxiety disorders are hypothesized to show relatively strong negative automatic associations towards social situations. To test this hypothesis, in chapter 2 we compared automatic associations to social- and school situations in adolescents who are at risk for developing social anxiety to adolescents with few or no symptoms of social anxiety.

Attentional bias to threat

In anxious adults, attentional bias to threat is a relatively robust phenomenon (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van IJzendoorn, 2007; Staugaard, 2010), that has been shown across anxiety disorders and with various types of experimental tasks. People diagnosed with anxiety disorders are known to selectively attend to information representing their concerns (i.e., rejecting faces in social anxiety). Different components of attentional bias (facilitated attention/vigilance, difficulty in disengagement and attentional avoidance) have been identified to play a role in anxiety (Cisler & Koster, 2010). Facilitated attention to threat may be a relative automatic process, whereas difficulty to disengage and attentional avoidance can be influenced by more strategic processes such as attentional control and emotion regulation goals. There is evidence that high socially anxious participants show initial vigilance for emotional faces but then switch their attention away from the emotional stimulus (attentional avoidance; Garner, Mogg, & Bradley, 2006). The design of tasks to measure attentional bias, in particular stimulus presentation times, appears to be very influential in which component of attention is captured and is one explanation of the variability in empirical results with regard to attentional bias in anxiety.

A task that is often used to assess selective attention to threat is the visual probe paradigm, originally developed by MacLeod, Mathews & Tata (1986). In this task (see figure 1.3), participants are seated in front of a computer screen and are instructed to fixate their attention upon a cross in the center of the screen. Two stimuli, one of which is neutral and one of which is threatening, appear simultaneously on either side of the screen for a very short period (most commonly 500 ms). As these stimuli disappear, a target is presented at the location of one former stimulus and participants are instructed to indicate the location (left/right or top/bottom) or properties (e.g., was it an upward or downward arrow) of the target as quickly as possible by key press. The latency between the presentation of the target and the key press is measured during a series of trials. When participants are usually faster in indicating the location or properties of the target when it was presented behind the threatening stimulus compared to trials when the target appeared behind the neutral stimulus, an attentional bias to threat occurs.

Figure 1.3. Example of a single trial on the visual probe task used in the current research project. Participants are instructed to focus on the cross and two stimuli, one negative and one neutral, are presented simultaneously for 500 ms. After the stimuli disappear, an arrow is presented until the participant identifies the arrow by pressing the upward or downward arrow key.

Although attentional bias to threat is an established factor in adult (social) anxiety (Bar-Haim et al., 2007; Staugaard, 2010), results in socially anxious children and adolescents are less straightforward. Anxious children in general have shown to selectively attend to threatening information at both short and longer time intervals (Puliafico & Kendall, 2006), but due to methodological differences between studies (e.g., using Stroop tasks versus visual-probe tasks to measure attentional bias) and generally small sample sizes there is no conclusive evidence yet. Although there is some preliminary support for the notion that enhanced initial attention for signs of social rejection might play a role in socially anxious children and adolescents (Roy et al., 2008; Stirling, Eley, & Clark, 2006), the evidence is very limited and needs further support. If attentional bias to threat is conceptualized as a vulnerability factor, such as described in the model by Ouimet et al. (2009), one would expect that also adolescents who are at risk for developing SAD would already show an attentional bias to social threat cues. Therefore, the study presented in chapter 3 explored whether adolescents with heightened levels of social anxiety (but below the clinical range) are indeed characterized by an attentional bias towards socially threatening information.

Interpretive bias

Interpretive bias is a tendency to interpret ambiguous situations in a relatively negative way. In the context of social anxiety, this situation is usually a social situation in which it is unclear whether the situation is threatening or safe. A colleague walking past you in the street without greeting could mean that he doesn't like you (negative interpretation), that he has difficulty recognizing faces outside of the usual context (neutral), or that he was busy thinking about something and did not notice you, otherwise he would have greeted you (positive). In reality, most social situations contain an element of ambiguity, since it is impossible to know what other people really think of you. This feature of social situations makes interpretive bias an important aspect of information processing in social anxiety. A task that is often used to assess interpretive bias is the recognition task (Mathews & Mackintosh, 2000; Salemink & van den Hout, 2010b). In this task (see figure 1.4), participants read a description of a social situation, followed by a word fragment that they are asked to solve. The social situation remains ambiguous, and a comprehension question appears which makes sure that participants have read the text. After a series of descriptions, the title of the description is repeated and participants are asked to rate the similarity of four different interpretations of the situation to the original situation that they have read before. These interpretations are positive, negative, neutral, or irrelevant. Positive and negative interpretive biases can be derived from the ratings on positive and negative interpretations.

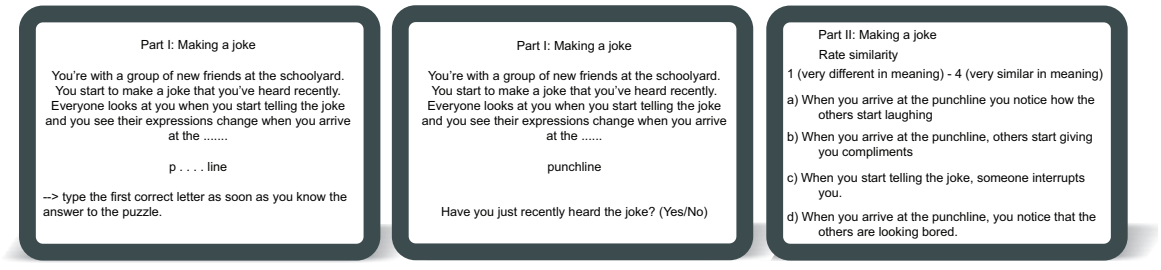

Figure 1.4. Two phases of the recognition task. In part I participants read stories describing ambiguous social situations, that end with a word fragment that has to be solved as quickly as possible by pressing the first missing letter. The story remains ambiguous. Directly after each story and word fragment an easy comprehension question ensures that the text is read. In part II, after a series of ten stories, in random order, the title of a story appears with 4 different interpretations below appearing in random order. Participants have to indicate for each interpretation separately the similarity in meaning to the story they read earlier.

In the context of social anxiety, the existence of an interpretive bias for ambiguous social information has been well-established (Salemink & van den Hout, 2010a). Ambiguous social scenarios are interpreted more negatively by social phobics (e.g., Franklin, Huppert, Langner, Leiberg, & Foa, 2005; Hirsch & Mathews,

2000; Mathews, Richards, & Eysenck, 1989; Voncken, Bögels, & Peeters, 2007) or socially anxious people (e.g., Beard & Amir, 2009; Huppert, Foa, Furr, Filip, & Mathews, 2003; Kanai, Sasagawa, Chen, Shimada, & Sakano, 2010) compared to non-anxious controls or people with other anxiety disorders. Socially anxious people will likely interpret the behavior of an acquaintance passing on the street without greeting negatively: *he does not want to talk to me*, instead of *he's busy thinking about something and did not notice me*. The existence of this interpretive bias in socially anxious or phobic adults has been thoroughly investigated using self-report questionnaires and various paradigms (e.g., word-fragment tasks, recognition test, homophone tasks). The pattern found in interpretive bias in social anxiety research usually shows a negative interpretive bias; which means that socially anxious people tend to interpret ambiguous information in a relatively threatening way (e.g., Kanai et al., 2010; Voncken et al., 2007). This interpretive bias is not caused by current mood state and is specific to social content (Constans, Penn, Ihen, & Hope, 1999; Salemink & van den Hout, 2010b; Voncken, Bögels, & de Vries, 2003). Furthermore, a lack of positive interpretations has been found, which means that socially anxious people, compared to non-anxious people, tend to make less positive interpretations (Beard & Amir, 2009; e.g., Constans et al., 1999; Hirsch & Mathews, 2000). This lack of positive interpretations is probably associated to a generally more negative affect, and not to social anxiety specifically (Huppert et al., 2003).

The existence of interpretive bias in socially anxious adults has been fairly well established, and the same pattern of results emerges in research on childhood anxiety. Anxious children show a negative interpretive bias in which ambiguous situations are interpreted as threatening (Cannon & Weems, 2010; Hadwin, Frost, French, & Richards, 1997; Taghavi, Moradi, Neshat-Doost, Yule, & Dalgleish, 2000) and socially anxious or socially phobic children show an interpretive bias specifically for social situations (Miers, Blöte, Bögels, & Westenberg, 2008). Interpretive bias has been found in various age groups, and no relationship with age was detected (Taghavi et al., 2000). Socially anxious children and adolescents tend to discount positive social events, catastrophize mildly negative social events, and have a more negative anticipation of social events (Vassilopoulos & Banerjee, 2008). They also overestimate the cost and probability of negative social events (Rheingold, Herbert, & Franklin, 2003).

If the tendency to infer relatively negative interpretations in socially ambiguous situations is conceptualized as a vulnerability factor, such as described in the model by Ouimet et al. (2009), interpretive bias is expected to exist in adolescents who are at risk for developing social anxiety disorder due to an elevated level of social anxiety symptoms. The study presented in chapter 4 explored whether indeed high socially anxious adolescents show a stronger tendency to interpret ambiguous social information in a negative or less positive way compared to adolescents with few or no symptoms of social anxiety.

Part II: Interventions targeting information processing in anxiety

The patterns of information processing described above are shown by clinically anxious populations as well as in nonclinical individuals who are vulnerable to develop anxiety disorders. As such, this is consistent with cognitive models that consider the operation of such processing biases to influence the development and maintenance of anxiety disorders (e.g., Daleiden & Vasey, 1997; Kearney, 2005; Ouimet, et al., 2009). If these processes causally influence anxiety, information processing biases would be an appropriate target for therapeutic interventions. Most studies described above employ a cross-sectional design to explore cognitive biases in anxious populations, which does not answer the question whether these biases are the cause or consequence of anxiety. Some predictive studies have shown that cognitive biases do predict heightened emotional reactivity to a subsequent stressful experience (e.g., Amir, Beard, & Bower, 2005; MacLeod & Hagan, 1992). In recent years, however, there has been a rapid increase in studies testing the causal link between cognitive biases and emotional disorders by modifying cognitive biases and testing subsequential effects on emotional vulnerability. To test the causal relation between cognitive biases and emotional vulnerability, techniques that were used to assess cognitive biases have been modified into tasks that aim at manipulating these biases (Grey & Mathews, 2000; MacLeod, Rutherford, Campbell, Ebsworthy, & Holker,

2002; Mathews & MacLeod, 2002) into either positive or negative directions. Koster, Fox and MacLeod (2009) formulated the key principles of Cognitive Bias Modification (CBM) as follows: (1) The direct target of change in each case is a cognitive bias known to characterize a clinical disorder, a clinically relevant symptom, or a personality trait associated with vulnerability to clinical dysfunction and (2) The method of manipulating the target cognitive bias has not principally relied on instruction but instead has involved extensive practice on a cognitive task designed to encourage and facilitate the desired cognitive change (p. 3).

Thus, the central idea behind CBM procedures is that participants perform a simple task in which the experimental contingency encourages the acquisition or reduction of the targeted processing bias. Since its development early in the early 2000s, the therapeutic possibilities of CBM procedures have been tested in various settings and populations. Results in clinically anxious populations are quite promising with effect sizes about equal to traditional cognitive behavioral therapy (CBT) interventions (e.g., Amir, Beard, Burns, & Bomyea, 2009; Schmidt, Richey, Buckner, & Timpano, 2009). Thus far research on the efficacy of CBM exclusively focused on (sub)clinical interventions. However, given the central role of cognitive biases in anxiety vulnerability, it would be interesting to see whether CBM can also be successfully applied in the context of the prevention of anxiety disorders (cf., March, 2010). Therefore, one of the ultimate aims of this project was to test whether indeed CBM can be applied as a preventive intervention. Accordingly, the second part of this thesis will describe our efforts to apply CBM training in the prevention of adolescent social anxiety, in a sample of adolescents at risk for developing social anxiety. First, I will shortly review evidence from earlier studies investigating the effects of cognitive bias modification of automatic associations, attentional bias, and interpretive bias on anxiety vulnerability, and introduce the tasks we used to modify cognitive biases in socially anxious adolescents.

Modifying automatic associations

Although automatic associations seem to be an important factor in anxiety, there are only a few studies which have endeavored to directly manipulate automatic associations. Although strictly speaking, automatic associations are involved in anxiety at a different level than cognitive processing biases such as attentional bias and interpretive bias, a similar procedure could be used to test the assumption that automatic biases are causally related to anxiety vulnerability. Two studies tracking the development of automatic associations over the course of CBT treatment of panic disorder (Teachman, Marker, & Smith-Janik, 2008) and spider phobia (Teachman & Woody, 2003) showed that changes in automatic associations preceded changes in symptoms. Continuing on these findings, Clerkin and Teachman (2010) evaluated whether implicit rejection associations were causally related to symptom reduction in social anxiety. Following a training consisting of an evaluative conditioning task (see De Houwer, Baeyens, & Field, 2005) high socially anxious students (*N* = 108) were asked to complete a public speaking task and fill in anxiety measures. The training task was modeled after a recently developed implicit self-esteem training task in which photographs of smiling faces consistently followed self-relevant information while other-relevant information was followed by neutral or negative photographs (Baccus, Baldwin, & Packer, 2004). Clerkin et al. (2010) used photographs of the current participant pretending to give a speech as self-relevant stimuli, in a 720-trial, 30 minute training. The positive social performance training condition was compared to two control conditions: a neutral social performance condition in which positive, neutral, and critical faces followed personal stimuli, and a condition with no social performance in which non-socially relevant objects were followed by randomly presented positive, neutral, and critical faces. The participants' task was to click on the location of the screen in which the self-, other, or non-socially relevant pictures appeared, after which a face appeared on the same location. Results indicated that following this training, participants in the positive social performance condition were faster in associating self with liked (versus rejected) than individuals in the control groups. There was no direct effect of the training on state anxiety and anticipation anxiety for the public speaking task, but the positively trained group was more likely to complete the public speaking task. Although the impact of the training on anxiety vulnerability

was relatively modest, it provides preliminary evidence that automatic associations can indeed be modified by means of a CBM procedure.

In the current study, we developed a task based on the implicit association test (Greenwald et al., 1998) which aimed to pair social-evaluative situations with positive outcomes. In this task, consisting of 500 trials per session, participants were instructed to sort words appearing on the screen into two categories: Dutch or English. Stimuli were neutral words (e.g., *chair*), words related to (social) evaluative situations, (e.g., *exam*), and positive outcome words (e.g., *success*). Social cues and positive outcome words were both consistently presented in Dutch, and were thus sharing one response button, while neutral words were all in English. The goal of this task was to strengthen the association between (feared) social-evaluative situations and a positive outcome of that situation (for a review of methods available to change automatic associations, see Gawronski & Sritharan, 2010). We also added an evaluative conditioning task that was originally designed by Baccus et al. (2004) in an attempt to strengthen positive affective self-associations (implicit self-esteem). Earlier research showed that improving automatic self-associations had a desirable influence on many relevant parameters including a reduction of physiological stress responses (Dijksterhuis, 2004). These positive effects were attributed to enhanced resilience and reduced sensitivity to negative social-evaluative information. Following this, we hypothesized that adding this task could also have beneficial self-enhancing and stress-buffering effects for socially anxious adolescents.

Modifying attentional biases

To explore whether attentional bias to threat was causally related to anxiety, MacLeod, Rutherford, Campbell, Ebsworthy and Holker (2002) developed a CBM procedure in which they trained participants to orient toward or away from specific emotional stimuli using an adapted visual probe task. While in a normal dot probe task the dot probe appears equally often at the former location of the neutral or emotional cue, in the attentional bias modification (CBM-A) task a contingency was created between the location of the threatening cue and the location of the dot probe. Attentional bias can thus be induced when the dot probe consistently follows the threatening stimulus or reduced when the dot probe consistently follows the neutral stimulus, opposite of the threatening stimulus. In this way, participants are prompted to either attend towards threat or divert their attention away from negative information. After initial studies in which was shown that it is possible to train attentional bias with effects on both attentional bias measures as well as emotional reactivity (MacLeod et al., 2002; MacLeod, Campbell, Rutherford, & Wilson, 2004; Mathews & MacLeod, 2002; Mathews & MacLeod, 2005), the possibilities of using this CBM procedure to reduce attentional bias as a clinical tool became evident. A sample of patients with social anxiety disorder (SAD, $N = 36$) received eight half-hour sessions of attention modification training (Schmidt et al., 2009), resulting in 72% of participants in the training condition no longer meeting criteria for SAD compared to 11% in the control dot-probe task condition. These results were replicated in a randomized, double-blind placebo controlled trial ($N = 44$) by Amir, Beard, Taylor et al. (2009), resulting in 50% of participants in the training condition no longer meeting criteria for SAD compared to 14% in the attention control condition. Both studies also reported sustained effects at follow-up after several months. Not all studies investigating the clinical application of CBM procedures modifying attentional bias have been this successful: recent reviews also report other studies with less impressive effects (Baert, Koster, & De Raedt, 2011; Bar-Haim, 2010; Beard, 2011). Two meta-analyses have recently been published. Hakamata et al. (2010) reported a large effect of CBM-A on attentional biases and a medium effect on anxiety symptoms, while Hallion and Ruscio (2011) found only a medium-sized effect of CBM-A on attention biases and CBM-I (interpretation training) on interpretive biases and a small effect of CBM-I and CBM-A on symptoms that was nonsignificant after correction for publication bias. Discrepancies between these meta-analyses can be accounted for by the inclusion of non-clinical studies and both attentional bias and interpretive bias modification in Hallion and Ruscio (2011), who intended to give a broad overview of current CBM studies, as opposed to the small focus on clinical studies using attention modification programs with the visual probe paradigm in Hakamata et al. (2010).

Although current meta-analyses of CBM do not promise large effect sizes of CBM interventions, it should be noted that studies of cognitive bias modification outside of laboratory settings are only a recent development and not many studies have yet been published on the efficacy of CBM interventions in clinical populations. Nevertheless, a few clinical studies (e.g., Amir, Beard, Taylor et al., 2009; Amir, Beard, Burns et al., 2009; Rozenman, Weersing, & Amir, 2011) have impressive effects on anxiety symptoms and implicate that CBM could be a step forward in the development of new treatment options for anxiety disorders.

In the current study, a large part of the training sessions consisted of attention bias modification tasks, which were based on the visual probe task (showing a pair of stimuli on the left and right side of the screen; Amir, Elias, Klumpp, & Przeworski, 2003; MacLeod et al., 2002), and the exogenous cueing task (showing one stimulus on the left or right side, with the opposite side blank; Posner, 1980; Yiend & Mathews, 2001). The objective was to guide participants to point their initial attention (presentation time of the stimuli was 500 ms) at positive (happy faces/words) or neutral (neutral faces/words) stimuli and away from fear-confirming stimuli (threatening faces/words).

Modifying interpretive biases

In the same way as the dot probe task was modified to induce/reduce attentional biases, the task that was used to assess interpretive biases as described above, was modified to change interpretive biases. In this interpretive bias training (CBM-I), participants are constrained to solve the word fragments consistently in a positive or negative manner (Grey & Mathews, 2000; Mathews & Mackintosh, 2000). Interpretive bias modified in this manner has been shown to generalize to new ambiguous scenarios (Mathews & Mackintosh, 2000) and to persist across several days (Yiend, Mackintosh, & Mathews, 2005). Most importantly, inducing a negative bias increases state anxiety responses to a subsequent stressor, whereas reducing negative bias attenuates state anxiety responses (Wilson, MacLeod, Mathews, & Rutherford, 2006). Randomized clinical trials using interpretive bias modification lag behind the developments in attentional bias modification. In analogue samples, however, multisession interpretive bias modification has shown some promising results in anxious adults (Hayes, Hirsch, Krebs, & Mathews, 2010; Salemink, van den Hout, & Kindt, 2009; Steinman & Teachman, 2010; Tran, Siemer, & Joormann, 2011), socially anxious adults (Beard & Amir, 2008), and socially anxious children (Vassilopoulos, Banerjee, & Prantzalou, 2009). In all of these studies CBM-I resulted in a reduction of both participants' interpretation bias and their anxiety symptoms.

In the current study, we used the training task that was originally designed by Mathews and Mackintosh (2000), in which participants were presented with ambiguous social scenarios that were followed by word fragments that had to be solved in a benign direction. The objective of this task was to implicitly guide participants to come up with benign interpretations of ambiguous social situations, which would help them to process real-life situations in a threat-disconfirming manner.

Cognitive Bias Modification in the Prevention of Adolescent Social Anxiety

Since its development in the early 2000s, CBM has shown to be a promising intervention or addition to existing treatment options for anxiety disorders. Because CBM directly targets anxiety vulnerability, it could probably also be used as a preventive intervention in individuals without a clinical disorder, who show warning signs of mental illness or who are at risk for developing anxiety disorders. Looking at the burden of mental health costs on society, prevention of mental disorders receives increasing attention in research. CBM is relatively easy to implement at a low cost, and might therefore be a valuable addition to the presently available preventive interventions (cf., Bar-Haim, 2010; Lothmann, Holmes, Chan, & Lau, 2011; March, 2011). Since social anxiety is a prevalent disorder in adolescents that is associated with a high cost for the individuals and society, the development of a preventive intervention using CBM in high socially anxious adolescents would be an ideal testcase for the efficacy of CBM in prevention.

The current thesis describes the results of a CBM intervention that targets dysfunctional cognitive processes in adolescents with an elevated level of social anxiety. We developed a multifaceted CBM training,

which consists of tasks targeting automatic associations, attentional bias, interpretive bias, and implicit self-esteem in a large number of sessions that could be completed over the internet (at home). We selected adolescents with symptoms of social anxiety and/or test anxiety, aged 12-14 at a number of secondary schools in the Northern part of the Netherlands and randomly allocated schools into three conditions. In order to test the preventive effect of this CBM intervention, the CBM group was compared to both a no-treatment control group and a golden-standard group treatment that employs principles of cognitive behavioral therapy (CBT). Chapter 5 describes the design in detail and focuses on the relative efficacy of CBM in reducing symptoms of social anxiety immediately after treatment and at one year follow-up. The longer term efficacy (two year) is addressed in chapter 6. As the ultimate test of a preventive effect, we also compared the number of DSM-IV diagnoses of social anxiety disorder between the three groups two years after the intervention period.

As described earlier in this introduction, automatic associations to threatening stimuli are at the basis of the expression of anxiety symptoms. Questionnaires asking explicitly about symptoms of social anxiety (e.g., *are you afraid to eat in the school canteen?*) do not tap into these associations. In order to broaden our view of the effect of the preventive interventions, we also assessed automatic associations to threatening stimuli, using the single-target implicit association test that is described earlier in this chapter. In this way, we are able to look at both the explicit level social anxiety (using questionnaires and interviews) as well as the implicit level of social anxiety (using a reaction-time based task such as the stIAT). The effects of the interventions on the automatic associations are described at short-term until one year follow-up in chapter 5 and at the long term (two year follow-up) in chapter 6.

Since CBM is only a recent development in psychotherapy research and much is yet unknown about the working mechanisms in effective CBM treatments, we also tested whether the CBM intervention did modify the targeted cognitive processes in chapter 7. In this chapter, we will compare the effects of the CBM training to CBT group training and no-treatment control group directly after the training and at the long term at two year follow-up. Although we cannot compare the specific ingredients we used in the CBM training (e.g., attentional bias modification vs. interpretive bias modification), this will give us some insight into whether we were indeed able to change cognitive biases and might provide clues for future research.

Since the cross-sectional and longitudinal studies discussed in this thesis contain different but overlapping participants, I conclude this introduction with figure 1.5, which provides an overview of the participants and assessment points that are part of the studies described.

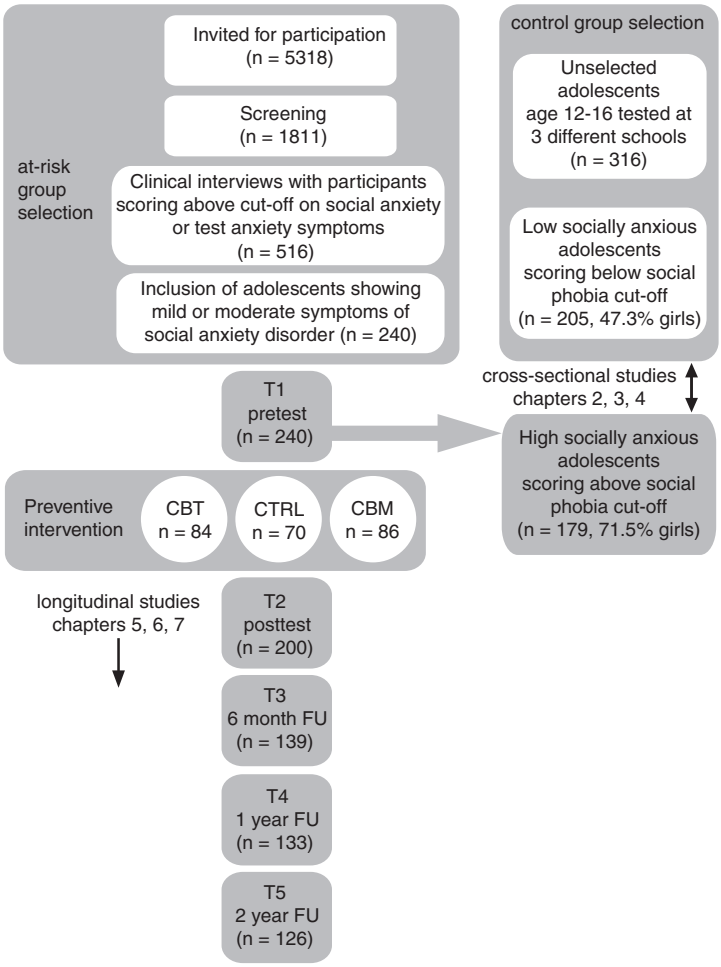

Figure 1.5. Overview of the participant flow in the studies presented in this thesis.

Chapter 2

Threat-Related Automatic Associations in Socially Anxious Adolescents

This chapter is based on the article that is published as:
de Hullu, E., de Jong, P.J., Sportel, B.E., & Nauta, M.H. (2011).
Threat-related automatic associations in socially anxious adolescents.
Behaviour Research and Therapy, 49, 518-522.

Abstract

Threat-related automatic associations are assumed to play an important role in the development and maintenance of social anxiety. We tested whether threat-related automatic associations are already evident in high socially anxious adolescents, by comparing a group of adolescents (age 12-15) with subclinical levels of social anxiety (n = 170) to a group of low socially anxious adolescents (n = 193). We used a single-target implicit association test to measure threat-related automatic associations to social cues. Results showed that indeed in high socially anxious adolescents social cues automatically elicited relatively strong threat-related associations. Supporting the relevance of differentiating between automatic and more explicit measures, both automatic and explicit associations were independently associated with adolescents' level of self-reported social anxiety. The present pattern of findings is not only consistent with the view that automatic and more deliberate threat-related associations are both involved in the etiology of social anxiety symptoms, but also suggest that both types of associations are proper targets for early intervention programs.

Introduction

Social anxiety typically develops during adolescence and elevated levels of social anxiety may have a large impact on current and future functioning (Wittchen, Nelson, & Lachner, 1998). For example, it may prevent adolescents from developing their social skills, hinder school performance (Wittchen, Stein, & Kessler, 1999), and may give rise to substance abuse, depression, social isolation, and poor functioning in work or studies (Essau, Conradt, & Petermann, 1999).

Current cognitive models of anxiety in children (Daleiden & Vasey, 1997; Muris & Field, 2008) stress the importance of threat-confirming information processing biases in the development and maintenance of childhood anxiety. It has been proposed that this biased information processing elicits feelings of fear and anxiety, which in turn enhances the occurrence of cognitive biases and further strengthens the associations between the threatening situation and anxious feelings in memory (Huijding, Wiers, & Field, 2010). Recent dual process models (e.g., Ouimet, Gawronski, & Dozois, 2009), emphasize the importance to differentiate between initial automatic associations elicited by a threatening stimulus and explicit associations, formed afterwards in the deliberate, rule-based memory system. Automatic associations and explicit associations may diverge, when the initial automatic associations are being discarded as irrelevant or untrue. The more deliberate, reflective explicit associations are assumed to guide the more controllable behaviors, whereas the initial, reflexive automatic associations are more important for driving spontaneous feelings and behaviors (Back, Schmukle, & Egloff, 2009). In support of this, it has been shown that indeed automatic associations displayed differential predictive validity for relatively automatic fear behaviors (e.g., Egloff & Schmukle, 2002; Huijding & de Jong, 2006). Attesting to the relevance of automatic associations in the context of fear and anxiety, previous research showed that parent-reported anxiety symptoms of clinically anxious children were best predicted by the children's automatic affective associations elicited by generally threatening pictures (Vervoort et al., 2010).

Supporting the view that automatic associations are also involved in social anxiety, socially anxious adults showed stronger threat-related associations towards social stimuli than low-anxious participants (de Jong, Pasman, Kindt & van den Hout, 2001). Since social anxiety typically starts in early adolescence (Rapee & Spence, 2004) it is important to examine whether early adolescents who show symptoms of social anxiety are similarly characterized by fear-confirming automatic associations. If automatic associations are critically involved in the origin of social anxiety, one would expect that threat-related automatic associations are already evident in adolescents with an elevated level of social anxiety. That is, in those adolescents who are shy and show symptoms of social anxiety, but do not (yet) suffer from a clinical disorder (e.g., Neal & Edelmann, 2003). Therefore, the present study tested the strength of automatic associations between social cue words (e.g., *conversation, exam*) and socially threatening negative outcome words (e.g., *stupid, failure*) in adolescents with subclinical social anxiety compared to low socially anxious adolescents. We also assessed more deliberate (explicit) associations to examine the predictive validity of automatic associations over and above explicitly assessed associations with respect to adolescents' current level of social anxiety.

Method

Participants

Participants in this study were selected from two different groups. The high socially anxious participants (n = 179, 12-15 years) were selected on the basis of a screening in a large research project on the prevention of social and test anxiety in adolescents (Project Pasta; `www.projectpasta.nl`). After approval for this study by the Medical Ethics Committee of the University Medical Center, a screening took place in the first two grades of 25 high schools in the Northern part of the Netherlands. Of the invited 5318 children, approximately one-third (one parent and the child signed an informed consent form) agreed to participate in the study and 1811 children were screened for symptoms of social anxiety. Children (n = 595) scoring above our cut-off (at 10 for females and 9 for males) on the social phobia subscale of the Revised Child Anxiety and Depression

Scale (RCADS; Chorpita, Yim, Moffitt, Umemoto, & Francis, 2000) were invited for the next step in the project. The RCADS cut-off scores were based on the 75th percentile in a large Dutch cohort of young adolescents (*N* = 2230, the TRAILS-study; Huisman et al., 2008). This study is part of a prevention project aiming at individuals at risk for developing social anxiety disorder, therefore we selected participants using the ADIS-C structured clinical interview (Anxiety Disorders Interview Schedule for Children ADIS-C; Silverman & Albano, 1996). We excluded adolescents with few or no symptoms of social anxiety (*n* = 211) and adolescents in need of treatment for social anxiety disorder (CSR [Clinician Rated Severity] >= 5) (*n* = 29) or other mental disorders (*n* = 28). Thus, adolescents were included in the project when they showed symptoms of social anxiety (i.e., afraid to speak in class or talk to strangers), but indicated only moderate (CSR = 4, *n* = 31) or mild (CSR < 4, *n* = 209) interference of social anxiety with their daily life (Albano & Hayward, 2004). Two weeks after the ADIS-C interview, all included participants took part in the assessment (questionnaires and performance measures) that provided the data for this study. Scores on RCADS-social phobia at this assessment were in quite a few cases lower than the original cut-off. Thus, for the purpose of this study, for the high-anxious group, only those with RCADS-social phobia scores above the cut-off were finally selected (*n* = 179, 71.5% girls, mean age 13.6; SD = 0.67).

The control group includes participants from three different high schools (not participating in Project Pasta). All children in the selected grades were asked to take part in a study about mental health, and about one-third (*n* = 316; aged 12-16 years) returned a signed informed consent form in which parent and child agreed to participate in the study. Participants in this group were rewarded with a €5 voucher directly after the assessment. From this control group, only those scoring below our cut-off on social phobia (*n* = 205, 47.3% girls, mean age 14.0; SD = 0.70) were selected for the low-anxious group.

Materials

Social Anxiety

The Revised Child Anxiety and Depression Scale (RCADS; Chorpita et al., 2000) is a revised version of the Spence Children's Anxiety Scale (SCAS; Spence, 1998). It is a 47-item self-report instrument, with items rated on a 4-point scale ranging from 0 to 3. In psychometric research the internal consistency of the scale and subscales were found to be good (Chorpita et al., 2000). In the current study only the social phobia subscale (9 items; α = .88) will be reported.

An important aspect of social anxiety is fear of negative evaluation, which we measured using the Brief Fear of Negative Evaluation Questionnaire (BFNE-II; Carleton, McCreary, Norton, & Asmundson, (2006). The BFNE-II is a 12-item, 5-point Likert scale ranging from 0 to 4, based on the BFNE by Leary (1983). The internal consistency of the BFNE-II was found to be excellent, with α = .95. In our sample we also found α = .96.

Since social anxiety takes the form of test anxiety in some adolescents, we also used the Dutch version of the Spielberger's Test Anxiety Inventory (Spielberger TAI; Spielberger et al., 1980), which consists of 20 items with a 4-point scale, ranging from 1 to 4. Previous research (van der Ploeg, 1988) showed a good reliability for the instrument (α = .93). In the current study we also found a good internal consistency (α = .89).

Automatic Associations

To examine threat-related automatic associations with social cues, we used a Single-Target Implicit Association Test (stIAT) that was specifically designed for this study. This variant of the IAT (Greenwald et al., 1998) is a computerized reaction time task that measures to what extent a single-target category is associated with two attribute categories. Following the design of Wigboldus, Holland, and van Knippenberg (2005), a social cues stIAT was constructed with the target category *social- or school activity*, and the attribute labels *positive outcome* and *negative outcome*. We chose to use these attribute labels to indicate threatening and safe associations with the target words. We labeled the target category *'social- or school activity'* to provide a neutral

category that could contain cues that are feared by socially anxious people, such as *conversation* or *exam*. The instructions and format of the present stIAT were based on an IAT (de Jong, Sportel, de Hullu, & Nauta, 2011) that was tailored to the present age group and piloted extensively.

In the stIAT, participants are asked to categorize words appearing in the centre of the screen as quickly as possible into the target category or the attributes, by pressing the left or right button on a response-box. The test phase consists of two blocks of 64 trials, each preceded by a short practice phase of 24 trials. An example of a trial in both blocks is presented in figure 2.1.

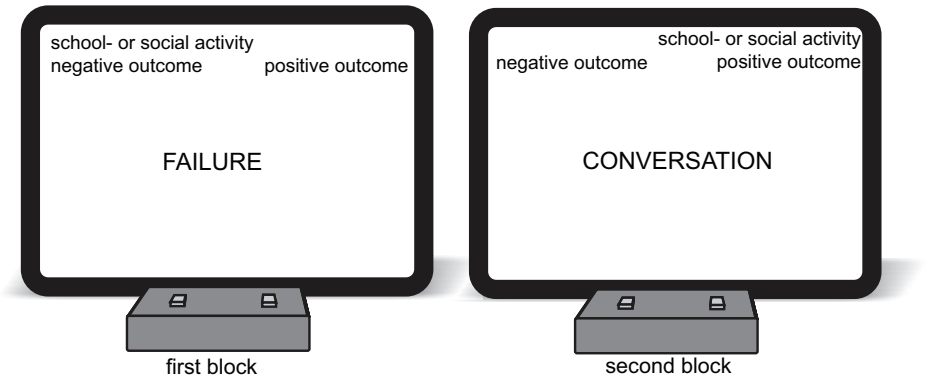

Figure 2.1. Presentation of target categories and attributes in the single-target IAT. In the first block, the target category and the negative outcome attribute share the left response button, and the positive outcome attribute is on the right side. Participants should respond in the first trial by pressing the left button, sorting *failure* into *negative outcome*. In the second block, the target category switches to the right side, now sharing the response button with the positive outcome attribute. In the second example, participants should respond by pressing the right button, sorting *conversation* into *school- or social activity*.

After a correct response, the next stimulus is presented after 500 ms. After an incorrect response a red X appears shortly above the stimulus. The stimulus remains on the screen until a correct response is given. The order of the category combinations is fixed across participants to reduce method variance. This is assumed to enhance the sensitivity of the stIAT as a measure of individual differences, which is important in view of the aim of the present study (cf., Asendorpf, 2007). For someone with a fear of social situations, associations between social cue words and negative outcome are assumed to be relatively strong, resulting in a fast response when the target category (*social- or school situation*) and *negative outcome* will be paired, and a relatively slow response time when the target category is paired with *positive outcome*. Single-Target IAT effects were computed according to the algorithm proposed by Greenwald, Nosek, and Banaji (2003). In this paper, we reported the so-called D_4-measure with a 600 ms error penalty. Thus positive stIAT effects represent relatively positive associations to social cue words. Practice trials have been discarded from the analyses (cf., Bluemke & Friese, 2008). The split-half reliability of the present stIAT was adequate, with a Spearman-Brown corrected correlation between test-halves of .76.

Explicit associations

The explicit measure of associations with the outcome of social- or school activities was a two-item questionnaire representing an explicit proxy of the stIAT, the single-target Explicit Association Test (stEAT). The first question was: how much do you feel that the words representing *social- or school activities* (e.g., *exam, presentation, school party*) fit to words representing a *positive outcome* (e.g., *nice, success, compliment*)? The second question was the same for negative outcome words (e.g., *stupid, shame, rejection*). All stimulus words used in the stIAT were presented as an illustration of the categories. Answers were given on a 7-point scale, ranging from 0 to 6. Subtracting the score for the negative item from the score on the positive item results in a stEAT index that served as an explicit proxy of the stIAT score (high scores reflect relatively positive/safe associations).

Procedure

The assessment took place at the participants' schools, during regular school hours, in a group of maximum 15 participants supervised by 2-3 research assistants. The stIAT as well as the relevant questionnaires (RCADS, Spielberger TAI, and BFNE-II) were delivered on a laptop computer in a fixed order. The stIAT was presented before the explicit measures.

Data Reduction

For both the high and low socially anxious adolescents, we excluded all participants (9 high-anxious, 12 low-anxious) who showed poor performance on the stIAT. These discarded participants showed response times faster than 300 ms in more than 10% of the trials, response times slower than 10.000 ms for more than 1% of the trials, or an error percentage greater than 2 SD above the mean (cf., Karpinski & Steinman, 2006). Ultimately, the high-anxious group (n = 170) consisted of 124 girls and 46 boys (mean age 13.56; SD = 0.67), and the low-anxious group (n = 193) consisted of 95 girls and 98 boys (mean age 14.07; SD = 0.70).

Results

Anxiety Measures

Table 2.1 shows means and standard deviations for all anxiety measures. Independent sample t tests indicated that the scores on social phobia (M difference = 9.21, t [361] = 28.53, p < .001), test anxiety (M difference = 15.44, t [361] = 13.81, p < .001), and fear of negative evaluation (M difference = 16.86, t [361] = 18.25, p < .001), were significantly higher for the high socially anxious group than the low socially anxious group.

Table 2.1. *Mean anxiety scores for high socially anxious (n = 170) and low socially anxious (n = 193) adolescents*

	High Socially Anxious		Low Socially Anxious	
Anxiety scale	Mean	*SD*	Mean	*SD*
Social phobia (RCADS SP)	15.14	3.60	5.93	2.52
Test anxiety (TAI)	44.74	13.74	29.31	6.80
Fear of negative evaluation (BFNE-II)	26.15	10.02	9.29	7.52

Data inspection

The average overall percentage of errors made on the stIAT was 11.71% (SD = 5.07). This number is relatively low compared to other stIATs in the same age groups (e.g., Thush & Wiers, 2007). In both groups, the scores on the stEAT index (high-anxious: D[170] = 0.14, p <.01; low-anxious: D[193] = 0.19, p <.01) were positively skewed and thus violated the assumption of normality. Data transformation (log-, square root- or reciprocal transformation) did not solve this issue. Therefore, we preferred a non-parametric approach for comparing scores on the stEAT. Variances for the stIAT were equal for the high-anxious and low-anxious groups and scores were normally distributed.

Table 2.2 provides an overview of mean response times for high-anxious and low-anxious groups in each block of the stIAT. An ANCOVA, with gender as covariate (since the groups have unequal distributions of male/female participants), showed that on average, high socially anxious adolescents were characterized by a stronger initial association between social cues and a negative outcome (stIAT effect D: M = -.034, SE =

Table 2.2. *stIAT latencies (ms) for high socially anxious (n = 170) and low socially anxious (n = 193) adolescents*

	High Socially Anxious		Low Socially Anxious	
stIAT block	Mean	*SD*	Mean	*SD*
Social cue + negative outcome (first block)	922	196	880	172
Social cue + positive outcome (second block)	940	215	841	156
Overall latencies	931	206	861	164

Note. stIAT latencies include 600ms penalty for wrong responses.

.022) than low socially anxious adolescents (M = .10, SE = .022), $F(1, 360) = 14.43$, $p < .001$, d = -0.45. The covariate gender was not significantly related to the stIAT effect, $F(1, 360) = 2.37$, $p = .125$.

Difference in explicit associations towards social-anxiety related stimuli

A Mann-Whitney U test was conducted to evaluate the hypothesis that high socially anxious adolescents had lower scores, on average, than low socially anxious adolescents on the stEAT index for explicit associations. The results of the test were in the expected direction and significant, U = 14591.50, z = -1.85, p = .032 (one-tailed), d = -.10. High socially anxious adolescents (M = 0.33; Mdn = 0) had an average rank of 171.33, while low socially anxious adolescents (M = 0.82; Mdn = 0) had an average rank of 191.40.

Relationship between social anxiety and automatic vs. explicit associations

There was no meaningful relationship between explicit (stEAT) and implicit (stIAT) measures (r = .07). To test whether the automatic and explicit associations with social cues are independently associated with social anxiety, we performed a forced entry regression analysis with social anxiety as the dependent variable and centered stEAT and stIAT as the independent variables. Both variables showed independent predictive value for social anxiety (see table 2.3). Adding the interaction between centered variables stEAT and stIAT (following Aiken & West, 1991) did not improve the model significantly.

Table 2.3. *Summary of Hierarchical Regression Analysis for variables predicting social anxiety in adolescents (n = 363)*

Dependent	Predictor		*B*	*SE B*	*ß*	*p*
RCADS	1.	stEAT explicit associations	-0.44	0.14	-0.16	.001
Social Phobia		stIAT automatic associations	-3.52	0.91	-0.20	<.001
	2.	stEAT*stIAT interaction	0.47	0.46	0.05	.302

Note. R^2 = .07 for step 1, ΔR^2 = .003 for step 2 (p = .302)

Discussion

This study was designed to test whether high socially anxious adolescents are characterized by threat-related automatic associations to social stimuli. The major results can be summarized as follows: (i) high socially anxious adolescents indeed showed relatively strong automatic associations between social cue words and

negative outcome words and (ii) automatic and explicit associations with social cues were independently associated with adolescents' current self-reported level of social anxiety.

Complementing previous research in socially anxious adults (de Jong et al., 2001), the present results show that also early adolescents with heightened levels of social anxiety are characterized by relatively strong automatic associations between social stimuli and negative outcomes. The finding that this type of social threat-confirming automatic associations are already evident in the age range during which social anxiety disorder typically starts, is in line with the view that automatic associations may contribute to the development and maintenance of social anxiety rather than being merely the result of prolonged suffering from social fears. A recent study by Vervoort et al. (2010) showed a similar evaluation bias in clinically anxious children for a broad range of threatening stimuli. Our study shows that this relation also holds for social anxiety-specific stimuli in high socially anxious adolescents. In future studies, it would be interesting to see if disorder-specific cues are associated with adverse outcomes in other anxiety disorders as well, such as obsessive compulsive disorder or separation anxiety disorder. This study also provides additional support for the use of reaction-time based tasks such as the stIAT in early adolescence (cf., Huijding et al., 2010).

Interestingly, the indices of automatic and deliberate social threat-confirming associations were largely unrelated. This is a common finding in this type of research (de Jong, van den Hout, van Rietbroek, & Huijding, 2003) and is consistent with the starting point that both indices reflect different types of processes (Gawronski & Bodenhausen, 2006). In further support of this, the present findings indicate that both types of indices are independently associated with individual's level of social anxiety (see also Back et al., 2009). Together this pattern of findings indicates that insight in automatic associations may help to further improve our understanding of the mechanisms involved in social anxiety. Threat-related automatic associations could serve to maintain social anxiety in several ways. First, threat-related automatic associations with social stimuli could lead to physical symptoms of anxiety, such as sweating and blushing, and anxious thoughts about these symptoms, which in turn may interfere with social interactions (e.g., Voncken, Dijk, de Jong, & Roelofs, 2010). Second, when people are characterized by dysfunctional/inadequate reflective strategies, the negative automatic associations will not be corrected, thereby fueling dysfunctional explicit beliefs. Third, in the absence of adequate cognitive control (e.g., Hofmann, Gschwendner, Friese, Wiers & Schmitt, 2008), for example when available cognitive resources are limited, these negative associations will guide people's behavior and may thus contribute to socially anxious adolescents' initial tendency to avoid and/or escape from social situations, thereby maintaining their socially anxious concerns.

It should be acknowledged that the cross sectional design of our study does not allow any firm conclusion regarding the direction of the present relationship between social anxiety and enhanced negative associations between social events and negative outcomes. Thus on the basis of the present findings it cannot be ruled out that enhanced threat-related automatic associations in adolescence are a component or consequence of social anxiety symptoms rather than a causal agent. To arrive at more solid grounds in this respect it is important to test the proposed interrelationship in a longitudinal design to investigate whether threat-related automatic and explicit associations indeed have prognostic value for the onset of symptoms of social anxiety disorder (e.g., Glashouwer, de Jong, & Penninx, 2011; Engelhard, Huijding, van den Hout, & de Jong, 2007). In addition, to test the alleged causal influence of automatic associations, it is important to examine whether experimental reduction of these threat-related automatic associations results in a reduction of socially anxious concerns. If so, this would not only confirm the alleged reciprocal relationship between automatic associations and anxiety symptoms, it would also point to fresh options that may help preventing the development of social anxiety disorder (e.g., Clerkin & Teachman, 2010). Finally, it is important to note that the stIAT is only one of several instruments that are often used to index automatic associations (for a critical overview, see De Houwer, Wiers, & Stacey, 2006) and the (st)IAT is not without its critics (e.g., Fiedler, Messner, & Bluemke, 2006). Therefore, conceptual replication of the present findings using other tasks remains important.

Conclusion

This study is the first to show that high socially anxious adolescents are characterized by threat-related automatic associations towards social stimuli, and provides robust findings in a large sample. Importantly these automatic associations showed cumulative predictive value for the level of social anxiety symptoms. This pattern of findings is in line with current dual process models of anxiety and points to the relevance of developing interventions that specifically target automatic associations in addition to explicit cognitions.

Chapter 3

Attentional Bias to Threatening Faces and Words in Socially Anxious Adolescents

This chapter is based on the article that is submitted as:

de Hullu, E., de Jong, P. J., Sportel, B. E., & Nauta, M. H. (2011).
Attentional bias to threatening faces and words in high socially anxious individuals.

Abstract

Attentional bias (AB) to threatening information is hypothesized to play an important role in the development and maintenance of social anxiety. If AB to threat is critically involved in the development of social anxiety, the phenomenon should also be evident in adolescents with subsyndromal social anxiety. Since previous research showed that the relationship between anxiety symptoms and AB was most pronounced in people with low attentional control, we also tested whether attentional control moderated the relationship between AB and social anxiety. Using both a pictorial and a verbal version of a (500 ms) visual probe task, we tested whether adolescents with symptoms of social anxiety showed a higher initial AB to disapproving faces or words compared to low socially anxious adolescents. Both high and low socially anxious adolescents showed AB to threatening faces and words and there was no difference in AB between both groups. The interaction between attentional control and AB to threat was not significantly related to symptoms of social anxiety. During the present visual probe task threat stimuli were presented for 500 ms. It can therefore not be ruled out that differential ABs might become evident when stimuli are presented for shorter (early detection) or longer (avoidance) time intervals. AB to disapproving faces and words was found to be a general characteristic of early adolescents. Because AB was not specifically pronounced in socially anxious adolescents, the results do not support the view that AB to threat plays a critical role in the development of social anxiety.

Introduction

Developmental models of social anxiety (e.g., Beidel & Turner, 2007a; Ledley & Heimberg, 2006) emphasize the role of selective processing of socially threatening information (e.g., rejecting faces), in the maintenance of social anxiety in both adults (e.g., Bögels & Mansell, 2004; Staugaard, 2010) and children (e.g., Hadwin, Garner, & Perez-Olivas, 2006; Puliafico & Kendall, 2006). In anxious adults, attentional bias to threat is a relatively robust phenomenon (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van IJzendoorn, 2007; Staugaard, 2010), that has been shown across anxiety disorders and with various types of experimental tasks. Attentional bias to threat in socially anxious adults seems most pronounced during the earlier stages of attention (Staugaard, 2010) and seems more easily elicited by facial than by verbal representations of social rejection (Pishyar, Harris, & Menzies, 2004).

In socially anxious children and adolescents, the results are less straightforward compared to adult research. Anxious children in general have shown to selectively attend to threatening information at both short and longer time intervals (Puliafico & Kendall, 2006), but due to methodological differences between studies (e.g., using Stroop tasks versus visual-probe tasks to measure attentional bias) and generally small sample sizes there is no conclusive evidence yet. Only two studies so far examined attentional bias with respect to social anxiety in adolescents. The first study (Stirling, Eley, & Clark, 2006) employed a visual probe task with a relatively long stimulus presentation time (1000 ms), and examined attentional bias to threatening faces in a large non-clinical sample of school-age children (age 9-11 yrs.). This study found a relationship between social anxiety symptoms and a tendency to direct attention away from negative faces, rather than towards signs of social threat. However, because only a relatively long stimulus presentation time was used in this study, it remains unclear whether perhaps this attentional avoidance was preceded by enhanced initial attention to social threat. In line with this, a second study using a 500 ms presentation duration in a large group of clinically anxious children and adolescents (age 7-18 yrs.; 77% diagnosed with social phobia) did find evidence for enhanced initial attention to threatening (angry) faces in social anxiety disorder (Roy et al., 2008). Thus there is some preliminary support for the notion that enhanced initial attention for signs of social rejection might (also) play a role in socially anxious children and adolescents. However, the evidence is very limited and further studies are required to arrive at more final conclusions in this respect.

Since social anxiety typically starts in early adolescence (Rapee & Spence, 2004) it is important to examine whether early adolescents who show symptoms of social anxiety are similarly characterized by enhanced initial attention to threat. If this bias is critically involved in the origin of social anxiety, one would expect that biased initial attention to threat is already evident in adolescents with an elevated level of social anxiety. That is, in those adolescents who are shy and show symptoms of social anxiety, but do not (yet) suffer from a clinical disorder (e.g., Neal & Edelmann, 2003). Therefore, the first goal of the current study is to investigate whether an initial attentional bias towards threatening social information is also present in adolescents with elevated levels of social anxiety.

Recently developed attentional bias modification procedures (e.g., Amir, Weber, Beard, Bomyea, & Taylor, 2008) are being applied to test whether attentional bias is causally involved in anxiety and if the training of attentional bias into a benign direction leads to decreases in anxiety symptoms. Currently, these procedures are also applied to treat anxiety in adolescents (e.g., Rozenman, Weersing, & Amir, 2011) and could possibly be used to prevent the generation of social anxiety disorder in adolescents (cf., March, 2010). Although there is some evidence that, also in adolescents, attentional bias modification procedures are associated with a decrease in anxiety (in 10-year old children: Bar-Haim, Morag, & Glickman, 2011; in 10-17 year old youths: Rozenman et al., 2011), it remains important to test whether this bias already exists in adolescents with subclinical levels of anxiety.

Thus far, studies investigating attentional bias in anxious adolescents have used threatening words (Dalgleish, Moradi, Taghavi, Neshat-Doost, & Yule, 2001; Dalgleish et al., 2003; Helzer, Connor-Smith, & Reed, 2009; Taghavi & Neshat-Doost, 1999; Vasey, Daleiden, Williams, & Brown, 1995) and faces (Monk et al.,

2006; Pine et al., 2005; Waters, Mogg, Bradley, & Pine, 2008; Waters, Henry, Mogg, Bradley, & Pine, 2010; Waters, Kokkoris, Mogg, Bradley, & Pine, 2010), both with mixed results. So far, no studies have compared responses on facial vs. verbal dot-probe tasks (cf., Mansell, Ehlers, Clark, & Chen, 2002; Pishyar et al., 2004) in children or adolescents and it remains thus to be seen whether socially anxious adolescents are most sensitive to facial cues or verbal signs of social rejection. Therefore, in the current study we included both a verbal and a facial version of the visual probe task.

One of the assumptions underlying studies of attentional bias is that interference arises when negative or threatening stimuli match the content of emotional concerns (Mathews, May, Mogg, & Eysenck, 1990). Since fear of negative evaluation is a core concern in social anxiety (American Psychiatric Association, 2000), we selected facial and verbal stimuli expressing contempt, rather than anger, as threatening stimuli.

As a subsidiary issue, we explored whether the relationship between attentional bias and social anxiety might be most pronounced in adolescents who show a relatively low habitual (trait) level of attentional control. Several studies (e.g., Derryberry & Reed, 2002; Helzer et al., 2009; Lonigan & Vasey, 2009) provided evidence indicating that attentional control moderates the relationship between attentional bias and anxiety, such that attentional biases are related to anxiety only in people with poor attentional control. Skilled control of voluntary attention may help to limit the impact of threatening information by facilitating people's attempts to direct attention away from threat or towards positive information (e.g., Derryberry & Reed, 2002). A high level of attentional control could thus protect children from experiencing the adverse consequences of biased attention to threat.

In summary, the current study examined whether (i) adolescents with heightened levels of social anxiety show enhanced attentional bias to socially threatening information (ii) this attentional bias is stronger for facial than for verbal signs of social rejection, and (iii) the alleged relationship between attentional bias and social anxiety is especially pronounced in individuals with a low habitual level of attentional control.

Method

Participants

Participants in this study were selected from two different groups. The high socially anxious participants (n = 179, 12-15 years) were selected on the basis of a screening in a large research project on the prevention of social and test anxiety in adolescents (Project Pasta; `www.projectpasta.nl`). After approval for this study by the Medical Ethics Committee of the University Medical Center, a screening took place in the first two grades of 25 high schools in the Northern part of the Netherlands. Of the invited 5318 children, approximately one-third agreed (one parent and the child signed an informed consent form) to participate in the study and 1811 children were tested for symptoms of social anxiety. Children (n = 595) scoring above our cut-off (at 10 for females and 9 for males) on the social phobia subscale of the Revised Child Anxiety and Depression Scale (RCADS; Chorpita, Yim, Moffitt, Umemoto, & Francis, 2000) were invited for the next step in this study. The RCADS cut-off scores were based on the 75th percentile in a large Dutch cohort of young adolescents (N = 2230, the TRAILS-study; Huisman et al., 2008). Since this study is part of a prevention project aiming at adolescents at risk for developing social anxiety disorder, we further selected adolescents using the ADIS-C structured clinical interview (Anxiety Disorders Interview Schedule for Children; ADIS-C; Silverman & Albano, 1996). We excluded adolescents with few or no symptoms of social anxiety (n = 211) and adolescents in need of treatment for social anxiety disorder (CSR [Clinician Rated Severity] >= 5) (n = 29) or other severe mental disorders (i.e., depression; n = 28). Thus, adolescents were included in the project when they showed symptoms of social anxiety (i.e., afraid to speak in class or talk to strangers), but indicated only moderate (CSR = 4, n = 31) or mild (CSR < 4, n = 209) interference of social anxiety with their daily life (Albano & Hayward, 2004). Two weeks after the ADIS-C interview, all included participants took part in the assessment (questionnaires and performance measures) that provided the data for this study. Scores on RCADS-social phobia at this assessment were in many cases lower than the original cut-off. Thus, for the purpose of this

study, for the high-anxious group, only those with RCADS-social phobia scores above the cut-off were finally selected (n = 179, 71.5% girls, mean age 13.6; SD = 0.67).

The control group consists of participants from three different high schools (not participating in Project Pasta) from the same grades as the anxious children. After approval for this part of the study by the Faculty Ethics Committee, all children in the selected grades were asked to take part in a study about mental health, and about one-third (n = 316; aged 12-16 years) eventually returned a signed informed consent form in which parent and child agreed to participate in the study. Participants in this group were rewarded with a €5 voucher directly after the assessment.

For the between-group analysis, we selected only those control participants for the low-anxious group who scored below our cut-off on social phobia (n = 205, 47.3% girls, mean age 14.0; SD = 0.70) from this control group. Table 3.1 shows descriptive statistics for the high and low social anxious groups.

Table 3.1. *Mean Anxiety questionnaire scores for high and low socially anxious adolescents*

	High social anxiety n = 179		Low social anxiety n = 205			
Variable	*M*	*SD*	*M*	*SD*	*t* (382)*	*p*
RCADS - Social Phobia	15.2	3.6	5.9	2.6	28.63	< .001
TAI - Test Anxiety	44.7	13.6	29.3	6.7	13.77	< .001
BFNE - Fear of Negative Evaluation	26.1	10.1	9.2	7.5	18.44	< .001

Note. * Levene's test indicated unequal variances for both groups on the anxiety measures; corrected *t* and *p* values are reported.

For the correlational analysis (see below) we selected all participants of the control group who also completed the attentional control measure, which was administered only to a part of the group due to time constraints (218 of 316 participants). Here, we did not exclude high- or low-anxious participants so this group represents a normal sample with both high and low socially anxious children. The sample comprised 114 girls and 104 boys with a mean age of 14.1, SD = 0.70. Mean anxiety scores were RCADS-SP: M = 8.83, SD = 5.22; TAI: M = 34.36, SD = 11.11; and BFNE: M = 14.84, SD = 12.06. Mean attentional control was ATQ-AC: M = 20.23, SD = 5.30, and attentional bias to threatening faces scores were AB: M = 28.22, SD = 45.24. After data-preparation of the visual probe tasks (see below), the final sample of 195 participants who were included in the correlational analysis consisted of 90 boys and 105 girls with a mean age of 14.1 years.

Materials

Social Anxiety

The Revised Child Anxiety and Depression Scale (RCADS; Chorpita et al., 2000) is a revised version of the Spence Children's Anxiety Scale (SCAS; Spence, 1998). It is a 47-item self-report instrument, with items rated on a 4-point scale ranging from 0 to 3. The questionnaire consists of six scales: separation anxiety disorder (SAD), social phobia (SP), obsessive-compulsive disorder (OCD), panic disorder (PD), generalized anxiety disorder (GAD) and major depressive disorder (MDD). There is an overall scale indicating the total level of internalizing psychopathology. In psychometric research the internal consistency of the scale and subscales were found to be good in a normal as well as a clinical population with age range 6-18 (Chorpita, Yim, Moffitt, Umemoto, & Francis, 2000; Chorpita, Moffitt, & Gray, 2005). The structure of the RCADS was found to be consistent with DSM-IV anxiety disorders and depression. In the current study only the SP subscale (9 items; α= .88) will be reported.

For a more comprehensive assessment we also measured individuals' fear of negative evaluation, as this represents an important aspect of social anxiety. Therefore, participants also completed the Brief Fear of Negative Evaluation Questionnaire (BFNE-II; Carleton, McCreary, Norton, & Asmundson, 2006). The BFNE-II is a 12-item, 5-point Likert scale ranging from 0 to 4 and is based on BFNE by Leary (1983), with the difference being the fact that the reverse-worded items in the BFNE are reworded in the other direction in the BFNE-II. The internal consistency of the BFNE-II was found to be excellent, with α = .95. In our sample we also found α = .96.

Since social anxiety takes the form of test anxiety in some high school students, we also used the Dutch version of the Spielberger's Test Anxiety Inventory (Spielberger TAI; Spielberger et al., 1980), which consists of 20 items with a 4-point scale, ranging from 1 to 4. Previous research (van der Ploeg, 1988) showed a good reliability for the instrument (α = .93). In the current study we also found a good internal consistency (α = .89).

Attentional bias

To examine attentional bias to social threat, we used two versions of a visual probe task that was specifically designed for this study: one using pictorial stimuli (Visual Probe task with Faces; VPF) and one using verbal stimuli (Visual Probe task with written Words; VPW). Each visual probe task comprised 76 trials; 12 practice trials (neutral-neutral, stimuli not present in the critical trials) and 64 critical trials (32 positive-neutral and 32 negative-neutral). Trials ran in a fixed random order. Stimuli were presented supraliminally on a white background. On each trial a black fixation cross appeared for 500 ms followed by a stimulus pair presented horizontally for 500 ms. Probes were small black arrows pointing upwards or downwards (size 2.5 x 1.5 mm), presented immediately after the stimuli disappeared. In the VPF, stimuli were neutral, friendly (happy) and threatening (contempt) faces, selected from the Karolinska Directed Emotional Faces series (KDEF: Lundqvist, Flykt, & Öhman, 1998), showing straight profile images of 32 men and 32 women. Each stimulus pair consisted of two pictures of faces belonging to the same individual, either friendly-neutral or threatening-neutral. Pictures were sized 5.5 x 7.5 cm and positioned with the center of the picture 11.5 cm from the left and right border of the screen (28.5cm width). See appendix 1 for a list of all used stimulus faces. In the VPW, stimuli were 64 different word pairs, matched for number of characters (3-11), with fixed random presentation of 32 combinations of neutral (*spoon, curtain*) – friendly (*smile, success*) and 32 combinations of neutral (*stove, blanket*) – threatening (*shame, failure*) words. See appendix 2 for a list of all used stimulus words. Words were printed in 18 point, Arial bold black font and placed in the same position as the pictures in the VPF. Left and right positions of the stimuli and probes and direction of the arrows were equally divided over the task. The visual probe task was delivered on a laptop computer, positioned at a table with the participant sitting in front of the laptop. The response-box with two buttons (up and down) was placed in front of the laptop. Screen size was 14 inch with 1024 x 768 pixels, refresh rate 60 Hz.

Attentional Control

The Adult Temperament Questionnaire (ATQ; Rothbart, Ahadi, & Evans, 2000) is a 77-item questionnaire, with items rated on a 7-point scale, ranging from 1 (*not at all true*) to 7 (*very true*). The instrument is an adaptation from the Physiological Reactions Questionnaire (Derryberry & Rothbart, 1988) and is developed by Evans and Rothbart (2007). The ATQ contains four overarching scales; negative affect, extraversion, effortful control, and orienting sensitivity, each consisting of several subscales. For the purpose of the current study, the subscale Attentional Control of the scale Effortful Control was used, with five items measuring the ability to focus and switch attention. The internal consistency of the ATQ is found to be good (`http://www.bowdoin.edu/~sputnam/rothbart-temperament-questionnaires/instrument-descriptions/adult-temperament-questionnaire.html`). In the current study the subscale Attentional Control had an internal consistency of α = .59.

Procedure

The assessment took place at the participants' schools, during regular school hours, in a group of maximum 15 participants supervised by 2-3 research assistants. The visual probe task (first VPF, second VPW) as well as the relevant questionnaires (RCADS, TAI, and BFNE-II) were delivered on a laptop computer in a fixed order. Following the recommendation of Bosson, Swann, and Pennebaker (2000) the visual probe tasks were presented before the explicit measures. Both tasks were presented in a fixed order to reduce the influence of method variance. This is assumed to enhance the sensitivity of the visual probe task as a measure of individual differences, which is important in view of the prospective design of the larger PASTA project (cf., Asendorpf, Banse, & Mücke, 2002). Other participants or the research assistants were not able to see the responses during the assessment, ensuring confidentiality and independent responding. Because the assessments took place during regular school hours and time was limited in some schools, some instruments such as the ATQ were administered only to a subsample of the control group.

Data Preparation Visual Probe Task

For both visual probe tasks, only RTs of correct trials were used in the analysis; incorrect responses and responses faster than 150 ms and responses larger than 2 standard deviations from a participant's mean in a specific trial category were excluded (Bar-Haim et al., 2007; Mogg, Philippot, & Bradley, 2004). Participants with missing data (excluded trials) on more than 4 trials of 16 trials in a specific category were excluded. In the between-groups analyses we thus removed attentional bias scores for VPF: 18 high-anxious, 15 low-anxious participants and VPW: 17 high-anxious, 13 low-anxious participants. Due to technical problems with the delivery of the visual probe task, four additional participants from the high-anxious group were excluded from analysis. In the ultimate sample for the between-groups analysis, high-anxious and low-anxious participants did not differ with respect to their number of errors on the VPF task (4.2% of 64 trials, t (345) = -0.438, p = .66) or on the VPW task (3.9% of 64 trials, t (348) = -0.136 p = .89). Statistical analyses were run on 90.8% of the data.

In the second sample for the correlational analysis, following the same procedure, 23 participants with poor task performance were removed (5 with poor performance on both VPF and VPW, 10 on the VPF, 8 on the VPW), leading to a statistical analysis on 89.5% of the data.

Attentional bias indices were computed according to the method described by Mogg et al. (2004), separately for each stimulus type (friendly/threatening). Attentional bias scores were calculated by subtracting the mean RT when the probe was in the same location as the emotional stimulus from the mean RT when the probe and emotional stimulus were in different locations. A positive attentional bias index indicates vigilance (faster RTs to probes following emotional stimuli compared to neutral stimuli), zero denotes no attentional bias and a negative score indicates avoidance (slower RTs to probes following emotional stimuli compared to neutral stimuli).

Data Analyses

In the selected high and low socially anxious samples, we used a mixed design ANOVA to compare both groups on different aspects of attentional bias and combined both groups to investigate bivariate correlations between bias indices. A hierarchical regression analysis was performed to investigate the relationship between attentional bias, attentional control and symptoms of social anxiety.

Results

Differences in attentional bias between groups

Table 3.2 shows descriptives of reaction times to probes in both versions of the visual probe task.

Table 3.2. *RTs (in milliseconds) to probes in same versus different location as emotional stimulus*

		High Social Anxiety		Low Social Anxiety	
Task	*Probe location*	*M*	*SD*	*M*	*SD*
Faces	Probe behind friendly face	686.7	138.7	636.4	104.7
	Probe opposite of friendly face	686.7	125.5	638.9	97.7
	Probe behind threatening face	679.4	125.2	632.4	100.2
	Probe opposite of threatening face	702.6	133.7	653.7	106.6
Words	Probe behind friendly word	673.3	109.4	643.5	89.5
	Probe opposite of friendly word	678.0	113.5	650.0	90.9
	Probe behind threatening word	680.4	109.0	645.1	94.0
	Probe opposite of threatening word	693.6	115.1	659.7	98.6

Note. Sample size differs per group per task;
Faces: HSA n =162, LSA n = 194; Words: HSA n = 167, LSA n = 202

A mixed design ANOVA with Group (high-anxious, low-anxious) as between-subject factor and Task (faces, words) and Expression (threatening, friendly) as within-subject factors was used to compare both groups with regard to their attentional bias scores. There was no main effect of Group, $F(1,328) = 0.64, p = .424$, or Task, $F(1, 328) = 0.80$, p = .371, but there was a main effect of Expression, $F(1,328) = 26.58$, $p < .001$. A significant Expression $\times$ Task interaction, $F(1,328) = 4.89$, $p < .05$, indicated that the difference between positive and negative expressions was stronger in the facial visual probe task. This pattern was independent of social anxiety as was evidenced by the absence of a significant Group $\times$ Task $\times$ Expression interaction, $F(1,328) = 0.08$, $p = .78$. There were no significant Group $\times$ Task, $F(1,328) = 0.02$, $p = .96$, or Group $\times$ Expression, $F(1,328) = 0.08$, $p = .77$ interactions. The pattern of results was identical when analyses were repeated while statistically controlling for gender effects or when outliers ($n = 5$) were removed. A contrast of bias scores (see Figure 3.1) against a value of zero indicated that both the low social anxiety group (threatening faces: t (189) = 5.73, $p < .001$; threatening words : t (191) = 4.13, $p < .001$) and the high social anxiety group (threatening faces: t (156) = 5.33, $p < .001$; threatening words : $t(157) = 3.05$, $p = .003$) showed a pattern of vigilance to threat. For both groups, the bias scores for friendly stimuli did not differ significantly from zero.

Intercorrelations of attentional bias indices

A correlation analysis in the combined sample of high socially anxious children from the at-risk group and low socially anxious children of the control group indicated that attentional bias to threatening faces was positively and significantly but weakly related to attentional bias toward threatening words, $r = .18$, $p < .001$, and also positively and significantly related to attentional bias to friendly words, $r = .11$, $p < .05$. All other indices of attentional bias to threatening and friendly faces or threatening and friendly words appeared unrelated ($p > .05$).

Attentional control as a moderator for the role of attentional bias in social anxiety.

A correlational analysis was conducted on 195 participants (from the control group, not selected for high or low social anxiety) who had completed the attentional control (AC) measure and had correctly performed the attentional bias tasks. The pattern of attentional bias indices was comparable to the results of the first analysis. A contrast of bias scores against a value of zero indicated that attentional bias to threatening faces: $M = 27.98$, $SD = 45.24$, t (194) = 8.64, $p < .001$ and threatening words $M = 12.29$, $SD = 47.21$, t (194) =

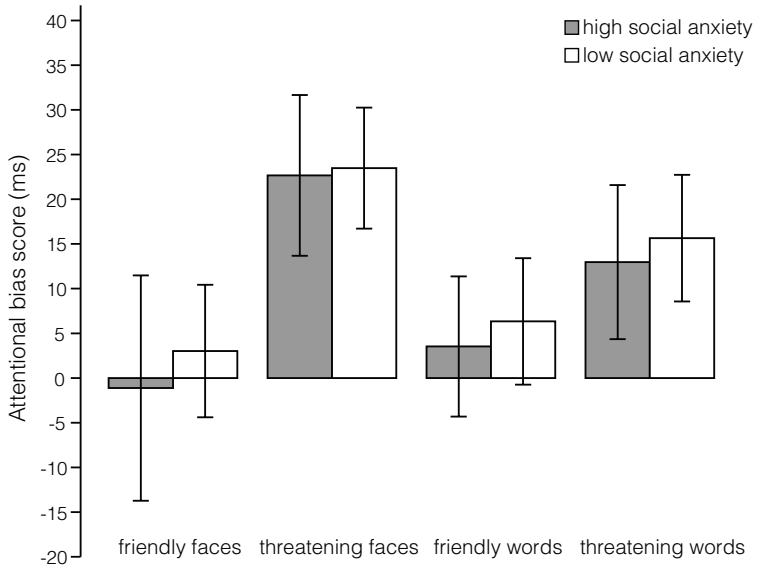

Figure 3.1. Attentional bias index by group, stimulus type, and valence. Error bars represent the 95% confidence interval.

3.64, $p < .001$) were significantly different from zero. The bias scores for friendly faces or words did not differ significantly from zero.

Replicating previous research, there was a significant correlation between social anxiety (RCADS-SP) and AC, r (SP,AC) = -.31, $p < .01$. Attentional bias to threatening faces (ABf) did not significantly correlate with SP or AC, r (ABf,SP) = .02, p = .817; r (ABf,AC) = -.02, p = .834. Similarly, attentional bias to threatening words (ABw) did not significantly correlate with SP or AC, r (ABw,SP) = .02, p = .829; r (ABw,AC) = -.10, p = .152. The interaction AC $\times$ ABf or AC $\times$ ABw (centered) did not significantly correlate with social anxiety; r (SP,AC $\times$ ABf) = -.08, p = .256; r (SP,AC $\times$ ABw) = .05, p = .532. Thus there was no evidence for a moderating influence of attentional control on the relationship between attentional bias and social anxiety.

Discussion

The main goal of this study was to examine whether attentional bias to social threat might be involved in adolescent social anxiety. The major results can be summarized as follows: (i) both high and low socially anxious adolescents displayed an attentional bias to threatening faces as well as to social threat words, whereas (ii) there was no evidence for a bias towards or away from positive stimuli, (iii) the relationship between attentional bias and social anxiety was not moderated by habitual attentional control.

In line with the alleged importance of attentional bias in the development of anxiety, high socially anxious adolescents displayed an attentional bias for threatening cues. However, unexpectedly, low socially anxious individuals displayed a very similar attentional bias. Thus, in apparent contrast to findings in non-clinical adult samples (Cisler & Koster, 2010; Staugaard, 2010), no evidence emerged to indicate that socially anxious adolescents are characterized by a relatively strong attentional bias, neither for verbal nor for facial signs of social rejection. Clearly then, this pattern of findings cast doubts on the role of attentional bias in the development of social anxiety disorder in adolescence. However, it should be acknowledged that in our study the social threat stimuli were always presented for 500 ms. Therefore, it cannot be ruled out that high socially anxious adolescents do show enhanced early detection of social threat cues (when presented for a shorter time interval) and/or an enhanced tendency to avoid social threat cues (when presented for a longer time interval). To arrive at a more final conclusion in this respect it would be important for future research to include multiple presentation times during the visual probe task (e.g., Mogg et al., 2004). In addition, it should be emphasized that our study tested the relevance of attentional bias in adolescents with heightened levels of social anxiety and who are assumed to be at risk for developing social anxiety disorder. Since our study

did not include clinically anxious individuals, it might still be that adolescents with a full blown social anxiety disorder do show an even stronger attentional bias for social threat cues.

One explanation for the finding that independent of social anxiety adolescents generally showed an attentional bias for signs of social rejection/disapproval might be that in adolescence, there is an increased understanding for social structures (Saarni, 1999) in an environment with an abundance of social demands and expectations (Higa-McMillan & Ebesutani, 2011). Perhaps then, the attentional bias for social threat stimuli in adolescence might reflect a generally enhanced sensitivity to social judgments (cf., Mogg et al., 2000). To further test the credibility of such an explanation it would be interesting for future research to test whether attentional bias for threat stimuli related to 'non-social' anxiety disorders (e.g., panic disorder or specific phobia) would show a differential pattern of attentional bias in adolescents as a function of fear.

Although the pattern of attentional bias was highly similar for facial and verbal stimuli, the relationship between both types of attentional bias was close to zero. Attentional biases to threatening faces and words were only weakly related. This suggests that facial and verbal visual probe tasks provide complementary information and also implies that findings based on a facial probe task do not necessarily generalize to verbal stimuli and vice versa. Future research is necessary to test whether similar patterns are also evident in other anxiety symptoms and whether both types of attentional bias may also have a differential influence. For example, attentional bias for verbal stimuli might make people especially sensitive for verbal expression of social rejection, whereas attentional bias for disapproving faces may render people especially sensitive for facial signals of social rejection. Although previous studies have used both faces and words as stimuli in visual probe tasks, our results suggest that these instruments are not interchangeable and measure different aspects of emotional processing. Attentional bias to threatening faces was also positively (albeit weakly) correlated with attentional bias to friendly faces. Attention to safety (positive attentional bias) and its relation to attention to threat (negative attentional bias) has not been studied extensively (Taylor, Bomyea, & Amir, 2010), and it remains therefore to be seen whether it represents a robust phenomenon that requires a theoretical explanation.

Previous research provided evidence that the relationship between attentional bias and anxiety might be restricted to individuals with low habitual attentional control (e.g., Derryberry & Reed, 2002; Helzer et al., 2009; Lonigan & Vasey, 2009). Yet, in the present study we found no evidence for such a moderating role of attentional control. Although relatively low attentional control was related to relatively high social anxiety (as was found in previous research; (e.g., Muris, Meesters, & Rompelberg, 2007), the relationship between attentional bias to threat and social anxiety appeared independent of habitual attentional control. It should be acknowledged however, that attentional control was measured with a self-report instrument. It can therefore not be ruled out that a performance measure would reveal a different result (Reinholdt-Dunne, Mogg, & Bradley, 2009).

Cognitive bias modification (CBM) procedures using visual-probe tasks to alter attentional biases have shown to be effective in ameliorating anxiety symptoms in adults (Bar-Haim, 2010) and adolescents (Rozenman et al., 2011), but it has not yet been proven that attention has to be biased for CBM to work; the mechanisms of change through which CBM operates are still unclear. However, the absence of a relatively enhanced attentional bias in socially anxious adolescents, does not point to attentional bias modification as the most obvious target for interventions that aim to prevent the development of social anxiety (disorder) in adolescents. Post-event processing, such as biased interpretations of ambiguous events might be a more convincing starting point, since by now there is quite some evidence that adolescents with heightened social anxiety do show a relatively enhanced social threat-confirming interpretation bias (e.g., Miers, Blöte, Bögels, & Westenberg, 2008; Rheingold, Herbert, & Franklin, 2003; Vassilopoulos & Banerjee, 2008). Accordingly, CBM interventions in adolescents might benefit most from using training paradigms focusing on a later stage in information processing.

Limitations

The present results do not support the view that attentional bias to socially threatening (facial or verbal) information is involved in subclinical adolescent social anxiety. Although there was no cros-sectional association between social anxiety and attentional bias, prospective and longitudinal studies are needed to test whether attentional biases might nevertheless have predictive value for future levels of social anxiety.

During the present visual probe task threat stimuli were always presented for 500 ms. It can, therefore, not be ruled out that differential attentional biases might become evident when stimuli are presented for shorter (early detection) or longer (avoidance) time intervals. In adult samples, however, a relationship between attentional bias to threat and anxiety has been most consistently found when stimuli where presented for 500 ms (Cisler & Koster, 2010).

One of the main differences between our study and other studies into attention to threat in (socially) anxious adolescents, is our use of stimuli expressing contempt, rather than anger. A differential attentional bias for angry faces or words might therefore still be found in socially anxious adolescents. Our use of rejection-relevant stimuli was motivated by the notion that a negative evaluation is more likely to be expressed with contempt rather than anger. There is ample evidence that stimuli used in attentional bias paradigms could be matched to specific disorders in children (e.g., Beck et al., 2011; In-Albon, Kossowsky, & Schneider, 2010), which suggests that stimuli referring to social rejection would be a proper choice for testing attentional bias in the context of social anxiety. As further support of the relevance of the present stimulus materials, high socially anxious adolescents were found to show relatively strong negative automatic associations to similar social threat words as were used in the present visual probe task (de Hullu, de Jong, Sportel, & Nauta, 2011).

Since we used a fixed order for the tasks and the verbal task was always presented as the second task, a comparison of the (strength of the) AB effect of faces vs. words cannot be made properly. However, this fixed order also implies a strong point of this study; since a similar difference between attentional bias for threatening and friendly stimuli was present in the pictorial task (presented first) and the verbal task (presented second), it cannot be argued that mere practice effects decreased the sensitivity of the task to find differences between low and high socially anxious adolescents.

Conclusion

A pattern of attentional bias towards threatening faces and words was clearly evident in both high and low socially anxious adolescents. This casts doubt on the notion that attentional bias to threat plays an important role in the origin of social anxiety disorder (at least in adolescents).

The use of an information processing framework in understanding the development of social anxiety (e.g., Ledley & Heimberg, 2006) has generated much interest in the role of information processing biases in the development and maintenance of social anxiety. In adult social anxiety, there is ample evidence of the existence of this bias and CBM studies have proven to be effective in reducing anxiety symptoms. However, since both high and low socially anxious adolescents display attentional biases to socially threatening faces and words, it is unlikely that these biases are a causal factor in the development of social anxiety.

Appendix 1: Visual probe task facial stimuli

Positive	Neutral counterpart	Negative	Neutral counterpart
af01has	af01nes	af03dis	af03nes
af06has	af06nes	af04dis	af04nes
af07has	af07nes	af05dis	af05nes
af09has	af09nes	af16dis	af16nes
af15has	af15nes	af21dis	af21nes
af18has	af18nes	af22dis	af22nes
af24has	af24nes	af30dis	af30nes
af25has	af25nes	af31dis	af31nes
af27has	af27nes	am02dis	am02nes
af32has	af32nes	am09dis	am09nes
am01has	am01nes	am13dis	am13nes
am06has	am06nes	am14dis	am14nes
am11has	am11nes	am15dis	am15nes
am16has	bm16nes	am27dis	am27nes
am23has	am23nes	am28dis	am28nes
am26has	am26nes	am31dis	am31nes
af02has	af02nes	af10dis	af10nes
af08has	af08nes	af12dis	af12nes
af11has	af11nes	af17dis	af17nes
af13has	af13nes	af19dis	af19nes
af26has	af26nes	af23dis	af23nes
af33has	af33nes	af28dis	af28nes
am03has	am03nes	af29dis	af29nes
am04has	am04nes	af35dis	af35nes
am08has	am08nes	am05dis	am05nes
am17has	am17nes	am07dis	am07nes
am22has	am22nes	am10dis	am10nes
am25has	am25nes	am18dis	am18nes
am29has	am29nes	am21dis	am21nes
am30has	am30nes	am33dis	am33nes
am32has	am32nes	am34dis	am34nes
am24has	bm24nes	am12dis	bm12nes

Note. KDEF Codes:
Letter 1: Session: A (series 1)
Letter 2: Gender: F = female, M = male
Letter 3 & 4: Identity number: 01 - 35
Letter 5 & 6: Expression: DI = disgusted, HA = happy, NE = neutral
Letter 7 & 8: Angle: S = straight

Appendix 2: Original stimulus words in Dutch with translation in English

Positive	Neutral counterpart	Negative	Neutral counterpart
genieten (enjoy)	kladblok (scrapbook)	ongewenst (undesirable)	tuinieren (gardening)
begaafd (gifted)	sleutel (key)	onhandig (clumsy)	schouder (shoulder)
briljant (brilliant)	vierkant (square)	walging (disgust)	station (station)
goedkeuring (approval)	kleerhanger (hanger)	lafaard (coward)	lucifer (match)
super (super)	lepel (spoon)	dom (stupid)	hek (fence)
bewonderen (admire)	boekenkast (bookcase)	eenzaam (lonely)	gordijn (curtain)
prijzen (recommend)	context (context)	onaardig (unkind)	diskette (disk)
charme (charm)	gewoon (just)	schaamte (shame)	computer (computer)
geweldig (great)	grasveld (lawn)	afkeer (aversion)	opslag (storage)
vrijheid (freedom)	handdoek (towel)	verwerpen (reject)	bloemkool (cauliflower)
aardig (nice)	garage (garage)	waardeloos (inferior)	spreektaal (language)
sympathie (sympathy)	eigenaren (owners)	uitlachen (ridicule)	snijplank (cutting board)
uitmuntend (excellent)	winkelruit (windowpane)	gekweld (harassed)	bewegen (move)
plezier (pleasure)	deurbel (doorbell)	verliezer (loser)	reservaat (reserve)
blijheid (glad)	koelkast (refrigerator)	haten (hate)	rails (rails)
lachen (laugh)	borden (signs)	vermijden (avoid)	gemiddeld (average)
genoegen (delight)	papieren (paper)	verlegen (shy)	opbergen (store)
succes (success)	keuken (kitchen)	verafschuwd (detest)	kledingkast (wardrobe)
gelukkig (happy)	moestuin (garden)	egoistisch (selfish)	meubileren (furnish)
dapper (brave)	middel (medium)	blozen (blush)	lepels (spoons)
glimlach (smile)	vaatdoek (dishcloth)	afgaan (fail)	poster (poster)
slim (smart)	bord (board)	afkeuring (disapproval)	busstation (bus station)
vrolijk (cheerful)	procent (percent)	afwijzing (rejection)	oorsprong (origin)
handig (handy)	lakens (sheets)	trillen (tremble)	glasbak (recycling)
waardering (appreciation)	herstellen (restore)	verwenst (cursed)	handpalm (palm)
aanbidden (adoration)	aardappel (potato)	beschaamd (ashamed)	rechthoek (rectangle)
plezier (joy)	potlood (pencil)	fout (mistake)	raam (window)
compliment (compliment)	verwarming (heating)	veracht (despised)	kantine (canteen)
liefhebbend (loving)	tijdschrift (magazine)	idioot (idiot)	kelder (basement)
lief (sweet)	vork (fork)	nutteloos (useless)	gasfornuis (stove)
behulpzaam (helpful)	afvalemmer (trashcan)	falen (failure)	deken (blanket)
leuk (fun)	maan (moon)	stom (stupid)	deur (door)

Chapter 4

Biased Interpretations of Ambiguous Social Situations in Socially Anxious Adolescents

Abstract

There is ample evidence that threat-related interpretive biases are involved in social anxiety. Although there is evidence that interpretive bias is evident in clinical groups of socially anxious adolescents, it is not yet clear whether adolescents who are at risk for developing social anxiety disorder are also characterized by a tendency to interpret ambiguous social situations in a negative way. Adolescents (age 12-15) with an elevated level of symptoms of social anxiety (n = 179) were compared to adolescents with a low level of social anxiety symptoms (n = 205) using two instruments to measure interpretive bias. Results indicated that high socially anxious adolescents interpret ambiguous social situations in a more negative and less positive way compared to their low-anxious peers. Results were most pronounced in the Adolescents' Interpretation and Belief Questionnaire; using the Recognition task we found differential effects for positive interpretive bias but not for negative interpretive bias. These results support the application of procedures to modify interpretive biases for the prevention of social anxiety in at-risk adolescents.

Introduction

The existence of interpretive bias in socially anxious children and adolescents has been fairly well established using various paradigms in both clinical and non-clinical samples. Anxious children show a negative interpretive bias for ambiguous situations (Cannon & Weems, 2010; Hadwin, Frost, French, & Richards, 1997; Taghavi, Moradi, Neshat-Doost, Yule, & Dalgleish, 2000) and socially anxious children show a negative interpretive bias specifically for social situations (Miers, Blöte, Bögels, & Westenberg, 2008). Interpretive bias has been found in various age groups, and there is no evidence indicating a relationship with age (Taghavi et al., 2000). Socially anxious children and adolescents tend to discount positive social events, to catastrophize mildly negative social events and to have a more negative anticipation of social events (Vassilopoulos & Banerjee, 2008). They also overestimate the cost and probability of negative social events (Rheingold, Herbert, & Franklin, 2003). Previous research has been performed in both clinical and sub-clinical samples, but it is not yet clear whether interpretive bias is a vulnerability factor in social anxiety that is already present in adolescents at risk for developing social anxiety. Therefore, the aim of the current study is to assess interpretive bias in adolescents with an elevated level of social anxiety symptoms compared to a group of low socially anxious adolescents.

Method

Participants

Participants in this study were selected from two different groups. The high socially anxious participants (n = 179, 12-15 years) were selected on the basis of a screening in a large research project on the prevention of social and test anxiety in adolescents (Project Pasta;`www.projectpasta.nl`). After approval for this study by the Medical Ethics Committee of the University Medical Center, a screening took place in the first two grades of 25 high schools in the Northern part of the Netherlands. Of the invited 5318 children, approximately one-third (one parent and the child signed an informed consent form) agreed to participate in the study and 1811 children were screened for symptoms of social anxiety. Children (n = 595) scoring above our cut-off (at 10 for females and 9 for males) on the social phobia subscale of the Revised Child Anxiety and Depression Scale (RCADS; (Chorpita, Yim, Moffitt, Umemoto, & Francis, 2000)) were invited for the next step in the project. The RCADS cut-off scores were based on the 75th percentile in a large Dutch cohort of young adolescents (N = 2230, the TRAILS-study; (Huisman et al., 2008)). This study is part of a prevention project aiming at individuals at risk for developing social anxiety disorder; therefore we selected participants using the ADIS-C structured clinical interview (Anxiety Disorders Interview Schedule for Children ADIS-C; (Silverman & Albano, 1996). We excluded adolescents with few or no symptoms of social anxiety (n = 211) and adolescents in need of treatment for social anxiety disorder (CSR [Clinician Rated Severity] >= 5) (n = 29) or other mental disorders (n = 28). Thus, adolescents were included in the project when they showed symptoms of social anxiety (i.e., afraid to speak in class or talk to strangers), but indicated only moderate (CSR = 4, n = 31) or mild (CSR < 4, n = 209) interference of social anxiety with their daily life (Albano & Hayward, 2004). Two weeks after the ADIS-C interview, all included participants took part in the assessment (questionnaires and performance measures) that provided the data for this study. Scores on RCADS-social phobia at this assessment were in quite a few cases lower than the original cut-off. Thus, for the purpose of this study, for the high-anxious group, only those with RCADS-social phobia scores above the cut-off were finally selected (n = 179, 71.5% girls, mean age 13.6; SD = 0.67).

The control group included participants from three different high schools (not participating in Project Pasta). All children in the selected grades were asked to take part in a study about mental health, and about one-third (n = 316; aged 12-16 years) returned a signed informed consent form in which parent and child agreed to participate in the study. Participants in this group were rewarded with a €5 voucher directly after the assessment. From this control group, only those scoring below our cut-off on social phobia (n = 205, 47.3% girls, mean age 14.0; SD = 0.70) were selected for the low-anxious group.

Materials

Social Anxiety

The Revised Child Anxiety and Depression Scale (RCADS; Chorpita et al., 2000) is a 47-item self-report instrument, with items rated on a 4-point scale ranging from 0 to 3. In psychometric research the internal consistency of the scale and subscales were found to be good (Chorpita et al., 2000). In the current study only the social phobia subscale (9 items; α = .88) will be reported.

Recognition Task

The Recognition Task was adapted from earlier versions (Mathews & Mackintosh, 2000; Salemink & van den Hout, 2010b) such that the scenarios presented were appropriate for adolescents in a school environment. On the computer screen, participants read a scenario of a social situation, followed by a word fragment that they were asked to solve. The (social) situation remained ambiguous, and a comprehension question appeared which made sure that participants had read the text. Incorrect answers on the comprehension questions are an indicator that the participant did not read the scenario carefully, such that the answers to the recognition question will not reflect actual interpretations but guesses. After 10 trials describing various (social) situations, the title of the description was repeated and participants were asked to rate the similarity (1 = *very similar in meaning* to 4 = *very different in meaning*) of four different interpretations (positive, negative, neutral, or irrelevant) of the situation to the original situation that they have read before. Positive and negative interpretive biases are calculated from the ratings on positive and negative interpretations. Mean scores for the 10 situations are reversed such that higher scores indicate a higher (positive or negative) interpretive bias.

Adolescents' Interpretation and Belief Questionnaire

The AIBQ (Miers et al., 2008) is a questionnaire developed to assess interpretations and beliefs about both social and non-social ambiguous situations, specifically designed for adolescents. In this study, we assessed only the positive and negative interpretations of social situations. An example of an item measuring interpretive bias for social situations is as follows: *You've invited a group of classmates to your birthday party, but a few have not yet said if they're coming. Why haven't they said something yet?* After this description, three interpretations of the situation (positive, negative, and neutral) were presented individually and respondents were asked to rate how likely it is that this interpretation would pop up in their mind (1 = *does not pop up in my mind* to 5 = *definitely pops up in my mind*). Interpretive bias was calculated by adding up the scores from each interpretation/situation combination divided by the number of situations (5), resulting in a range with minimum 1 (no bias) to 5 (high bias).

Results

For both the high and low socially anxious children, we excluded participants (9 high-anxious, 10 low-anxious) who showed poor performance on the recognition task, such that only participants who correctly responded to more than 50% of the comprehension questions remained in the analysis. The high-anxious group (n = 170) consisted of 121 girls and 49 boys (mean age 13.56; SD = 0.67), and the low-anxious group (n = 195) consisted of 96 girls and 99 boys (mean age 14.01; SD = 0.70). An independent sample t test indicated that the scores on social phobia (M difference = 9.23, t [363] = 28.12, p < .001) were significantly higher for the high socially anxious group (M = 15.07, SD 3.61) than the low socially anxious group (M = 5.93, SD 2.56). Distributions of the data were checked and confirmed that the assumptions of parametric tests were met.

Two separate repeated measures ANOVA's were performed for the two interpretive bias measures (recognition task and AIBQ) with valence (*negative/positive*) as within-subject factor and group (*high socially anxious/low socially anxious*) as between subject factor, plus the interaction between group and valence. These analyses were repeated with gender as a covariate to check if effects were similar when controlled for gender. Post-hoc t-tests were performed to compare positive and negative interpretive bias, separately

for both instruments. Paired-sample *t*-tests were performed in both high and low social anxiety groups to compare positive and negative interpretive bias within each group. Table 4.1 shows means and standard deviations for the two interpretive bias indices.

Table 4.1. *Mean interpretive bias for high socially anxious (n = 170) and low socially anxious (n = 195) adolescents*

	Low Social Anxiety		High Social Anxiety	
	M	*SD*	*M*	*SD*
Recognition Task Negative Interpretive Bias	2.30	0.46	2.38	0.51
Recognition Task Positive Interpretive Bias	2.64	0.38	2.54	0.40
AIBQ Negative Interpretive Bias for social situations	2.31	0.67	3.17	0.76
AIBQ Positive Interpretive Bias for social situations	2.95	0.68	2.44	0.69

For interpretive bias measured using the **Recognition Task** (see figure 4.1), there was a main effect of valence (F [1,363] = 65.07, $p < .001$, partial $\eta^2 = .15$): overall, adolescents showed a relatively positive interpretive bias. There was a significant interaction effect of valence*group (F [1,363] = 8.74, $p = .003$, partial $\eta^2 = .02$), indicating that high socially anxious adolescents showed slightly more interpretive bias compared to low socially anxious adolescents. These effects were similar when gender was added as a covariate. Post-hoc t-tests showed that high socially anxious adolescents showed significantly less positive interpretive bias than low socially anxious adolescents (t [363] = 2.38, $p = .02$), whereas there was an opposite trend for negative interpretive bias that did not reach the conventional level of significance (t [363] = -1.68, $p = .09$). Positive interpretive bias was significantly higher than negative interpretive bias in the high socially anxious group (t [169] = -3.51, $p = .001$), as well as in the low socially anxious group (t [194] = -8.05, $p < .001$).

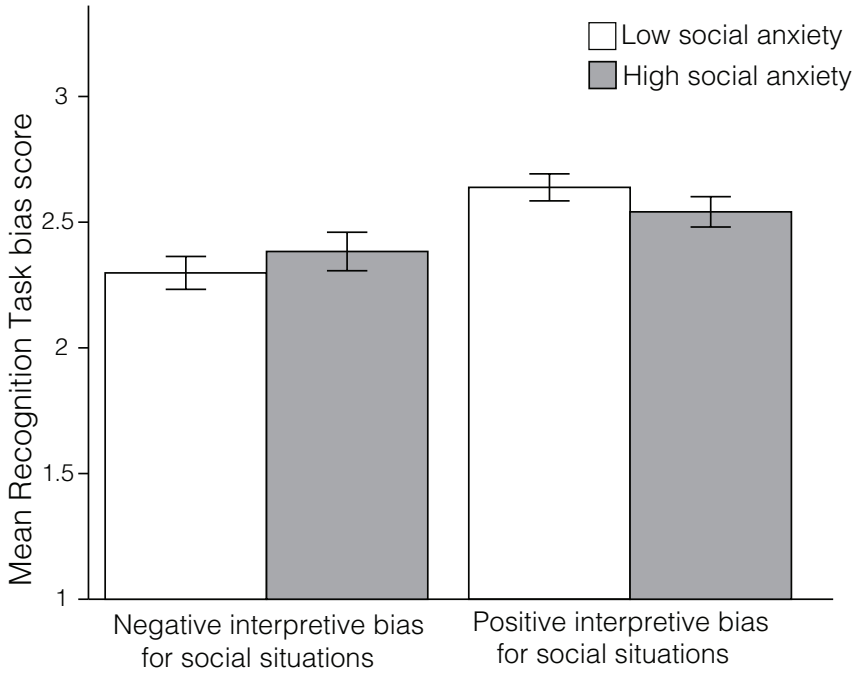

Figure 4.1. Interpretive bias measured using the Recognition Task. Error bars represent the 95% confidence interval.

For interpretive bias measured using the **AIBQ** (see figure 4.2), there was no main effect of valence, indicating that overall, adolescents did not show a similar positivity bias as shown in the results of the recognition task. There was a large and significant interaction effect of valence*group (F [1,363] = 157.35, p < .001, partial η^2 = .30), meaning that patterns of interpretive bias are different for high and low socially anxious groups. These effects were similar when gender was added as a covariate. Post-hoc t-tests indicated that high socially anxious adolescents showed both a significantly weaker positive interpretive bias (t [363] = 7.11, p < .001) and a significantly stronger negative interpretive bias (t [363] = -11.55, p = < .001) than low socially anxious individuals. In the high socially anxious group, negative interpretive bias was stronger than positive interpretive bias (t [169] = 8.09, p < .001), while in the low socially anxious group positive interpretive bias was significantly stronger than negative interpretive bias (t [194] = -9.84, p < .001).

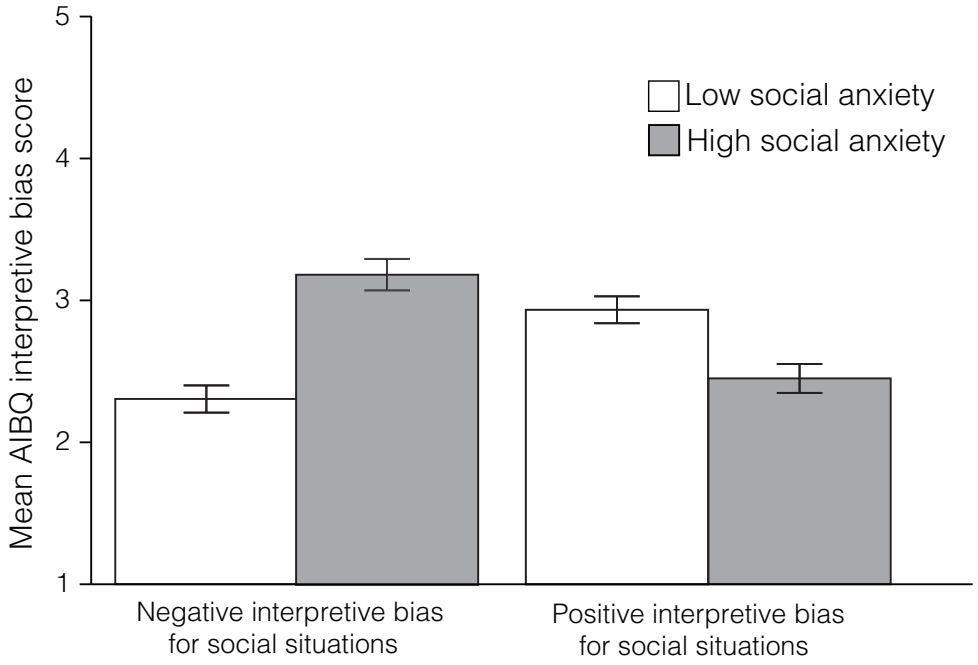

Figure 4.2. Interpretive bias measured using the AIBQ. Error bars represent the 95% confidence interval.

Discussion

As expected, high and low socially anxious adolescents differed with respect to their interpretive bias for ambiguous social situations. This effect was most clear in the Adolescents' Interpretation and Belief Questionnaire (AIBQ) scales: high socially anxious adolescents interpreted ambiguous social situations more negative and less positive. In the recognition task, we found a similar pattern although the difference specifically for the negative interpretation bias did not reach significance. High socially anxious adolescents had less positive interpretations of ambiguous social situations but there was no difference between groups with respect to negative interpretations. The recognition task showed a stronger positive interpretive bias for both high and low socially anxious adolescents. The AIBQ showed that high socially anxious adolescents are characterized by a stronger negative interpretive bias while low socially anxious adolescents are characterized by a positive interpretive bias.

These slight differences between the findings of both indices of interpretive bias may be due to the differences between the two instruments: the recognition task first presents stories and later asks about the similarity between (biased) interpretations of the situations and the original ambiguous scenario and thus might reflect biased interpretations in memory; the AIBQ asks about the likelihood that a (biased) interpretation pops up in the mind just after being presented with an ambiguous situation and might reflect a biased judgement of ambiguous social situations. Miers et al. (2008) compared a group of high and low socially

anxious adolescents from the first 4 grades of highschool (mean age 14 years, N = 73) using the AIBQ and found a significant difference between groups with respect to negative interpretations, whereas the difference regarding positive interpretations of social situations did not reach significance. Since mean scores on the AIBQ for high and low socially anxious adolescents in this earlier study were quite similar to the scores we found in the current study, the difference in findings between both studies might well reflect differences in the statistical power to detect (relatively modest) differences.

For the purpose of this thesis, we can conclude that adolescents at risk for social anxiety do differ in their interpretations of social situations. Because the cross-sectional design of this study and those described above do not answer the question whether interpretive bias is causally related to social anxiety, it remains important to experimentally modify interpretive biases and measure subsequent effects on social anxiety (e.g., Beard & Amir, 2008). An intervention designed to enhance benign interpretations of ambiguous situations could possibly prevent social anxiety to emerge in adolescents who are at risk, or help reduce early symptoms of social anxiety.

Chapter 5

Cognitive Bias Modification versus CBT in Preventing Adolescent Social Anxiety: A Randomized Controlled Trial

This chapter is based on the article that is submitted as:
Sportel, B. E.[1], de Hullu, E.[1], de Jong, P. J., & Nauta, M. H. (2011). *Cognitive bias modification versus CBT in preventing adolescent social anxiety: A randomized controlled trial.* Manuscript Submitted for Publication.

[1] These authors contributed equally to this work

Abstract

This study investigated the relative efficacy of an internet-based cognitive bias modification (CBM; n = 86) and a school-based cognitive behavioral group training (CBT; n = 84) compared to a no-intervention control group (n = 70) in preventing the development of social anxiety disorder in high socially anxious adolescents aged 13-15 years. Eligible participants (n = 240) were randomized at school level over the three conditions. CBM consisted of a 20-session at home internet-delivered cognitive bias modification training; CBT was a 10-session at school group training, delivered by registered psychologists. Participants were assessed immediately before and after the intervention as well as at 6 and 12 months follow-up. Independent of condition participants generally improved from pretest to 12 month follow-up (p < .001). At 6 months follow-up CBT resulted in more improvement as indexed by lower self reported social anxiety than the control condition (p < .05). For CBM, this effect was only trend-significant (p = .08). At 12 month follow-up this initial benefit was no longer present.

Interestingly, participants in the CBM condition improved more with regard to the automatic threat-related associations, compared to both other conditions in the long term (CBT: p < .01; CTRL: p < .05), whereas adolescents in the CBT condition reported less test anxiety and fear of negative evaluation (p < .05). Most important, the results indicate that the active conditions resulted in a faster decline of symptoms than the control condition, whereas the eventual end point was not affected by the present interventions.

Introduction

Social Anxiety in Children and Adolescents

Social anxiety disorder is one of the most common mental disorders in children and adolescents, with about 9.5% of girls and 4.9% of boys facing social anxiety disorder in their adolescent period (14-24 years old; Wittchen & Fehm, 2003). Social anxiety is associated with poor development of social skills, reduced social interactions, low self esteem, and lower school performance (Stein & Kean, 2000). In addition, social anxiety disorder at an early age may lead to problems in adulthood, such as other anxiety disorders, depression, alcohol and drug misuse, and lowered academic or work performance (Wittchen, Fuetsch, Sonntag, Müller, & Liebowitz, 2000). Social anxiety in adolescents can express itself in many different ways. Some children avoid walking the school's hallways alone, in fear of being stared at; some worry extensively about their looks; some study for hours into the night, avoiding the possibility to fail an exam (Beidel & Turner, 2007b). Social anxiety in adolescents often takes the form of test anxiety; these adolescents fear that they will perform poorly on tests, resulting in heart palpitations, sweating, and school avoidance on test days (Beidel & Turner, 2007b). Social anxiety is characterized by fear of negative evaluation, which sharply increases in adolescence (Gullone & King, 1993).

Because social anxiety has such a pervasive impact on the well-being of school children, prevention of social anxiety is of great importance. Previous research has shown that prevention in a school setting can be effective in reducing anxiety symptoms and in preventing the onset of anxiety disorders in general, both at short and long term (see Neil & Christensen, 2009 for a review). Various programs have been successfully applied in the prevention of anxiety disorders, using CBT techniques delivered by a mental health practitioner or teacher. In most published studies, the intervention leads to a significant reduction in anxiety symptoms compared to a control group, with effect sizes in the small to moderate range (Neil & Christensen, 2009).

Thus far, little is known about the efficacy of school-based interventions that are specifically targeted at the prevention of social anxiety disorder. Social anxiety disorder typically develops in early adolescence, and specific interventions directly aimed at social anxiety disorder may enhance the effectiveness of the preventive intervention. The single study in the literature that specifically focused on the prevention of social anxiety used a universal school-based program (Aune & Stiles, 2009). This intervention was found to be effective in reducing symptoms of social anxiety in both a population sample and in a subsample with elevated levels of social anxiety. Moreover, it was effective in preventing the onset of social anxiety disorder at one year follow-up. So far, no studies have been conducted specifically aiming at the prevention of social anxiety in at-risk adolescents with subthreshold symptoms. Such indicated intervention may be more efficient with respect to time invested by participants, materials, and costs. Therefore, the first aim of the present study was to examine the efficacy of an indicated intervention to prevent social anxiety.

Models of Social Anxiety

According to current models of social anxiety, cognitive vulnerability factors play a major role in the etiology of social anxiety disorder (e.g., Daleiden & Vasey, 1997; Kearney, 2005; Ouimet, Gawronski, & Dozois, 2009). In line with this view, there is evidence indicating that socially anxious children view their environment different from their peers in several ways. First, it has been shown that they tend to preferentially direct their attention towards emotionally threatening information (Muris & Field, 2008). Such attentional bias is assumed to interfere with ongoing task performance (e.g., Derryberry & Reed, 1996; Mogg & Bradley, 1998). Second, several studies showed that socially anxious adolescents tend to interpret ambiguous information as threatening (Bögels & Zigterman, 2000; Taghavi, Moradi, Neshat-Doost, Yule, & Dalgleish, 2000), which decreases their sensitivity to potentially corrective environmental information. These early biases toward processing negative information may prompt anxious children to adopt a strategy of maintaining personal safety through avoiding and escaping threat cues, which will leave their fearful preoccupations unchanged by information that could

disconfirm their fears. Therefore, we designed a preventive intervention that directly aimed to attenuate or even reverse this type of threat-enhancing attentional and interpretive biases (cf., March, 2010).

Applying models of social anxiety in prevention

Directly targeting the interpretation and attention bias has become accessible through new developments in the field of experimental psychopathology. A relatively new way to treat anxiety is by direct modification of the aforementioned core cognitive processes: attentional and interpretive biases (Hirsch & Clark, 2004; Huppert & Foa, 2004). There is accumulating evidence that (social) anxiety can be decreased through cognitive bias modification (CBM) procedures targeting interpretive bias (e.g., Beard & Amir, 2008; Salemink, van den Hout, & Kindt, 2009) or attentional bias (e.g., Amir, Beard, Burns, & Bomyea, 2009; Bar-Haim, 2010). Although thus far studies on the efficacy of CBM procedures focused predominantly on adult populations, there is also evidence that these paradigms can be successfully applied to children and adolescents as well. For example, training high socially anxious 10 - 11 year-olds to endorse benign rather than negative interpretations of potentially threatening situations, resulted in a less negative interpretive bias, as well as in a reduction in anticipated anxiety and trait social anxiety, compared to a placebo-treatment control group (Vassilopoulos, Banerjee, & Prantzalou, 2009). Since CBM can be easily delivered over the internet, with minimal assistance and without the involvement of therapists, CBM-based prevention is not only promising with regard to treatment success but also with regard to cost-effectiveness. Therefore, the present study tested the efficacy of CBM as a preventive intervention and contrasted CBM with a more traditional CBT approach.

In the present CBT-based preventive intervention we tried to integrate all ingredients that have been shown to be effective in the treatment of social anxiety in children and adolescents. We created an intervention based on current golden-standard treatment protocols (e.g., Kendall, Hudson, Choudhury, Webb, & Pimentel, 2005; Warner, Fisher, Shrout, Rathor, & Klein, 2007), adjusted for the purpose of prevention. It has been shown that effective CBT studies in children and adolescents typically used cognitive restructuring and exposure techniques (for a review see Segool & Carlson, 2008). Cognitive restructuring may well reduce interpretation bias in social anxiety, whereas task concentration training (TCT) may be more relevant for attenuating attention bias. TCT (Mulkens, Bögels, de Jong, & Louwers, 2001) proved to be successful in reducing socially anxious symptoms in adults (Mulkens et al., 2001; Bögels, 2006; Bögels, Sijbers, & Voncken, 2006) and aims at coping with social anxiety by redirecting attention away from yourself and towards the task at hand. Other ingredients of effective CBT programs in social anxiety are psycho-education (Rummel-Kluge, Pitschel-Walz, & Kissling, 2009) and skills training. Therefore, our CBT group intervention integrated psycho-education, cognitive restructuring, exposure techniques, and task concentration training.

The CBM training was designed to target attentional bias, interpretive bias, dysfunctional associations, and implicit self esteem in socially anxious adolescents. Based on the argument made by Hirsch, Clark, and Mathews (2006), we chose to include tasks that modify different biases into one training, thus allowing for effects of the training on interpretive bias to interact with effects on attentional bias and vice versa in an attempt to maximize the efficacy of the training. We combined some well established paradigms such as a word fragment task to modify interpretive bias (Mathews & Mackintosh, 2000) and a modified visual probe task to modify attentional bias (MacLeod, Rutherford, Campbell, Ebsworthy, & Holker, 2002) with less-often used paradigms, such as a conditioning paradigm to modify implicit social anxiety associations (Clerkin & Teachman, 2010) and a classical conditioning task to amplify self-related positive associations (Baccus, Baldwin, & Packer, 2004).

Both training methods were rolled out in a school-based setting, since previous research has shown that the school setting is ideal for reaching children and adolescents who would not reach mental health care otherwise (Warner et al., 2007). Next to that, in a school setting the program is easily accessible, and extra costs or time investments are avoided. Furthermore, we chose to apply the program in an indicated manner, so that relatively small groups of adolescents with mild symptoms were trained. Such small groups provide

the possibility to tailor the training to the specific needs of participants and thus have the potential to achieve substantial individual effects (Neil & Christensen, 2009). Other advantages of indicated prevention are saving time, money and materials, compared to a universal training.

Measuring Social Anxiety

In most anxiety prevention studies (Neil & Christensen, 2009), the efficacy of the intervention is indexed by structured interviews, self report-measures, and parent-report measures. Recent studies have shown that changes in these explicit measures are not always paralleled by similar changes at the more implicit level (e.g., Teachman & Woody, 2003). Exclusively relying on explicit measures may thus result in exaggerating the actual treatment effects. The relevance of complementing self-reports with performance measures is underlined further by current dual process models that emphasize the importance to differentiate between more deliberate, rule-based (i.e., explicit) self-reports and more automatically activated associations (e.g., Gawronski & Bodenhausen, 2006). While explicit cognitions tend to predict more deliberate, controlled behaviors, automatic associations seem to play an important role in guiding relatively spontaneous, uncontrollable behavioral responses towards social stimuli (e.g., Spalding & Hardin, 1999; Egloff & Schmukle, 2002; Huijding & de Jong, 2006). Accordingly, the more automatic and controlled processes are assumed to independently and jointly influence socially anxious behaviors (e.g., Strack & Deutsch, 2004). In line with this, recent research focusing on high socially anxious adolescents showed that implicit and explicit measures of social anxiety relevant associations were independently associated with social anxiety symptoms (de Hullu, de Jong, Sportel, & Nauta, 2011). Thus for a more comprehensive assessment of the efficacy of interventions, it is important to complement explicit instruments with more implicit performance based measures. Therefore, in the present study we have chosen to evaluate the outcome of the interventions not only by looking at self-report questionnaires and structured clinical interviews, but also by measuring change in social anxiety-relevant automatic associations.

Research Questions

To summarize, in this indicated prevention study we compare a newly developed CBM-intervention to a CBT group prevention program and a no-intervention control group in adolescents with elevated levels of social anxiety. Our main research question is whether the active intervention groups are more effective than the control group in reducing symptoms of social anxiety and preventing enhancement of symptoms of social anxiety, as indexed by both self reported and more indirect performance-based measures. We look at the efficacy of these preventive interventions immediately post-treatment, as well as at 6 and 12 months follow-up.

Method

Trial Design

The present study used a multi-arm parallel group approach and employed a stratified design with balanced randomization (1:1:1). This study was named Project Pasta, Prevention of Adolescent Social and Test Anxiety (`www.projectpasta.nl`).

Participants

Before the start of current project the necessary sample size to find a medium effect was defined using power calculations. These calculations showed that for a medium effect, with a power of .80, within three groups, at $p = .05$ the sample size had to be 52 for each condition. Keeping drop-out in mind, we aimed at 75 participants in each condition. To reach this number we subsequently calculated the number of adolescents that should be interviewed. To reach this number of participants, we calculated, given cut-off scores (based on previous research) and chance of not meeting inclusion criteria that 346 adolescents were to be interviewed, meaning that approximately 1400 children were to be screened for social and test anxiety.

In total, 5318 adolescents in the first and second year of regular secondary schools in the northern part of the Netherlands were invited to participate in a study about the prevention of social and test anxiety. The current study was approved by the medical ethics committee of the University Medical Center Groningen and registered in the Dutch trial register with number NTR965 (`http://www.trialregister.nl`). Figure 5.1 displays a flow diagram of this study. As can be seen, a total of 1811 participants were screened for social and test anxiety using the Revised Child Anxiety and Depression Scale (RCADS; Chorpita, Yim, Moffitt, Umemoto, & Francis, 2000) and the Dutch version of the Spielberger's Test Anxiety Inventory (TAI; Examen/Toets Attitude Vragenlijst; van der Ploeg, 1988). Participants scoring above cut-off on social and test anxiety as measured by the RCADS and TAI (n = 516) were invited to participate in a clinical interview. Used cut-off scores for girls were >10 on RCADS social phobia and >43 on TAI, cut-off scores for boys were >9 on RCADS social phobia and >38 on TAI. The RCADS cut-off scores were based on the 75th percentile in a large Dutch cohort of young adolescents (N = 2230, the TRAILS-study; Huisman et al., 2008). Screening took place in two waves, including 12 schools in the first year and 13 schools in the second year.

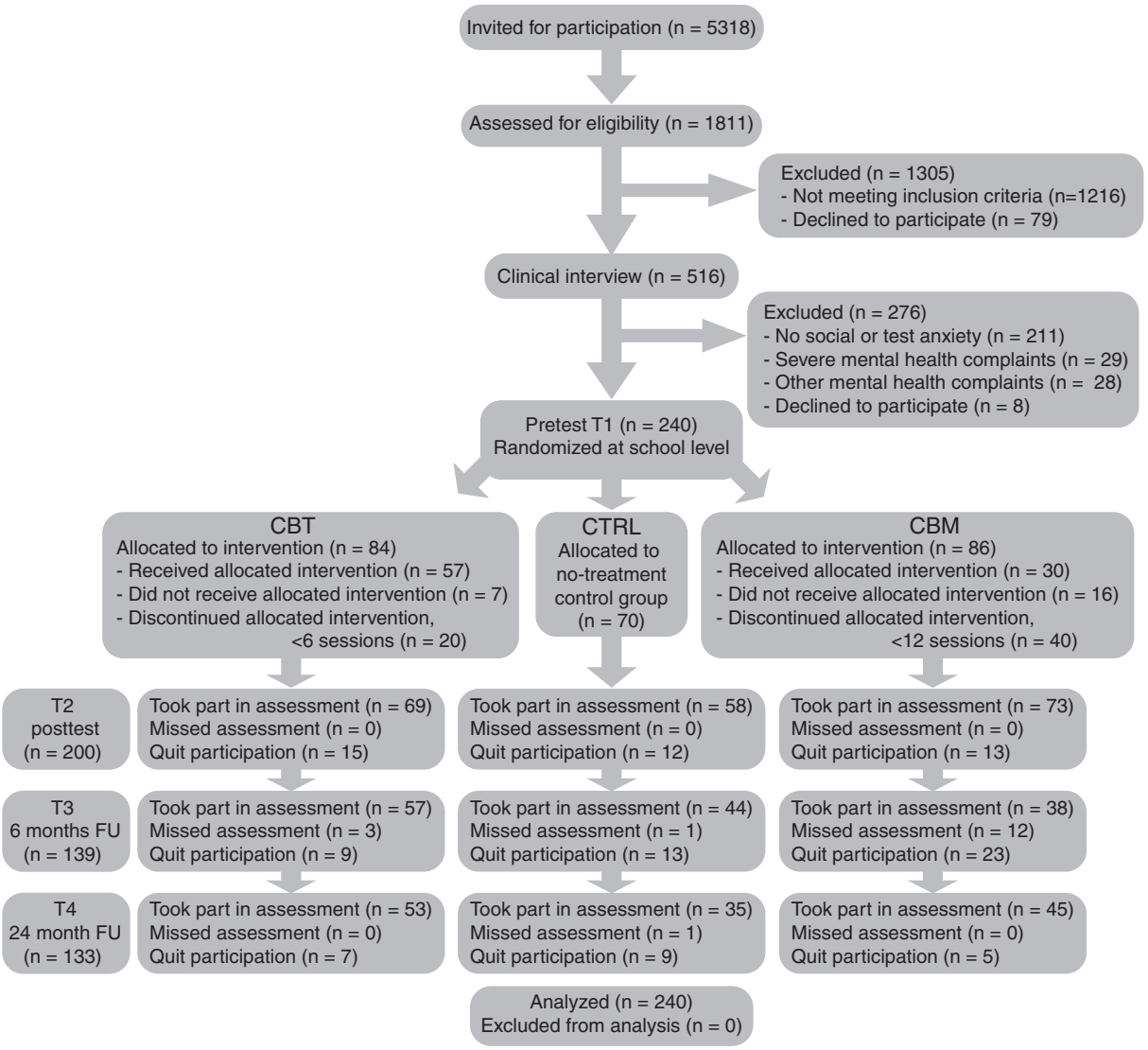

Figure 5.1. Study overview.

Based on the Anxiety Disorders Interview Schedule for Children (ADIS-C; Silverman & Albano, 1996), 240 adolescents (age 12-15) with low-level social anxiety were included in the current study. The ADIS-C provides a DSM-IV diagnosis of various anxiety disorders, as well as a clinician severity rating (CSR) that is rated on a 9-point-scale (0 = not at all disturbing/disabling; 8 = very severely disturbing/disabling; with a rating

under 4 being sub-clinical). Since this prevention study aims at individuals at risk for developing a social anxiety disorder, we excluded adolescents with CSR ratings of 5 and higher (n = 29), and advised these adolescents to seek treatment. Thus, adolescents were included when they showed symptoms of social anxiety (i.e., afraid to speak in class or talk to strangers), but indicated only mild (CSR <4) or moderate (CSR = 4) interference of social anxiety with their daily life (Albano & Hayward, 2004). Distribution of the CSRs was: CSR = 4, n = 31; CSR = 3, n = 51; CSR = 2, n = 32; CSR = 1, n = 2; CSR = 0, n = 124.

Two weeks after the ADIS-C interview, 240 included participants took part in the pretest (questionnaires and performance measures) and were subsequently randomized at school-level over one of three conditions. Precise numbers for each condition can be found in Figure 5.1. Three months after pretest, the participants completed a posttest (n = 200), and follow-ups at 6 months (n = 139), and 12 months (n = 133). Drop-out was stable over the three conditions.

At pretest the mean age of the 240 participants (66 boys, 174 girls) was 14.09 years, SD = 0.65. About one-third (31%) of the participants came from an urban area and 69% from a rural area, as defined by Statistics Netherlands (`http://www.rivm.nl/vtv/object_map/o2617n21780.html`; following Reijneveld et al., 2010). Furthermore 97.1% of the participants had the Dutch nationality, with at least one Dutch parent. The other 2.9% had either two non-Dutch parents, or was non-Dutch him- or herself with at least one non-Dutch parent. The majority (80.8%) of the participants were living with their non-divorced biological parents. All these demographic statistics are comparable to those of the total group of participants that were initially screened within the context of Project PASTA (`www.projectpasta.nl`; Sportel, Nauta, de Hullu, de Jong, & Hartman, 2011).

Interventions

Cognitive bias modification (CBM)

The cognitive bias modification (CBM) training consisted of twenty 40-minute sessions, delivered over the internet over a period of 10 weeks. Based on the literature available on modifying cognitive biases, the training mainly consisted of tasks to modify attentional biases and interpretive biases. These tasks were supplemented by relatively new tasks that were designed to modify automatic association and implicit self-esteem. Since the latter type of tasks are not yet well established in the literature, the backbone of the intervention consisted of attention and interpretation modification. Each session consisted of one or two different tasks out of four available tasks. Before the start of the CBM training, participants received information explaining the rationale of the training by letter and in a phone call. They received an e-mail with links to two training sessions each week, and were reminded if they did not complete the session by e-mail or phone. After each session, they received a compliment for completing it by e-mail. The training was delivered in a Macromedia Authorware (`www.adobe.com/products/authorware/`) webplayer applet, available for Windows and Apple operating systems.

Since it was shown that it is feasible to train interpretive biases (Salemink, van den Hout, & Kindt, 2007) and attentional biases (Browning, Holmes, & Harmer, 2010) in a benign direction, the backbone of our CBM training consists of tasks to modify these biases. One large part of the training (9 sessions) consisted of interpretive bias modification tasks along the lines of the CBM-I originally designed by Mathews and Mackintosh (2000). The objective was to implicitly guide participants to come up with benign interpretations of ambiguous social situations, which would help them to process real-life situations in a fear-disconfirming manner. During these tasks participants were presented with ambiguous social scenarios that were followed by word fragments that had to be solved in a benign direction (e.g., *You are at the birthday party of a good friend. You had great difficulty in finding him a nice birthday present. He unwraps the package and his face shows en--ym-nt.*). Most (80%) of the trials were ambiguous with positive word fragments, 20% were neutral filler trials without ambiguity or emotional content, to make the induction procedure less obvious. After each trial, a com-

prehension question (e.g., *Was it easy to find a present for your friend?*) followed to make sure participants would read the entire story. The number of trials and the type of ambiguous scenario's describing various aspects of adolescents' social life (school, sports, parents, friends, family) were based on Salemink et al. (2009), although we used less trials (60 compared to 104 trials per session) to limit the burden on the participants. The other large part of the training (8 sessions) consisted of attention bias modification tasks, which were based on the visual probe task (showing a pair of stimuli on the left and right side of the screen; Amir, Elias, Klumpp, & Przeworski, 2003; MacLeod et al., 2002), and the exogenous cueing task (showing one stimulus on the left or right side, with the opposite side blank; Posner, 1980; Yiend & Mathews, 2001). The objective was to guide participants to point their initial attention (presentation time of the stimuli was 500 ms) at positive (happy faces/words) or neutral (neutral faces/words) stimuli and away from fear-confirming stimuli (threatening faces/words). Initial attention to safe or positive information as opposed to initial attention to threat could help them in real-life situations to decrease avoidance behaviors and help disconfirm their fears. Participants were instructed to indicate as fast as possible whether the small arrow (probe) that appeared after 500 ms was directed upwards or downwards. Each session consisted of 450 trials, with pictorial (faces) and verbal stimuli (words) in equal proportions. Exogenous cueing task trials and visual probe trials were delivered intermixed. In half of the training sessions, the stimulus did not disappear after the probe appeared but stayed on screen, thus allowing for prolongated attention to the benign stimulus. Three training sessions aimed at changing automatic associations to social anxiety relevant stimuli. We developed a task based on the implicit association test (Greenwald, McGhee, & Schwartz, 1998), which aimed to couple social-evaluative situations with positive outcomes. In this task, consisting of 500 trials per session, participants were instructed to sort words appearing on the screen into two categories: Dutch or English. Stimuli were neutral words (e.g., *chair*), words related to (social) evaluative situations, (e.g., *exam*), and positive outcome words (e.g., *success*). Social cues and positive outcome words were both consistently presented in Dutch, and were thus sharing one response button, while neutral words were all in English. The goal of this task was to strengthen the association between (feared) social-evaluative situations and a positive outcome of that situation. Finally, a short evaluative conditioning task (Baccus et al., 2004; Clerkin & Teachman, 2010) of 240 trials was added as a second task to 10 sessions of attentional bias and automatic association tasks, aiming to enhance implicit self-esteem by associating self-relevant information (e.g., name, first letter of name, hometown) with positive outcomes. Participants were instructed to point the mouse as fast as they could in the quarter of a matrix where a word or object appeared. After the mouse-click, the stimulus was replaced by positive (personal stimuli) or neutral (non-personal stimuli) feedback (smileys and positive outcome words or pictures of household objects and neutral words).

The combination of tasks used in this CBM training differs in several ways from its predecessors in other CBM studies in clinical or subclinical populations. First, most studies used single-session (Amir, Bomyea, & Beard, 2010) or up to 8 sessions (Amir et al., 2009; Blackwell & Holmes, 2010; Vassilopoulos et al., 2009) training programs. We shaped our training to compare time-investment needed by participants in the CBT condition, so both interventions could serve as an attention control condition. Also, since CBM is a developing field, it is unclear what number of sessions per task is needed for a significant and lasting effect. We chose to aim for a larger impact of the training by offering extensive training sessions for a long period of time. Second, we combined multiple tasks in the CBM training, based on the argument made by Hirsch et al. (2006) that cognitive biases may mutually influence each other. The present multiple task approach was preferred in an attempt to increase the efficacy of the CBM training. Moreover, we anticipated that offering a variety of tasks would also help to keep participants motivated for the training. Tasks were delivered in an overlapping order (e.g., two sessions of attentional bias training + short self esteem tasks after two sessions of interpretive bias training, then one session of association task + a short self esteem task, etc). Third, at the start of each task, a screen was shown shortly explaining the rationale for that particular training. For example, in the interpretation training task the explanation was: *when you feel bad, this sometimes makes the world look bad too. Putting on rose-colored glasses can help you to perceive the world more positively and improve your mood*. During every session it was emphasized that a lot of practice is needed to change one's way of

thinking. Fourth, performance on tasks was tracked and after each block, during a short break, a summary of speed and performance was shown on the screen, in an attempt to make the task more challenging. Also, the number of trials completed and number of trials left was shown, to help participants to continue the task to the end. Fifth, in the interpretive bias tasks, we added instructions to visualize the scenario presented, as previous research has shown that imagining the positive interpretations may amplify the effectiveness of the task (Holmes, Mathews, Dalgleish, & Mackintosh, 2006). Therefore, in the first interpretive bias training session, a short imagination training was included (a stepwise instruction to imagine the taste of a lemon). Last, the speed in the attentional bias task was tailored to individual performance. If the target was identified correctly for more than 75% of the trials, in the next block the presentation time of the target arrow decreased with 25 ms, and in the same way it increased when performance was poor. This tailoring kept the task at the right level of difficulty for individual participants.

Cognitive behavioral group training (CBT)

The cognitive behavioral group training (CBT) consisted of ten weekly sessions of 1.5 hours. All training sessions took place at school, if possible immediately after school hours. The groups had a minimum of 3 and a maximum of 10 participants. All sessions were delivered by a psychologist from a local center for child and adolescent psychiatry.

The CBT training had four main components, 1. psycho-education, consisting of broadening the participants' knowledge on anxiety symptoms in general and on social and test anxiety more specifically, using the model of Clark and Wells (1995) to explain anxiety symptomatology; 2. task concentration training (Mulkens et al., 2001), with as major aim the improvement of the awareness of the focus of attention and the ability to control this attention; 3. cognitive restructuring, focusing on the identification and modification of dysfunctional thoughts; and, 4. exposure, practicing with personal anxiety provoking situations. The first two sessions consisted of psycho-education, followed by two sessions of task concentration training, two sessions of cognitive restructuring and three sessions of exposure. The last session focused on personal pitfalls and how to avoid them. Each session had a similar framework, starting with discussing home work assignments, followed by the introduction of a new theme and active exercises, such as attention training, identification of thinking errors, role-play or in vivo exposure exercises. Next to the sessions the participants had homework assignments each week, taking one up to two hours a week. The training protocol can be requested from the authors.

Controls

Participants in the control condition participated in all measurements, but did not receive training. The participants were allowed to make use of care as usual, at 12 months follow-up, one of the participants in the control condition received psychological help for her social anxiety. No participants received help for other reasons (e.g., death of a family member).

Procedure

Informed consent

All designated participants received information about the project at school, given by the researchers and interns in class. At the same day information letters were sent to the adolescents and their parents or caretakers at their home addresses via their schools, together with a letter of recommendation to participate from the school, an informed consent form and a return envelope. The information for parent and child contained some explanation concerning social anxiety, and the three conditions to which participants could be assigned. All adolescents in first and second year of the participating regular secondary schools were invited. As a reward a gift certificate worth €20 was raffled for each 20 participants. Adolescents willing to participate had to fill out and sign the informed consent together with at least one parent or caretaker and send it back by mail (free of charge) to the researchers. Returned informed consents were collected in a database and used

for inviting the adolescents for the screening. Participants could withdraw from the study at any given time, without presenting a reason.

Screening

The screening took place during school hours, at school in groups of 10–15 students. During the 50 minute screening participants completed tasks and filled out questionnaires on laptops in a fixed order. A researcher or intern was present at all times to answer questions, other participants and the researchers were not able to see the responses during the assessment, ensuring confidential and independent responding. At the end of the screening, those scoring above cut-off on social phobia as measured by the RCADS social phobia subscale and/or test anxiety as measured by the TAI automatically received a message on the laptop screen indicating they had a high chance of being invited for the next step in the project. Those scoring otherwise received the message that there was little chance to be invited for the next step.

Intake Interview and Pretest

Adolescents with a score above cut-off on social or test anxiety were invited for a clinical interview, the Anxiety Disorders Interview Schedule for Children (ADIS-C; Silverman & Albano, 1996). All interviews took place at school, during school hours, and were held by the researchers or other trained psychologists. Participants were included when they showed mild to moderate symptoms of social anxiety disorder; as indicated by an ADIS-C clinician rated severity (CRS) index of 4 or lower. Participants were excluded when they had no socially anxious symptoms or severe social anxiety (CRS >4) or other primary disorders. Note that for none of the adolescents with a CSR of 4 the interviewers saw the need for immediate intervention, nor did these participants themselves express a need for treatment. All adolescents finally included in the study met at least DSM-IV criteria A and B for social phobia (fear of negative evaluation in multiple social contexts). A majority did not meet full criteria for social phobia because the interference level of anxiety with their daily life was moderate or mild.

When participants were selected for the project based on the interview results, feedback was given to the participant and his or her parents informing that the participant had heightened levels of social anxiety and was invited for the next step in the project. Within three weeks the participants completed a pretest, one or two weeks before the start of the training period. The pretest took place at school, immediately after school hours, with other selected participants of that school in a group of maximum 15 adolescents. The assessment was performed on laptops and consisted of tasks and questionnaires, together taking approximately 30-45 minutes to complete. Again, researchers and interns were present to answer questions and to ensure confidentiality. After the pretest, participants received information on what condition they were assigned to: no training, CBT group training or CBM internet training, together with detailed information about how the project was to proceed.

Posttest, 6 Month Follow-up and 12 Month Follow-up

Twelve weeks after pretest, posttest took place, followed by follow-up assessments at 6 and 12 months. Invitations were send by mail one or two weeks before the measurement. One or two days before the measurement participants received a phone call from the researchers or an intern to remind them to be present. All measurements included tasks and questionnaires and were again completed on laptops, at school, immediately after school hours. Participants received a gift certificate of €5 for each assessment. The ADIS-C interview at posttest was conducted via telephone. Interviewers remained blind for participants' condition.

Measures

Anxiety Disorders Interview Schedule

The Anxiety Disorder Interview Schedule-Children (ADIS-C; Silverman & Albano, 1996) is a semi-structured

interview based on DSM-IV classification of psychopathology (American Psychiatric Association, 2000). Besides the focus on anxiety, the interview also includes other mental disorders such as depression, dysthymia and externalizing disorders. Obtained scores are rated by the clinician in a clinician severity rating (CSR), a 9-point scale with 0 meaning *not at all disturbing/disabling*, and 8 meaning very *severely disturbing/disabling*, a score of 4 and higher is indicating the presence of a disorder. The ADIS-C was used for DSM-IV diagnoses of anxiety disorders and depression. Participants were interviewed at pretest in a private room at school and posttest by telephone. Interviews were held by the first authors and other trained psychologists. Parents of participants were not interviewed. The validity of ADIS-C (to assess the presence of anxiety disorders) has been shown to be satisfactory (Wood, Piacentini, Bergman, McCracken, & Barrios, 2002). In the current sample, the interrater-reliability was very high with 99.7% overlap (based on ratings by a psychologist and independent rater scoring a random selection (n = 30) of the available ADIS-C interviews (n = 248) from pretest. In the analyses, we use a dichotomic variable indicating a DSM-IV Social Anxiety Disorder (SAD) diagnosis, which is 0 when no SAD is present and 1 when SAD is present, in cases with a CSR of 4 or higher on the ADIS-C.

Revised Child Anxiety and Depression Scale

The Revised Child Anxiety and Depression Scale (RCADS; Chorpita et al., 2000) is a revised version of the Spence Children's Anxiety Scale (SCAS; Spence, 1998). It is a 47-item self-report, with items rated on a 4-point scale ranging from 0 (*never*) to 3 (*always*). The questionnaire consists of six scales: separation anxiety disorder, social phobia, obsessive-compulsive disorder, panic disorder, generalized anxiety disorder and major depressive disorder. There is a sum score indicating the total level of internalizing psychopathology. In the current study, the social phobia subscale of the RCADS was used, consisting of 9 items. The internal consistency of the scale and subscales were found to be good in a normal as well as a clinical population (Chorpita, Moffitt, & Gray, 2005; Chorpita et al., 2000). The structure of the RCADS was found to be consistent with DSM-IV anxiety disorders and depression. In the current study, internal consistency of the social phobia subscale was satisfactory (at pretest α= .79). The RCADS was used at screening, pretest, posttest, 6 month follow-up, and 12 month follow-up.

Spielberger Test Anxiety Inventory

The Spielberger Test Anxiety Inventory (Spielberger TAI; Spielberger et al., 1980) is a 20-item self-report, with items rated on a 4-point scale, ranging from 1 (*almost never*) to 4 (*all the time*). The instrument consists of three scales, a sum scale, a worrying scale, and an emotionality subscale. In this study the Spielberger TAI was used on all assessment points. Previous research showed good reliability for the sum scale and the two subscales (van der Ploeg, 1988). In the current study, the sum scale was used and its reliability at pretest proved to be excellent (α = .95). The TAI was administered in the screening, pretest, posttest, 6 month follow-up, and 12 month follow-up.

Brief Fear of Negative Evaluation-II Scale

The Brief Fear of Negative Evaluation-II (BFNE-II; Carleton, McCreary, Norton, & Asmundson, 2006; authorized Dutch translation by Van Wees-Cieraad & de Jong, 2007) is a 12-item, 5-point Likert scale ranging from 0 (*does not fit me at all*) to 4 (*fits me very well*). The BFNE-II is based on BFNE by Leary (1983), with the difference that the reverse-worded items in the BFNE are reworded in the other direction in the BFNE-II. The internal consistency of the BFNE-II was found to be excellent, with α = .95. In our sample we also found α = .95 at pretest. In current study the BFNE-II was used in pretest, posttest, 6 month follow-up, and 12 month follow-up.

Implicit Association Test

To examine threat-related automatic associations with social cues, we used a single-target Implicit Association

Test (stIAT) that was specifically designed for this study. This variant of the IAT (Greenwald, McGhee, & Schwartz, 1998) is a computerized reaction time task that measures to what extent a single target category is associated with two attribute categories. Following the design of Wigboldus, Holland,van Knippenberg, den Hartog en Belles (2002), a social cues stIAT was constructed with the target category *social- or school activity*, and the attribute labels *positive outcome* and *negative outcome*. We chose to use these attribute labels to indicate threatening and safe associations with the target words. We labeled the target category *'social- or school activity'* to provide a neutral category that could contain cues that are feared by socially anxious people, such as conversation or exam. The instructions and format of the present stIAT were based on an IAT (de Jong, Sportel, de Hullu, & Nauta, 2011) that was tailored to the present age group and piloted extensively. In the stIAT, participants are asked to categorize words appearing in the centre of the screen as quickly as possible into the target category or the attributes, by pressing the left or right button on a response-box. The test phase consists of two blocks of 64 trials, each preceded by a short practice phase of 24 trials. After a correct response, the next stimulus is presented after 500 ms. After an incorrect response a red X appears shortly above the stimulus. Meanwhile, the stimulus remains on the screen until the correct response is given. The order of the category combinations is fixed across participants to reduce method variance. This is assumed to enhance the sensitivity of the stIAT as a measure of individual differences, which is important in view of the aim of the present study (cf., Borg, de Jong, & Weijmar Schultz, 2010; Schnabel, Asendorpf, & Greenwald, 2008; Steffens & König, 2006). Negative stIAT effects indicate relatively fast responses when *social and school activities* shared the response key with *negative outcome*. For someone with a fear of social situations, associations between social cue words and negative outcome are assumed to be relatively strong, resulting in a fast response when the target category (*social- or school activity*) and *negative outcome* will be paired, and a relatively slow response time when the target category is paired with *positive outcome*. For someone without social anxiety, the reverse response pattern is expected.

In current study the stIAT was used in pretest, posttest, 6 month follow-up, and 12 month follow-up. The split-half reliability of the stIAT was sufficient with Spearman-Brown corrected coefficient of .72.

Randomization

Stratified randomization took place at school-level. Schools were, based on number of participants, randomly grouped by three and then the three grouped schools were all allocated to one condition each, to make sure the amount of participants in each condition would be approximately the same. Of the 24 participating schools, 8 schools received CBT, 7 schools received CBM, and 7 schools got the control condition. Two small schools were excluded from randomization since no students were eligible for inclusion. The allocation of the schools was done by the project leader, by blind drawing same size papers with the conditions CBT, CBM or Control from a bowl. Participants and researchers supervising the assessments did not receive information about the condition until after the pretest to make sure condition was not of influence in the testing nor in the willingness to participate. After the pretest, all participants received a letter containing information about how the study continued, including information about the condition. In following assessments the interns supervising the assessments were not aware of the conditions of the participants. The first authors performing the interviews were aware of the school conditions but performed the interviews based on a name and participant number list, not containing school information.

Statistical Analyses

First, ANOVA and Pearsons χ^2 tests were used to analyze possible differences between conditions for the primary outcome measures at pretest. To test whether adolescents who completed all assessments differed from those that did not complete all assessments, we used *t*-tests and Pearsons χ^2 tests.

Multilevel analysis, using MLwiN Version 2.1 (Rasbash, Charlton, Browne, Healy, & Cameron, 2010), was used to answer the primary research question whether (a) the two training conditions were effective in preventing social anxiety and reducing socially anxious symptoms and (b) whether one of the training conditions

was more effective than the other. Multilevel modeling was chosen because it provides an elegant way to deal with missing data, taking all available data into account in all analyses. Multilevel models were estimated for the four primary outcome measures of social and test anxiety, namely ADIS-C, RCADS, Spielberger TAI and stIAT, and the secondary outcome measure BFNE-II. As a first step in the modeling the levels were defined, with test session at first level and participant at second level. School could have been added as a third level, however, exploratory analyses showed no effect of school. School was found to hold 0% up to 2.2% of the variance, and was therefore not included as a grouping variable in further analyses. Next, an unconditional model was employed to estimate the variance partitioned at each level. Then, an overall model was created, with pretest and 12 month follow-up as markers, to get an idea of the overall change within and between the groups. After adding time as variable, group $\times$ time was added. In a more specific model, looking into the various time segments, the categorical variable time (assessment point) was added, with random slopes for level 2. For the conditional model, third, the interaction variable time $\times$ training condition was added in a fixed manner, with control condition and pretest as reference categories. After that, we checked whether the model could be improved by including gender and treatment attendance as covariates. The reported effect sizes for group differences are derived from the differences between groups at time points, reported effect sizes over time were derived from differences between time points.

Results

Missing Data

Since the assessments were administered through laptops, there were no missing items on the questionnaires. However, we did have missing measurements at several points in time. The pattern of missing data was as follows: 33 (38.4%) of the 86 participants in the CBM conditions completed all four measurements, in the CBT condition 50 (59.5%) of the 84 participants completed all measurements, and in the control conditions 34 (48.6%) of the 70 participants completed all four measurements. In this study we dealt with the missing data as follows: First we compared, at pretest, those who did not participate in any measurements with those who completed all measurements, by means of a *t*-test, for the primary and secondary outcome measures: ADIS-C SAD (presence or absence of DSM-IV SAD, ADIS-C CSR >4), RCADS social phobia, Spielberger TAI, stIAT, and BFNE-II. These tests showed that both groups did not differ significantly at pretest (ADIS-C SAD: $\chi^2(1) = 0.66$, $p = .45$; RCADS-sp: $t = -0.55$, $p = .58$; TAI: $t = 0.48$, $p = .64$; stIAT: $t = -0.57$, $p = .57$; BFNE-II: $t = -1.03$, $p = .30$).

Secondly, we compared the non-completers in the three conditions, to see whether differences were present in their pretest data, by means of an ANOVA with conditions as factor. No differences were found between the non-completers in the three conditions (ADIS-C SAD: χ^2 (2) = 0.59, $p = .77$; RCADS-sp: $F(2,120) = 1.62$, $p = .20$; TAI: $F(2,120) = 0.02$, $p = .99$; stIAT: $F(2,120) = 0.44$, $p = .65$; BFNE-II: $F(2,120) = 0.38$, $p = .69$).

Descriptive Statistics

The means and standard deviations for the five outcome measures at the four assessment points are shown in Table 5.1. At pretest, there were no differences between the CBT, CBM and CTRL condition on the main outcome measures (RCADS-sp $F(2,239) = 0.30$, $p = .74$; Spielberger TAI $F(2,239) = 0.06$, $p = .94$; BFNE-II $F(2,239) = 0.31$, $p = .74$; stIAT $F(2,227) = 0.16$, $p = .85$ and ADIS-C SAD χ^2 (2) = 1.36, $p = .54$).

All analyses were conducted following the intent-to-treat principle, including all participants who were measured at pretest ($n = 240$) into the analysis. Table 5.1 provides an overview of the outcome variables between pretest and one year follow-up. Significant results from the table are described in the text below.

Table 5.1. *Means and standard deviations of all dependent variables at pretest, posttest, and 6 and 12 month follow-up by condition (Cognitive Bias Modification/Cognitive Behavior Therapy/no-treatment control*)

	CBM		CBT		Control	
Dependent	Mean	*SD*	Mean	*SD*	Mean	*SD*
RCADS social phobia						
pretest	13.64	4.95	13.11	4.26	13.27	4.52
posttest	11.34	5.42	12.35	4.84	11.59	4.75
6 month FU	10.00	5.91	9.71	3.71	11.48	4.89
12 month FU	10.15	5.73	10.13	4.70	10.94	4.55
Spielberger TAI Test Anxiety						
pretest	41.09	13.94	41.82	13.28	41.59	13.23
posttest	35.51	11.47	34.76	10.82	38.56	13.17
6 month FU	34.27	12.09	31.11	8.63	37.36	12.44
12 month FU	32.62	11.83	31.58	9.67	35.14	11.08
BFNE-II Fear of Negative Evaluation						
pretest	23.52	11.64	22.40	10.36	22.31	11.13
posttest	21.67	11.74	19.90	11.50	22.05	12.38
6 month FU	21.08	12.98	17.55	9.95	20.09	12.36
12 month FU	20.13	13.26	17.36	10.54	19.74	11.68
stIAT Automatic Threat-related Associations						
pretest	-0.02	0.35	-0.03	0.29	0.00	0.27
posttest	-0.01	0.27	-0.11	0.29	-0.03	0.28
6 month FU	0.00	0.29	-0.08	0.34	-0.01	0.29
12 month FU	0.07	0.27	-0.10	0.29	-0.06	0.26
ADIS-C Social Anxiety Disorder						
pretest	0.16	0.37	0.11	0.31	0.11	0.32
posttest	0.13	0.34	0.09	0.29	0.04	0.19

Long Term Influences of Gender and Treatment Attendance

Gender

We looked into gender differences over time for social anxiety from pretest tot 12 month follow-up. We did not find differences over time, if any, the reduction in social anxiety was most pronounced for the girls (coefficient = 0.10, *SE* = 0.07, *p* = .08).

Treatment attendance

Next, we examined the influence of treatment attendance. The participants in the control condition were not included in the analysis, since they did not receive a training. Attendance was measured as the number of sessions participants attended. On average participants in the CBT condition participated in 6.7 sessions (out of 10 sessions; *SD* = 3.3) and in the CBM condition in 8.5 sessions (out of 20 sessions, *SD* = 6.9). For social anxiety no effect was found for attendance over time, coefficient = -0.01, *SE* = 0.01, *p* = .22.. Thus, the number of attended sessions was not of influence on the future level of social anxiety. However, a positive

effect was found for level of pretreatment social anxiety on attended number of sessions, with participants with lower anxiety attending fewer sessions (coefficient = 0.19, *SE* = 0.07, *p* = .003).

Long term effects for CBM, CBT, and Control Condition Between Pretest and Twelve Month Follow-up

In the following section, we tested whether symptoms changed over time in the long term (pretest 12 month follow-up) and whether this change was different for the CBM, CBT and Control Condition. Table 5.2 provides an overview of the results.

Table 5.2. *Estimated effects for the conditional models between pretest and 12 months follow-up*

	RCADS Social Phobia		TAI Test Anxiety		BFNE-II Fear of Negative Evaluation		stIAT Automatic Threat-related Associations		ADIS-C Social Anxiety Disorder	
	β	*SE*	*β*	*SE*	*β*	*SE*	*β*	*SE*	*β*	*SE*
Intercept	12.73	0.22	39.89	0.60	22.40	0.52	-0.03	0.02	0.13	0.02
Time effect	-0.21***	0.04	-0.56***	0.09	-0.29***	0.09	0.00	0.00	–	–
CBM vs CTRL	-0.06	0.08	-0.25	0.19	0.12	0.20	0.01	0.00	–	–
CBT vs CTRL	-0.08	0.08	-0.40*	0.18	-0.19	0.19	-0.01	0.00	–	–
CBM vs CBT	0.03	0.08	0.15	0.17	0.31*	0.18	0.01**	0.00	–	–

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

Social phobia (RCADS)

The unconditional means model for RCADS social phobia scores showed that 67.6% of variance was between subjects and 32.4% of variance was within subjects. The time variable indicated that social phobia scores decreased between pretest and 12 month follow-up (coefficient = -0.21, *SE* = 0.04, $p < .001$, ES = .64), this decrease did not differ between the three conditions (*p*-values between .15 and .36).

Test anxiety (Spielberger TAI)

For Spielberger TAI scores, the unconditional means model showed that 73.7% of variance was between subjects and 26.3% of variance was within subjects. A decrease in test anxiety was found between pretest and 12 month follow-up (coefficient = -0.56, *SE* = 0.09, $p < .001$, *ES*: Cohen's *d* = 0.71), with a significant overall difference between the CBT and the control condition (coefficient = -0.40, *SE* = 0.18, *p* = .01, ES: Cohen's *d* = 0.34), indicating that CBT showed a relatively large decrease.

Fear of Negative Evaluation (BFNE-II)

Scores on the BFNE-II revealed that in the unconditional means model 74.7% of variance was between subjects and 25.3% of variance was within subjects. We did find an overall time effect for fear of negative evaluation (coefficient = -0.29, *SE* = 0.09, $p < .001$, ES: Cohen's *d* = 0.34). An overall significant difference was found between the CBM and the CBT condition over time (coefficient = 0.31, *SE* = 0.18, $p < .05$, ES: Cohen's *d* = 0.21) with a stronger reduction in levels of fear of negative evaluation in the CBT condition.

Threat-related automatic associations (stIAT)

The unconditional means model for stIAT scores showed that 50.0% of the variance was between subjects and 50.0% of variance was within subjects. Overall, no time effects were found (coefficient = 0.00, $SE < 0.01$, $p = .50$). However, there was a significant time X condition effect for CBM versus CBT (coefficient = 0.01, $SE < 0.01$, $p = .003$, ES: Cohen's $d = 0.61$), with the CBM condition showing a relatively strong reduction in threat-related associations. No differences were found between the training conditions and the control condition.

Social Anxiety Disorder Diagnosis (ADIS-C)

For the ADIS-C SAD, in the unconditional means model 42.5% of variance was found between subjects and 57.5% of variance was found within subject. ADIS-C SAD was measured only at pretest and posttest, and no significant change in number of SAD diagnoses was found over time (coefficient = -0.01, $SE = 0.01$, $p = .08$).

A time $\times$ group interaction was found between pretest and posttest between CBM and the control condition, with the CBM condition showing more SAD diagnoses (coefficient = 0.03, $SE = 0.02$, $p < .05$, ES: Cohen's $d = 0.35$). At pretest, 11% of the participants in CBT, 16% of the participants in CBM and 11% of participants in the control condition had a DSM-IV diagnosis of social anxiety disorder. At posttest, these frequencies were 9%, 13% and 4% for CBT, CBM and CTRL respectively.

Differences Between CBM, CBT, and Control Condition for the Various Time Segments

In the following section we will focus in more detail on the three time segments that were covered in this project (from pretest to posttest, from posttest to 6 month follow-up, and from 6 month follow-up to 12 month follow-up). Table 5.3 provides an overview of the outcome variables for these three segments.

Social phobia (RCADS)

Looking at the time segments more precisely (see figure 5.2) it emerged that an overall decrease in reported socially anxious symptoms was present in the first segment (ES: Cohen's $d = 0.42$), next to that the coefficients of the time $\times$ group interaction show that between posttest and 6 month follow-up the difference between the CBT condition and the control condition was significant, in favor of the CBT condition (ES: Cohen's $d = 0.41$). For the CBM condition a similar pattern emerged although the difference between CBM and the control condition did not reach the conventional level of significance (coefficient = -1.48, $SE = 1.06$, $p = .08$). Figure 5.2 shows the change in RCADS social phobia for the three conditions.

Test anxiety (Spielberger TAI)

A significant overall decrease in test anxiety was found between pretest and posttest (ES: Cohen's $d = 0.42$). Significant differences between CBT and the control condition were found regarding the immediate effect of the intervention (from pretest to posttest, Cohen's $d = 0.29$), and regarding the short term follow-up period (from posttest to 6 months follow-up, Cohen's $d = 0.51$), with CBT showing significantly stronger reduction in TAI scores than the control condition.

Fear of Negative Evaluation (BFNE-II)

At time segment level no time effects were found, nor differences between conditions.

Threat-related automatic associations (stIAT)

In the time segments no overall time effects emerged. A difference was found between pretest and posttest for CBT versus the control condition (ES for difference scores posttest-pretest: Cohen's $d = 0.28$), and between CBT and CBM, with the CBT condition showing less reduction in negative associations (ES for difference

Table 5.3. *Estimated effects for the conditional models between pretest and posttest; posttest and 6 month follow-up; and 6 month follow up and 12 month follow-up*

	RCADS Social Phobia		TAI Test Anxiety		BFNE-II Fear of Negative Evaluation		stIAT Automatic Threat-related Associations		ADIS-C Social Anxiety Disorder	
	β	*SE*	*β*	*SE*	*β*	*SE*	*β*	*SE*	*β*	*SE*
Time effect										
Intercept	13.35	0.30	41.49	0.78	22.78	0.71	-0.02	0.02	0.13	0.02
Posttest vs pretest	-1.68**	0.73	-3.20*	1.80	-0.70	1.72	0.00	0.04	-0.01	0.01
6 month FU vs posttest	0.14	0.79	1.30	1.89	-1.06	1.91	0.04	0.05	_	_
12 month FU vs 6 month FU	0.09	0.89	1.18	2.09	-0.88	2.08	-0.02	0.06	_	_
CBM vs control										
Posttest vs pretest	-0.27	0.89	-2.56	2.16	-0.42	2.09	0.01	0.05	0.03*	0.02
6 month FU vs posttest	-1.48	1.06	-3.09	2.53	0.99	2.55	-0.01	0.07	_	_
12 month FU vs 6 month FU	-0.50	1.05	-2.53	2.48	1.40	2.45	0.13*	0.07	_	_
CBT vs control										
Posttest vs pretest	-0.58	0.90	-3.67*	2.18	-2.19	2.11	-0.09*	0.05	0.02	0.02
6 month FU vs posttest	-1.76*	0.96	-6.26***	2.28	-2.54	2.31	-0.06	0.06	_	_
12 month FU vs 6 month FU	-0.40	1.03	-3.56	2.40	-1.50	2.40	-0.04	0.06	_	_
CBM vs CBT										
Posttest vs pretest	0.32	0.84	1.11	2.03	1.77	1.98	0.10*	0.05	0.02	0.02
6 month FU vs posttest	0.29	1.02	3.16	2.40	3.53	2.42	0.05	0.07	_	_
12 month FU vs 6 month FU	-0.10	0.95	1.04	2.21	2.90	2.22	0.17**	0.06	_	_

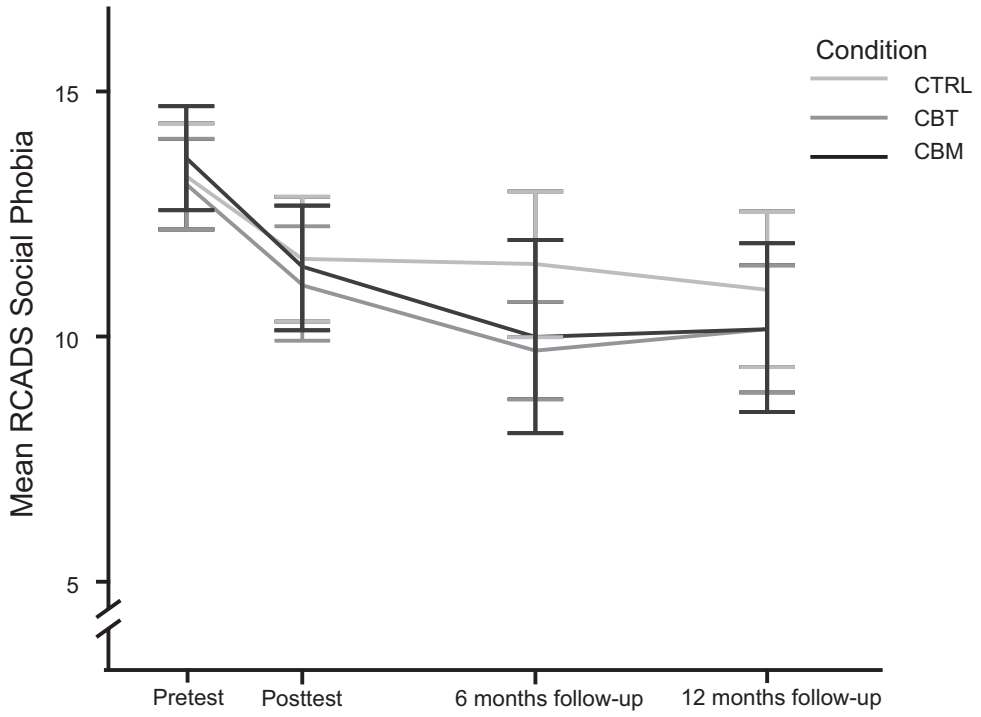

Figure 5.2. RCADS social phobia over time for Cognitive Bias Modification (CBM), Cognitive Behavioral Training (CBT) and No-treatment Control Group (CTRL).

scores posttest-pretest: Cohen's d = 0.36). No differences in this time segment were found between the control condition and CBM. In addition a difference was found for CBM versus CBT and for CBM versus the control condition between 6 months and 12 months follow-up, with the CBM condition showing a stronger increase in positive automatic associations (ES for difference scores 6 to 12 months: Cohen's d = 0.61 [CBM vs CBT] and d = 0.47 [CBM vs control group]).

Discussion

In the present indicated prevention study we tested the relative efficacy of a newly developed CBM-intervention compared to a golden-standard CBT group treatment and a no-intervention control group in adolescents with elevated levels of social anxiety. The major findings can be summarized as follows: (i) In the short run (6 months follow-up) participants in the CBT condition showed a larger reduction in social anxiety symptoms than participants in the control condition, and a similar trend was evident in the CBM condition, with effect sizes in the small to moderate range, (ii) In the long run (12 months follow-up) the control condition eventually showed a similar reduction in social anxiety symptoms as both active conditions, (iii) After CBT adolescents reported a stronger decrease of test anxiety compared to the control condition and fear of negative evaluation compared to the CBM condition, (iv) The pattern of automatic associations between social cues and negative outcomes varied across conditions over time: From post-test to 12 months follow up the CBM group showed a stronger decrease of negative automatic associations than both the CBT and the no-intervention control group.

Self-reported social anxiety

Regarding our main outcome measure for social anxiety (Revised Child Anxiety and Depression Scale, social phobia subscale; Chorpita et al., 2000) we found an overall improvement over time with a medium effect size. In addition, we found a relatively strong improvement in the CBT condition at 6 months follow-up, and a similar trend for CBM, both with small to medium effect sizes. An advantage for the active conditions was not evident immediately following the intervention (i.e., at posttest). In prevention research (see Neil &

Christensen, 2009, for a review) it is more often seen that effects are not visible directly after the intervention. In the present study, this may at least partly be due to the fact that the questionnaire measure of social anxiety predominantly inquired about behavior that has already occurred for some time. This may well have reduced the sensitivity of this instrument to detect immediate improvement. Moreover, it seems reasonable to assume that after training, participants still need further practice and reassuring experiences in concrete social situations before they actually correct their original (dysfunctional) cognitions. The difference between the active conditions and control condition at 6 month follow-up may thus be regarded as the actual treatment effect: participants had time to practice the newly learned skills and/or to experience the corrective impact of the interventions on habitual information processing strategies. This finding is comparable to Aune and Stiles (2009), who tested the efficacy of a universal CBT program and found a prevention effect for syndromal and subsyndromal social anxiety 8 months after the active intervention period.

At 12 month follow-up, we found no differences between the three conditions in social anxiety. Participants in the control condition further improved, whereas participants in both training conditions remained at the same level of social anxiety. One explanation could be that participants in the training condition had already approached normal levels of social anxiety. In line with this, Chorpita et al. (2000) reported an average of 11.7-12.3 on the RCADS social phobia scale for this age group in a normal sample, where our post-intervention scores at 12 month follow-up were between 10.1 and 10.9. Direct comparison of our scores to a Dutch population sample (van Oort, Greaves-Lord, Verhulst, Ormel, & Huizink, 2009) in the TRAILS study (n = 1657; scores slightly increasing from 6.4 to 6.8 in this age period) indicates that the scores in our sample were within one SD of the mean. In addition, the general decline of RCADS-SP scores in our study was very similar to the natural course of RCADS-SP scores in high socially anxious adolescents that was found within TRAILS (based on our cut-offs, N = 272, a decline of M = 13.2 (SD = 3.0) at mean age 13 to M = 10.5 (SD = 4.8) at mean age 15; personal communication, April 11th, 2011). Thus, it seems that there was room for further improvement, although restricted.

Perhaps it could be beneficial in this respect to add booster sessions during the follow up period. This may not only help to prevent the recurrence of symptoms but may also stimulate/motivate the participants to further train their newly acquired skills. It would be important for future research to examine whether indeed this type of additional components would help to further improve this type of preventive intervention.

Also in the study of Aune and Stiles (2009) there was a general decline in social anxiety symptoms, although the decrease was most pronounced in the active condition. The general decrease in social anxiety symptoms over time in all these samples may well reflect a regression to the mean effect.

All in all, the present study showed a beneficial effect of CBT and a trend effect of CBM on social anxiety in the mid long term, but in the long term, training high socially anxious adolescents does not seem to lead to a relatively strong decrease in self-reported anxiety symptoms.

Our other self-report instruments were the Spielberger TAI, the BFNE-II, and the ADIS-C. These instruments also showed an overall (small) decrease in reported scores, with a favorable effect for the CBT condition, which over time resulted in less test anxiety compared to the control condition and less fear of negative evaluation compared to the CBM condition. The decrease in test anxiety can be seen as a training effect. In the CBT condition, participants learn to actively cope with their test anxiety. This may explain the relative efficacy of CBT over the control condition. Although quite some scenario's in the interpretive bias task focused on test-anxiety specific situations, participants received little help to learn how to cope with acute test-anxiety. The overall stronger reduction of self-reported fear of negative evaluation in the CBT condition compared to the CBM and control condition may also partly be due to the conceptual overlap between the CBT training and the outcome measures. In CBT the cognitions are explicitly modified and the BFNE-II also measures explicit cognitions, whereas in the CBM condition the cognitions are indirectly modified. Indirect performance based measures may be more sensitive to detect the influence of CBM.

Results for ADIS-C SAD showed a decrease in DSM-IV diagnoses of social anxiety disorder between pretest and posttest for all conditions. The lack of a differential effect for the active conditions is also reflected

in self-reported social anxiety scores, and may be explained by the short time frame between pretest and posttest. There is still the possibility that a longer-term follow-up may reveal a preventive effect, if the active conditions were able to prevent the actual onset of social anxiety disorder.

Automatic evaluative threat-related associations

CBM showed overall a more favorable effect on reducing automatic social threat-related associations than CBT. Participants in the CBM condition showed relatively less negative associations for words signaling evaluative threat over time. This difference between CBM and CBT was evident for all time segments. Specifically in the longer-term follow-up period (from 6 months to 12 months follow-up), the CBM condition also showed a more favorable effect than the control condition. This pattern of findings not only supports the efficacy of CBM, but also points to the relevance of complementing the routinely used self-report measures with performance based measures that may be more sensitive to automatically activated associations in memory. Previous research in adult samples showed that this type of automatic associations has predictive validity for the onset of anxiety disorders (Glashouwer, de Jong, & Penninx, 2011). Although within the present time frame CBM did not have a more favorable effect on social anxiety compared to the control condition, it would be interesting to see whether perhaps in the long term differential effects may arise. Moreover, it would be interesting to see whether more generally the strength of automatic associations has predictive validity for the level of future social anxiety symptoms.

Gender and Treatment Attendance

When looking into the effect of gender on levels of social anxiety, we found that males and females did not differ with regard to the level of self-reported social anxiety. Next to that, number of attended treatment sessions did not influence social anxiety at post-test or follow-up. This could be explained by the relation between number of treatment sessions and levels of social anxiety before the start of the training. Highly anxious participants completed more sessions than participants with lower levels of anxiety. Probably, when participants were less anxious, their level of motivation was lower, increasing the chances of drop-out. Highly anxious adolescents may have had a stronger motivation and thus may have been more inclined to continue participating in the training.

Strengths, Limitations and Conclusions

A strength of this study is that we compared the new, promising and low-cost CBM method not only with a no-treatment control group, but also with a high-standard CBT group training. The CBM training used in this study combined multiple tasks, originating from the idea that cognitive biases mutually influence each other and that variation would help to keep up participants' motivation. Studies in CBM with favorable effects have thus far focused on single cognitive mechanisms, such as attentional bias or interpretive bias. Therefore, on the basis of the available evidence it can not be ruled out that the combination of tasks we used might in fact have led to suboptimal effects. The finding that the decrease in automatic threat-associations was most pronounced for the CBM condition is promising and supports the validity of the CBM approach. However, future research is required to test which element of the CBM training is most effective in decreasing associations to threat. Furthermore, earlier research has demonstrated that automatic associations may be especially relevant in guiding more spontaneous fear behaviors (e.g., Huijding & de Jong, 2006). Unfortunately, the present study did not include indices of relatively spontaneous fear behaviors (e.g., heart rate during an actual evaluative conversation). For a more comprehensive appreciation of the relevance of the relatively strong reduction of the automatic associations in the CBM condition, it would be an interesting venue for future research to include such tasks as an additional outcome measure. The possible benefit of our preventive interventions may be in the long-term, so before drawing definitive conclusions, it might be necessary to look at longer term follow-up effects.

Finally, some comments are in order regarding the limitations of the current study. First, we can not rule out the influence of selection bias. We invited 5318 adolescents to participate and received written informed consent from one-third of these adolescents and their parents, leaving two-third of the invited participants unscreened. The medical ethics committee did not allow further contact with these non-responders, leaving the reasons for their non-response unclear. In the provided information for adolescents and parents received the aim of the study was pointed out, which may have led to non-response in a particular subsample of anxious adolescents. In addition, some participants dropped out during various stages of the project. Although the drop-outs did not differ at pretest from the completers, it did obviously result in a loss of power for the analyses. We reduced the negative impact of drop-outs by using multilevel modeling, a method that allows for using all available data from all participants without the need for imputation.

Our selection of participants was based on a high level of social anxiety as measured by self-report questionnaires and the ADIS-C clinical interview. Our aim was to select adolescents at risk for developing social anxiety disorder, but we can not be sure whether the selected children actually represented an at-risk group. This issue may be important, since it may be the case that there are better predictors for developing social anxiety disorder than socially anxious symptoms at age 13-14. To get some insight in this, we tested our initial screening group of 1811 participants again two years later. The data of this repeated large scale screening may provide important information that can help answering this question, but goes beyond the scope of current paper.

For future research it is important to try to improve the effect of the training conditions, so that observed effects will strengthen at 6 months follow-up and to ensure a beneficial effect in the longer term. One way this could be done is by booster sessions after the training period, another important way could be to raise the level of attendance, especially for CBM, but also for CBT. Involvement of a therapist in some level of coaching may be of help, since internet-based approaches have proven to be more effective if some form of therapist contact is available. Finally, identifying the critical ingredients of CBM, and aiming at those mechanisms may help improving the training effects of CBM.

In sum, the current study showed a beneficial effect of preventive training in the mid long term (6 months follow-up) for CBT and a similar trend for CBM, However, in the longer term (12 months follow-up) this training benefit disappeared and participants did not reach the normal range of social anxiety symptoms. Based on these data, one could conclude that prevention efforts in this way are not very fruitful in the short term. It may be more cost-effective to focus on treatment of actual anxiety disorders, as well as lowering the threshold for socially anxious adolescents to seek treatment. However, for a more comprehensive appreciation of the efficacy of the present indicated prevention strategies, it would be important to also test the preventive effects at an even longer follow up and to also include measures of relatively automatic socially anxious behaviors in addition to indices of more explicit/verbal components of social anxiety.

Chapter 6

Long term effects of Cognitive Bias Modification and CBT in the Prevention of Adolescent Social Anxiety and Test Anxiety

This chapter is based on the article that will be submitted as:
de Hullu, E.[1], Sportel, B. E.[1], de Jong, P. J., & Nauta, M. H. (2011). *Long term effects of cognitive bias modification and CBT in the prevention of adolescent social anxiety and test anxiety: 2-year follow-up of a randomized controlled trial.*

[1] These authors contributed equally to this work

Abstract

This study reports the long term outcomes of a RCT comparing an internet-based cognitive bias modification training (CBM; n = 86), a school-based cognitive behavioral group training (CBT; n = 84), and a no-intervention control group (CTRL; n = 70) in preventing the development of social anxiety disorder in high socially anxious adolescents aged 13-15 years at the start of the study. In the period of two years after the 10-weeks intervention period, test anxiety in the CBM and CBT condition decreased significantly compared to the no-treatment control group. Self-reported social anxiety symptoms decreased over time regardless of condition, as did self-reported depression and internalizing symptoms. The incidence of DSM IV diagnosed social anxiety disorder at two year follow-up was very low and did not differ between conditions, as did parent-reported social anxiety symptoms. Threat-related automatic associations significantly improved in the CBM condition compared to CBT and CTRL, suggesting that CBT for social anxiety could be improved by adding components that focus on associations between social situations and positive outcomes. Although the need for prevention of anxiety disorders in adolescents is evident, the small effects reported in this study do not warrant implementation of the studied programs in adolescents at risk for social anxiety.

Introduction

In adolescence, many youngsters face the fear of negative evaluation. Quite some of these adolescents even develop a social anxiety disorder. With estimates of 9.5% of girls and 4.9% of boys, social anxiety disorder is considered the most common mental disorder in adolescence (Wittchen & Fehm, 2003). Social anxiety disorder is associated with poor social skills, reduced social interactions, low self-esteem and low school performance (Stein & Kean, 2000). It can also lead to many adverse outcomes in adulthood, such as comorbid anxiety disorders, depression, alcohol and drug misuse and lowered academic or work performance (Wittchen, Fuetsch, Sonntag, Müller, & Liebowitz, 2000). Thus, the development of social anxiety disorder during adolescence can have a great impact on current and future performance. Only a small proportion of children and adolescents with social anxiety disorder seek or receive professional help and many adolescents suffering from social anxiety remain unnoticed (Magee, Eaton, Wittchen, McGonagle, & Kessler, 1996).

Because social anxiety has such a pervasive impact on the well-being of school children, prevention of social anxiety is of great importance. Previous research has shown that prevention in a school setting can be effective in reducing anxiety symptoms and in preventing the onset of anxiety disorders in general, both at short and long term (see Neil & Christensen, 2009 for a review). Various programs have been successfully applied in the prevention of anxiety disorders, using CBT techniques delivered by a mental health practitioner or teacher. In most published studies, the intervention leads to a significant reduction in anxiety symptoms compared to a no-intervention control group, with effect sizes in the small to moderate range (e.g., Fisak, Richard, & Mann, 2011; Neil & Christensen, 2009).

Thus far, only two studies specifically focused on the prevention of social anxiety. The first study tested the efficacy of a short CBT-based training program that was delivered to school classes as part of the curriculum (Aune & Stiles, 2009). This universal intervention program successfully reduced social anxiety symptoms and was effective in preventing the onset of social anxiety disorder at one year follow-up. Since universal prevention programs are costly, a subsequent study evaluated the efficacy of an indicated preventive intervention that was specifically focused on adolescents with elevated levels of social anxiety, who were therefore assumed to be at risk for developing a social anxiety disorder (Sportel, de Hullu, de Jong, & Nauta, 2011). This second study tested the relative efficacy of two types of interventions and compared a Cognitive Behavioral Group training (CBT) with an internet-delivered Cognitive Bias Modification training (CBM). Although it was found that the level of social anxiety generally decreased over time (also for the no-intervention control group), both types of interventions resulted in a relatively strong reduction of social anxiety symptoms at six months follow-up. Unexpectedly, this advantage relative to the no-treatment control group was no longer significant at one year follow-up.

However, to effectively test the preventive effect of an intervention, it is important to follow participants over a prolonged period of time to ensure all potential effects are detected (Gillham, Shatté, & Reivich, 2001). Therefore, the present study tested the efficacy of the CBT and CBM prevention programs of Sportel et al. (2011) at a longer term (two year follow-up) with a broader scope of outcome measures. A limitation of using self-report measures is that they rely primarily on the participant's own view on their symptoms, which might not optimally reflect the reality of their anxiety symptoms. One way to counter this limitation is to use other informants, such as a participant's parents. At long-term follow-up we therefore included both child and parent reports of social anxiety. Although this prevention study aims at reducing the risk of developing social anxiety, it is also important to include commonly comorbid conditions in the assessment of long-term effects, such as depression and other anxiety disorders (Feldner & Zvolensky, 2004). In this follow-up report, we therefore evaluated (also) the impact of our prevention program on adolescents' level of self-reported depression and anxiety disorders over time.

Another recent development in anxiety research, is the use of implicit instruments to tap into processes associated with anxiety symptoms, such as automatic associations between social situations and indicators of a negative outcome (de Hullu, de Jong, Sportel, & Nauta, 2011). Although adolescents may be unaware

of their automatic associations, these associations are hypothesized to influence the way they perceive social situations (Ouimet, Gawronski, & Dozois, 2009; Rapee & Spence, 2004) and an assessment of threat-related associations could be an important addition to explicit measures of anxiety. Therefore, we complemented explicit self- report indices of subjective social anxiety with an implicit performance measure that was designed to index more automatic social threat associations.

Finally, although many prevention studies primarily focus on changes in self-reported symptoms of anxiety (Feldner & Zvolensky, 2004; Neil & Christensen, 2009), the ultimate question is whether the prevention program is able to reduce the incidence of social anxiety disorder. Therefore, as the most rigorous test of the preventive effect of both interventions we also compared the number of adolescents who complied with the diagnostic criteria of social anxiety disorder between conditions.

Method

Trial Design

The present study used a multi-arm parallel group approach and employed a stratified design with balanced randomization (1:1:1). This study was named Project Pasta, Prevention of Adolescent Social and Test Anxiety (`www.projectpasta.nl`).

Participants

Before the start of current project the necessary sample size to find a medium effect was defined using power calculations. These calculations showed that for a medium effect, with a power of .80, within three groups, at $p = .05$ the sample size had to be 52 for each condition. Keeping drop-out in mind, we aimed at 75 participants in each condition. To reach this number we subsequently calculated the number of adolescents that should be interviewed. To reach this number of participants, we calculated, given cut-off scores (based on previous research) and chance of not meeting inclusion criteria that 346 adolescents were to be interviewed, meaning that approximately 1400 children were to be screened for social and test anxiety.

In total, 5318 adolescents in the first and second year of regular secondary schools in the northern part of the Netherlands were invited to participate in a study about the prevention of social and test anxiety. The current study was approved by the medical ethics committee of the University Medical Center Groningen and registered in the Dutch trial register with number NTR965 (`http://www.trialregister.nl`). Figure 6.1 displays a flow diagram of this study. As can be seen, a total of 1811 participants were screened for social and test anxiety using the Revised Child Anxiety and Depression Scale (RCADS; Chorpita, Yim, Moffitt, Umemoto, & Francis, 2000) and the Dutch version of the Spielberger's Test Anxiety Inventory (TAI; Examen/Toets Attitude Vragenlijst; van der Ploeg, 1988). Participants scoring above cut-off on social and test anxiety as measured by the RCADS and TAI ($n = 516$) were invited to participate in a clinical interview. Used cut-off scores for girls were >10 on RCADS social phobia and >43 on TAI, cut-off scores for boys were >9 on RCADS social phobia and >38 on TAI. The RCADS cut-off scores were based on the 75th percentile in a large Dutch cohort of young adolescents ($N = 2230$, the TRAILS-study; Huisman et al., 2008). Screening took place in two waves, including 12 schools in the first year and 13 schools in the second year.

Based on the Anxiety Disorders Interview Schedule for Children (ADIS-C; Silverman & Albano, 1996), 240 adolescents (age 12-15) with low-level social anxiety were included in the current study. The ADIS-C provides a DSM-IV diagnosis of various anxiety disorders, as well as a clinician severity rating (CSR) that is rated on a 9-point-scale (0 = not at all disturbing/disabling; 8 = very severely disturbing/disabling; with a rating under 4 being sub-clinical). Since this prevention study aims at individuals at risk for developing a social anxiety disorder, we excluded adolescents with CSR ratings of 5 and higher ($n = 29$), and advised these adolescents to seek treatment. Thus, adolescents were included when they showed symptoms of social anxiety (i.e., afraid to speak in class or talk to strangers), but indicated only mild (CSR <4) or moderate (CSR

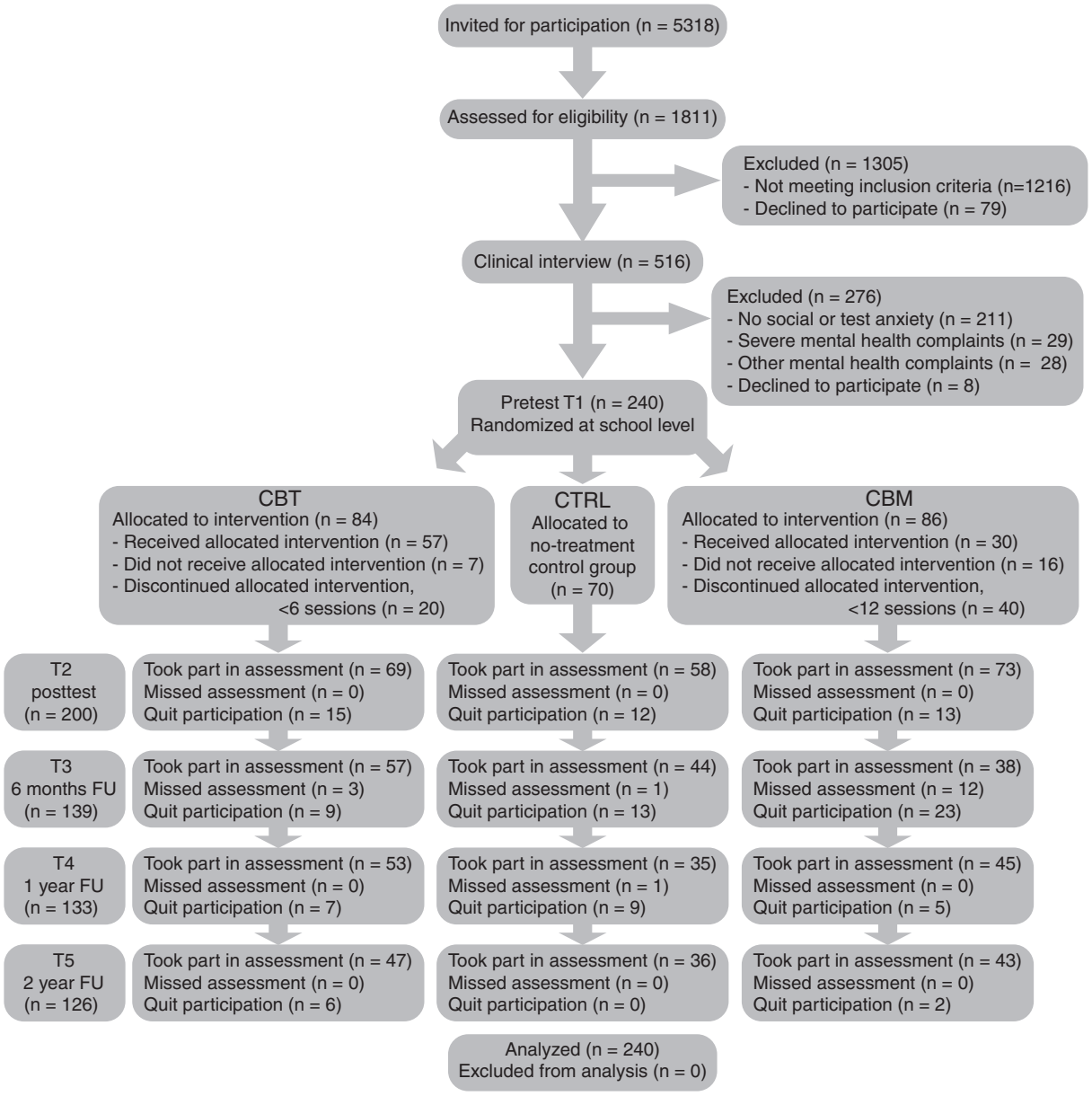

Figure 6.1. Flowchart of the study from screening until two year follow-up.

= 4) interference of social anxiety with their daily life (Albano & Hayward, 2004). Distribution of the CSRs was: CSR = 4, *n* = 31; CSR = 3, *n* = 51; CSR = 2, *n* = 32; CSR = 1, *n* = 2; CSR = 0, *n* = 124.

Two weeks after the ADIS-C interview, 240 included participants took part in the pretest (questionnaires and performance measures) and were subsequently randomized at school-level over one of three conditions. Precise numbers for each condition can be found in Figure 6.1. Three months after pretest, the participants completed a posttest (*n* = 200), and follow-ups at 6 months (*n* = 139), one year (*n* = 133) and two year (*n* = 126). Drop-out was comparable over the three conditions.

At pretest the mean age of the 240 participants (66 boys, 174 girls) was 14.09 years, *SD* = 0.65. About one-third (31%) of the participants came from an urban area and 69% from a rural area, as defined by Statistics Netherlands (`http://www.rivm.nl/vtv/object_map/o2617n21780.html`; following Reijneveld et al., 2010). Furthermore 97.1% of the participants had the Dutch nationality, with at least one Dutch parent. The other 2.9% had either two non-Dutch parents, or was non-Dutch him- or herself with at least one non-Dutch parent. The majority (80.8%) of the participants were living with their non-divorced biological parents. All these demographic statistics are comparable to those of the total group of participants that were initially

screened within the context of Project Pasta (www.projectpasta.nl; Sportel, Nauta, de Hullu, de Jong, & Hartman, 2011).

Interventions

Cognitive bias modification (CBM)

The cognitive bias modification (CBM) training consisted of twenty 40-minute sessions, delivered over the internet over a period of 10 weeks. Based on the literature available on modifying cognitive biases, the training mainly consisted of tasks to modify attentional biases and interpretive biases. These tasks were supplemented by relatively new tasks that were designed to modify automatic association and implicit self-esteem. Since the latter types of tasks are not yet well established in the literature, the backbone of the intervention consisted of attention and interpretation modification. Each session consisted of one or two different tasks out of four available tasks. Before the start of the CBM training, participants received information explaining the rationale of the training by letter and in a phone call. They received an e-mail with links to two training sessions each week, and were reminded if they did not complete the session by e-mail or phone. After each session, they received a compliment for completing it by e-mail. The training was delivered in a Macromedia Authorware (http://www.adobe.com/products/authorware/) webplayer applet, available for Windows and Apple operating systems.

Since it was shown that it is feasible to train interpretive biases (Salemink, van den Hout, & Kindt, 2007) and attentional biases (Browning, Holmes, & Harmer, 2010) in a benign direction, the backbone of our CBM training consists of tasks to modify these biases. One large part of the training (9 sessions) consisted of interpretive bias modification tasks along the lines of the CBM-I originally designed by Mathews and Mackintosh (2000). The objective was to implicitly guide participants to come up with benign interpretations of ambiguous social situations, which would help them to process real-life situations in a fear-disconfirming manner. During these tasks participants were presented with ambiguous social scenarios that were followed by word fragments that had to be solved in a benign direction (e.g., *You are at the birthday party of a good friend. You had great difficulty in finding him a nice birthday present. He unwraps the package and his face shows en- -ym-nt.*). Most (80%) of the trials were ambiguous with positive word fragments, 20% were neutral filler trials without ambiguity or emotional content, to make the induction procedure less obvious. After each trial, a comprehension question (e.g., *Was it easy to find a present for your friend?*) followed to make sure participants would read the entire story. The number of trials and the type of ambiguous scenarios describing various aspects of adolescents' social life (school, sports, parents, friends, family) were based on Salemink et al. (2009), although we used less trials (60 compared to 104 trials per session) to limit the burden on the participants. The other large part of the training (8 sessions) consisted of attention bias modification tasks, which were based on the visual probe task (showing a pair of stimuli on the left and right side of the screen; Amir, Elias, Klumpp, & Przeworski, 2003; MacLeod et al., 2002), and the exogenous cueing task (showing one stimulus on the left or right side, with the opposite side blank; Posner, 1980; Yiend & Mathews, 2001). The objective was to guide participants to point their initial attention (presentation time of the stimuli was 500 ms) at positive (happy faces/words) or neutral (neutral faces/words) stimuli and away from fear-confirming stimuli (threatening faces/words). Initial attention to safe or positive information as opposed to initial attention to threat could help them in real-life situations to decrease avoidance behaviors and help disconfirm their fears. Participants were instructed to indicate as fast as possible whether the small arrow (probe) that appeared after 500 ms was directed upwards or downwards. Each session consisted of 450 trials, with pictorial (faces) and verbal stimuli (words) in equal proportions. Exogenous cueing task trials and visual probe trials were delivered intermixed. In half of the training sessions, the stimulus did not disappear after the probe appeared but stayed on screen, thus allowing for prolongated attention to the benign stimulus. Three training sessions aimed at changing automatic associations to social anxiety relevant stimuli. We developed a task based on the implicit association test (Greenwald, McGhee, & Schwartz, 1998), which aimed to couple social-evaluative

situations with positive outcomes. In this task, consisting of 500 trials per session, participants were instructed to sort words appearing on the screen into two categories: Dutch or English. Stimuli were neutral words (e.g., *chair*), words related to (social) evaluative situations, (e.g., *exam*), and positive outcome words (e.g., success). Social cues and positive outcome words were both consistently presented in Dutch, and were thus sharing one response button, while neutral words were all in English. The goal of this task was to strengthen the association between (feared) social-evaluative situations and a positive outcome of that situation. Finally, a short evaluative conditioning task (Baccus et al., 2004; Clerkin & Teachman, 2010) of 240 trials was added as a second task to 10 sessions of attentional bias or automatic association tasks, aiming to enhance implicit self-esteem by associating self-relevant information (e.g., name, first letter of name, hometown) with positive outcomes. Participants were instructed to point the mouse as fast as they could in the quarter of a matrix where a word or object appeared. After the mouse-click, the stimulus was replaced by positive (in case of personal stimuli) or neutral (in case of non-personal stimuli) feedback. Positive feedback stimuli were smileys and positive outcome words, neutral feedback stimuli were pictures of household objects and neutral words.

The combination of tasks used in this CBM training differs in several ways from its predecessors in other CBM studies in clinical or subclinical populations. First, most studies used single-session (Amir, Bomyea, & Beard, 2010) or up to 8 sessions (Amir et al., 2009; Blackwell & Holmes, 2010; Vassilopoulos et al., 2009) training programs. We shaped our training to be similar to the CBT condition regarding time-investment needed by participants in the CBT condition. Also, since CBM is a developing field, it is unclear what number of sessions per task is needed for a significant and lasting effect. We chose to aim for a larger impact of the training by offering extensive training sessions for a long period of time. Second, we combined multiple tasks in the CBM training, based on the argument made by Hirsch et al. (2006) that cognitive biases may mutually influence each other. The present multiple task approach was preferred in an attempt to increase the efficacy of the CBM training. Moreover, we anticipated that offering a variety of tasks would also help to keep participants motivated for the training. Third, at the start of each task, a screen was shown shortly explaining the rationale for that particular training. For example, in the interpretation training task the explanation was: *when you feel bad, this sometimes makes the world look bad too. Putting on rose-colored glasses can help you to perceive the world more positively and improve your mood*. During every session it was emphasized that a lot of practice is needed to change one's way of thinking. Fourth, performance on tasks was tracked and after each block, during a short break, a summary of speed and performance was shown on the screen, in an attempt to make the task more challenging. Also, the number of trials completed and number of trials left was shown, to help participants to continue the task to the end. Fifth, in the interpretive bias tasks, we added instructions to visualize the scenario presented, as previous research has shown that imagining the positive interpretations may amplify the effectiveness of the task (Holmes, Mathews, Dalgleish, & Mackintosh, 2006). Therefore, in the first interpretive bias training session, a short imagination training was included (a stepwise instruction to imagine the taste of a lemon). Last, the speed in the attentional bias task was tailored to individual performance. If the target was identified correctly for more than 75% of the trials, in the next block the presentation time of the target arrow decreased with 25 ms, and in the same way it increased when performance was poor. This tailoring kept the task at the right level of difficulty for individual participants.

Cognitive behavioral group training (CBT)

The cognitive behavioral group training (CBT) consisted of ten weekly sessions of 1.5 hours. All training sessions took place at school, if possible immediately after school hours. The groups had a minimum of 3 and a maximum of 10 participants. All sessions were delivered by a psychologist from a local center for child and adolescent psychiatry.

The CBT training had four main components, 1. psycho-education, consisting of broadening the participants' knowledge on anxiety symptoms in general and on social and test anxiety more specifically, using the model of Clark and Wells (1995) to explain anxiety symptomatology; 2. task concentration training (Mulkens et al., 2001), with as major aim the improvement of the awareness of the focus of attention and the ability to

control this attention; 3. cognitive restructuring, focusing on the identification and modification of dysfunctional thoughts; and, 4. exposure, practicing with personal anxiety provoking situations. The first two sessions consisted of psycho-education, followed by two sessions of task concentration training, two sessions of cognitive restructuring and three sessions of exposure. The last session focused on personal pitfalls and how to avoid them. Each session had a similar framework, starting with discussing homework assignments, followed by the introduction of a new theme and active exercises, such as attention training, identification of thinking errors, role-play or in vivo exposure exercises. Next to the sessions the participants had homework assignments each week, taking one up to two hours a week. The training protocol can be requested from the authors.

Controls

Participants in the control condition participated in all measurements, but did not receive training. The participants were allowed to make use of care as usual.

Procedure

Informed consent

All designated participants received information about the project at school, given by the researchers and interns in class. At the same day information letters were sent to the adolescents and their parents or caretakers at their home addresses via their schools, together with a letter of recommendation to participate from the school, an informed consent form and a return envelope. The information for parent and child contained some explanation concerning social anxiety, and the three conditions to which participants could be assigned. All adolescents in first and second year of the participating regular secondary schools were invited. As a reward a gift certificate worth €20 was raffled for each 20 actual participants. Adolescents willing to participate had to fill out and sign the informed consent together with at least one parent or caretaker and send it back by mail (free of charge) to the researchers. Returned informed consents were collected in a database and used for inviting the adolescents for the screening. Participants could withdraw from the study at any given time, without presenting a reason.

Screening

The screening took place during school hours, at school in groups of 10 -15 students. During the 50 minute screening participants completed tasks and filled out questionnaires on laptops in a fixed order. A researcher or intern was present at all times to answer questions, other participants and the researchers were not able to see the responses during the assessment, ensuring confidential and independent responding. At the end of the screening, those scoring above cut-off on social phobia as measured by the RCADS social phobia subscale and/or test anxiety as measured by the TAI automatically received a message on the laptop screen indicating they had a high chance of being invited for the next step in the project. Those scoring otherwise received the message that there was little chance to be invited for the next step.

Intake Interview and Pretest

Adolescents with a score above cut-off on social or test anxiety were invited for a clinical interview, the Anxiety Disorders Interview Schedule for Children (ADIS-C; Silverman & Albano, 1996). All interviews took place at school, during school hours, and were held by the researchers or other trained psychologists. Participants were included when they showed mild to moderate symptoms of social anxiety disorder; as indicated by an ADIS-C clinician rated severity (CRS) index of 4 or lower. Participants were excluded when they had no socially anxious symptoms or severe social anxiety (CRS >4) or other primary disorders. Note that for none of the adolescents with a CSR of 4 the interviewers saw the need for immediate intervention, nor did these participants themselves express a need for treatment. All adolescents finally included in the study met at least DSM-IV criteria A and B for social phobia (fear of negative evaluation in multiple social contexts). A majority

did not meet full criteria for social phobia because the interference level of anxiety with their daily life was moderate or mild.

When participants were selected for the project based on the interview results, feedback was given to the participant and his or her parents informing that the participant had heightened levels of social anxiety and was invited for the next step in the project. Within three weeks the participants completed a pretest, one or two weeks before the start of the training period. The pretest took place at school, immediately after school hours, with other selected participants of that school in a group of maximum 15 adolescents. The assessment was performed on laptops and consisted of tasks and questionnaires, together taking approximately 30-45 minutes to complete. Again, researchers and interns were present to answer questions and to ensure confidentiality. After the pretest, participants received information on what condition they were assigned to: no training, CBT group training or CBM internet training, together with detailed information about how the project was to proceed.

Posttest, 6 Month Follow-up, one year follow-up and two year follow-up

Twelve weeks after pretest, posttest took place, followed by follow-up assessments at 6 months, one year and two year. Invitations were sent by mail one or two weeks before the assessment. One or two days before the assessment, participants received a phone call from the researchers or an intern to remind them to be present. All assessments included tasks and questionnaires and were completed on laptops, at school, immediately after school hours. Participants received a gift certificate of €5 for each assessment.

Measures

Anxiety Disorders Interview Schedule

The Anxiety Disorder Interview Schedule-Children (ADIS-C; Silverman & Albano, 1996) is a semi-structured interview based on DSM-IV classification of psychopathology (American Psychiatric Association, 2000). Besides the focus on anxiety, the interview also includes other mental disorders such as depression, dysthymia and externalizing disorders. Obtained scores are rated by the clinician in a clinician severity rating (CSR), a 9-point scale with 0 meaning not at all disturbing/disabling, and 8 meaning very severely disturbing/disabling, a score of 4 and higher indicates the presence of a disorder. The ADIS-C was used for DSM-IV diagnoses of anxiety disorders and depression. Participants were interviewed at pretest in a private room at school and posttest and two year follow-up by telephone. Interviews were held by the first authors and other trained psychologists. Parents of participants were not interviewed. The validity of ADIS-C (to assess the presence of anxiety disorders) has been shown to be satisfactory (Wood, Piacentini, Bergman, McCracken, & Barrios, 2002). In the current sample, the inter-rater-reliability was very high with 99.7% overlap (based on ratings by a psychologist and independent rater scoring a random selection (n = 30) of the available audio-recorded ADIS-C interviews (n = 248) from pretest. In the analyses, we use a dichotomic variable indicating a DSM-IV Social Anxiety Disorder (SAD) diagnosis, which is 0 when no SAD is present and 1 when SAD is present, in cases with a CSR of 4 or higher on the ADIS-C.

Revised Child Anxiety and Depression Scale – Child Version

The Revised Child Anxiety and Depression Scale (RCADS; Chorpita et al., 2000) is a revised version of the Spence Children's Anxiety Scale (SCAS; Spence, 1998). In this study, we used both the parent version and the child version of the RCADS. The child version is a 47-item self-report, with items rated on a 4-point scale ranging from 0 (never) to 3 (always). The questionnaire consists of six scales: separation anxiety disorder, social phobia, obsessive-compulsive disorder, panic disorder, generalized anxiety disorder and major depressive disorder. A total score gives an impression of the level of overall internalizing symptoms. In the current study, the social phobia (9 items), generalized anxiety (6 items) and depression (10 items) subscales of the RCADS were used, as well as the total score. The internal consistency of the scale and subscales were found

to be good in a normal as well as a clinical population (Chorpita, Moffitt, & Gray, 2005; Chorpita et al., 2000). The structure of the RCADS was found to be consistent with DSM-IV anxiety disorders and depression. In the current study, internal consistency was satisfactory for the social phobia subscale (at pretest α = .79), the generalized anxiety subscale (at pretest α = .85), for the depression subscale (at pretest α = .80), and for the total scale (at pretest α = .93). The RCADS was used at screening, pretest, posttest, 6 month follow-up, one year follow-up and two year follow-up.

Revised Child Anxiety and Depression Scale – Parent Version

The parent version of the RCADS is equal to the child version, with 47 items asking about the child. The internal consistency for the social phobia subscale was good (at two year follow-up α = .86). The RCADS parent version was completed by parents at two year follow-up.

Spielberger Test Anxiety Inventory

The Spielberger Test Anxiety Inventory (Spielberger TAI; Spielberger et al., 1980) is a 20-item self-report, with items rated on a 4-point scale, ranging from 1 (almost never) to 4 (all the time). The instrument consists of three scales, a sum scale, a worrying scale, and an emotionality subscale. In this study the Spielberger TAI was used on all assessment points. Previous research showed good reliability for the sum scale and the two subscales (van der Ploeg, 1988). In the current study, the sum scale was used and its reliability at pretest proved to be excellent (α = .95). The TAI was administered in the screening, pretest, posttest, 6 month follow-up, one year follow-up and two year follow-up.

Brief Fear of Negative Evaluation-II Scale

The Brief Fear of Negative Evaluation-II (BFNE-II; Carleton, McCreary, Norton, & Asmundson, 2006; authorized Dutch translation by Van Wees-Cieraad & de Jong, 2007) is a 12-item, 5-point Likert scale ranging from 0 (does not fit me at all) to 4 (fits me very well). The BFNE-II is based on BFNE by Leary (1983), with the difference that the reverse-worded items in the BFNE are reworded in the other direction in the BFNE-II. The internal consistency of the BFNE-II was found to be excellent, with α = .95. In our sample we also found α = .95 at pretest. In current study the BFNE-II was used in pretest, posttest, 6 month follow-up, one year follow-up and two year follow-up.

Implicit Association Test

To examine threat-related automatic associations with social cues, we used a single-target Implicit Association Test (stIAT) that was specifically designed for this study. This variant of the IAT (Greenwald, McGhee, & Schwartz, 1998) is a computerized reaction time task that measures to what extent a single target category is associated with two attribute categories. Following the design of Wigboldus, Holland, van Knippenberg, den Hartog en Belles (2002), a social cues stIAT was constructed with the target category *social- or school activity*, and the attribute labels positive outcome and negative outcome. We chose to use these attribute labels to indicate threatening and safe associations with the target words. We labeled the target category *social- or school activity* to provide a neutral category that could contain cues that are feared by socially anxious people, such as conversation or exam. The instructions and format of the present stIAT were based on an IAT (de Jong, Sportel, de Hullu, & Nauta, 2011) that was tailored to the present age group and piloted extensively. In the stIAT, participants are asked to categorize words appearing in the centre of the screen as quickly as possible into the target category or the attributes, by pressing the left or right button on a response-box. The test phase consists of two blocks of 64 trials, each preceded by a short practice phase of 24 trials. After a correct response, the next stimulus is presented after 500 ms. After an incorrect response a red X appears shortly above the stimulus. Meanwhile, the stimulus remains on the screen until the correct response is given. The order of the category combinations is fixed across participants to reduce method variance. This is assumed to enhance the sensitivity of the stIAT as a measure of individual differences, which is important

in view of the aim of the present study (cf., Borg, de Jong, & Weijmar Schultz, 2010; Schnabel, Asendorpf, & Greenwald, 2008; Steffens & König, 2006). Negative stIAT effects indicate relatively fast responses when social and school activities shared the response key with negative outcome. For someone with a fear of social situations, associations between social cue words and negative outcome are assumed to be relatively strong, resulting in a fast response when the target category (social- or school situation) and negative outcome will be paired, and a relatively slow response time when the target category is paired with positive outcome. For someone without social anxiety, the reverse response pattern is expected.

In current study the stIAT was used in pretest, posttest, 6 month follow-up, one year follow-up and two year follow-up. The split-half reliability of the stIAT was sufficient with Spearman-Brown corrected coefficient of .72 at pretest.

Randomization

Stratified randomization took place at school-level. Schools were, based on number of participants, randomly grouped by three and then the three grouped schools were all allocated to one condition each, to make sure the amount of participants in each condition would be approximately the same. Of the 24 participating schools, 8 schools received CBT, 7 schools received CBM, and 7 schools got the control condition. Two small schools were excluded from randomization since no students were eligible for inclusion. The allocation of the schools was done by the project leader (fourth author), by blind drawing same size papers with the conditions CBT, CBM or Control from a bowl (in the presence of the third author). Participants and researchers supervising the assessments did not receive information about the condition until after the pretest, to make sure condition was not of influence in the testing nor in the willingness to participate. After the pretest, all participants received a letter containing information about how the study continued, including information about the condition. In following assessments the interns supervising the assessments were not aware of the conditions of the participants. The first authors performing the interviews were aware of the school conditions but performed the interviews based on a name and participant number list, not containing school information.

Statistical Analyses

First, ANOVA and Pearsons χ^2 tests were used to analyze possible differences between conditions for the primary outcome measures at pretest. To test whether adolescents who completed all assessments differed from those that did not complete all assessments, we used t-tests and Pearsons χ^2 tests.

Multilevel analysis, using MLwiN Version 2.18 (Rasbash, Charlton, Browne, Healy, & Cameron, 2010), was used to answer the question whether (a) the two training conditions were effective in preventing social anxiety and reducing symptoms of social anxiety and (b) whether one of the training conditions was more effective than the other. Multilevel modeling was chosen because it provides an elegant way to deal with missing data, taking all available data into account in all analyses.

Multilevel models were estimated for the three primary outcome measures of social and test anxiety, namely RCADS-SP-C, Spielberger TAI, BFNE-II (child questionnaires) and stIAT, and the secondary outcome measures RCADS internalizing symptoms, RCADS-Depression and RCADS-Generalized Anxiety(child questionnaires). As a first step in the modeling the levels were defined, with test session at first level and participant at second level. School could have been added as a third level, however, exploratory analyses showed no effect of school. School was found to hold 0% up to 2.2% of the variance, and was therefore not included as a grouping variable in further analyses. Next, an unconditional model was employed to estimate the variance partitioned at each level. Then, an overall model was created, with pretest and two year follow-up as markers, to get an idea of the overall change within and between the groups. After adding time as variable, group x time was added. In a more specific model, looking into the various time segments (one year follow-up vs. two year follow-up), the categorical variable time (assessment point) was added, with random slopes for level 2. For the conditional model, third, the interaction variable time x training condition was added in a fixed manner, with control condition and pretest as reference categories. After that, we checked whether the model could be im-

proved by including gender and treatment attendance as covariates. The reported effect sizes (Cohen's *d*) for group differences over a particular time span are derived from the difference scores for each group. Reported effect sizes over time were derived from differences between pretest and two year follow-up. In calculating effect sizes, we followed the method recommended by Dunlap, Cortina, Vaslow and Burke (1996), taking into account the correlation between measures. When appropriate, we report 95% confidence intervals.

To obtain a full set of parent-reported social anxiety (RCADS-SP-P) at two year follow-up, missing data (46.67%) were imputed using multiple imputation. Multiple imputation is one of the state-of-the-art and preferred methods for dealing with missing data (Jelicić, Phelps, & Lerner, 2010; Schafer & Graham, 2002). Missing data was imputed 40 times using PASW Statistics 18.0, based on all available scores (self-report and stIAT) from pretest, post-test, 6 months, one year and two year follow-up. Multiple imputation renders pooled results, over all 40 imputations. Subsequently, we performed an ANOVA analysis to test whether two year follow-up parent reported social anxiety scores were different between CBM, CBT or control conditions.

Results

Missing Data

There were no missing items on the questionnaires, since all data was gathered using laptops. However, we did have missing measurements at several points in time. The pattern of missing data was as follows: 31 (36.0%) of the 86 participants in the CBM conditions completed all six measurements, in the CBT condition 42 (50.0%) of the 84 participants completed all measurements, and in the control conditions 31 (44.3%) of the 70 participants completed all six measurements. In this study we dealt with the missing data as follows: First we compared, at pretest, those who did not participate in all measurements with those who completed all measurements, by means of a χ^2 -test or t-test, for the primary and secondary outcome measures: ADIS-C SAD (presence or absence of DSM-IV SAD, ADIS-C CSR >4), RCADS social phobia, Spielberger TAI, stIAT, and BFNE-II. These tests showed that both groups did not differ significantly at pretest (ADIS-C SAD: $\chi^2(1)$ = 0.89, p = .44; RCADS-sp: t = 0.04, p = .98; TAI: t = 0.68, p = .50; stIAT: t = 0.26, p = .79; BFNE-II: t = -.34, p = .73).

Secondly, we compared the non-completers in the three conditions, to see whether differences were present in their pretest data, by means of an ANOVA or χ^2-test with condition as factor. No differences were found between the non-completers in the three conditions (ADIS-C SAD: χ^2 (2) = 0.24, p = .89; RCADS-sp: $F(2,135)$ = 1.16, p = .32; TAI: $F(2,135)$ = 0.19, p = .83; stIAT: $F(2,127)$ = 0.48, p = .62; BFNE-II: $F(2,135)$ = 0.228, p = .80).

Descriptive Statistics

The means and standard deviations for all primary and secondary outcome measures at the assessment points are shown in Table 6.1. At pretest, there were no differences between the CBT, CBM and CTRL condition on the primary outcome measures (RCADS-sp $F(2,239)$ = 0.30, p = .74; Spielberger TAI $F(2,239)$ = 0.06, p = .94; BFNE-II $F(2,239)$ = 0.31, p = .74; stIAT $F(2,227)$ = 0.16, p = .85 and ADIS-C SAD $\chi^2(2)$ = 1.36, p = .54).

All analyses were conducted following the intent-to-treat principle, including all participants who were measured at pretest (n = 240) into the analysis. Table 6.2 provides an overview of the overall time effects for the primary and secondary outcome variables. Significant results from the tables are described in the text below.

Table 6.1. *Means and standard deviations of all primary and secondary outcome measures at the assessment points by condition (Cognitive Bias Modification/Cognitive Behavior Therapy/no-treatment control)*

	CBM		CBT		Control	
Dependent	Mean	*SD*	Mean	*SD*	Mean	*SD*
RCADS Social Phobia						
pretest	13.64	4.95	13.11	4.26	13.27	4.52
1 year FU	10.16	5.73	10.13	4.70	10.94	4.55
2 year FU	9.53	5.86	8.96	5.16	10.83	5.38
Spielberger TAI Test Anxiety						
pretest	41.09	13.94	41.82	13.28	41.59	13.23
1 year FU	32.62	11.83	31.58	9.67	35.15	11.08
2 year FU	32.35	12.12	31.04	10.10	36.57	12.88
BFNE-II Fear of Negative Evaluation						
pretest	23.52	11.64	22.40	10.36	22.31	11.13
1 year FU	20.13	13.26	17.36	10.54	19.74	11.68
2 year FU	17.48	13.67	17.35	12.07	20.14	11.54
stIAT Automatic Threat-related Associations						
pretest	-0.03	0.33	-0.03	0.29	0.00	0.28
1 year FU	0.08	0.28	-0.09	0.29	-0.06	0.27
2 year FU	0.08	0.28	-0.08	0.27	0.02	0.27
ADIS-C Social Anxiety Disorder						
pretest	0.16	0.37	0.11	0.31	0.11	0.32
1 year FU	0.10	.30	0.02	.15	0.06	.25
RCADS parent-rated social phobia						
2 year FU	7.38	3.80	6.87	2.80	7.09	2.91
RCADS internalizing symptoms						
pretest	42.42	18.10	38.63	17.04	38.80	16.32
2 year FU	26.43	18.54	23.63	14.95	29.43	16.31
RCADS depression						
pretest	8.83	4.40	7.49	4.21	7.41	4.09
2 year FU	5.50	3.94	5.91	4.74	6.40	4.04
RCADS generalized anxiety disorder						
pretest	5.99	3.43	5.64	3.45	5.56	3.61
2 year FU	4.38	3.74	3.17	2.63	4.11	2.83

Differences Between CBM, CBT, and Control Condition over Time (pretest two year follow-up) for Primary Outcome Measures

Social phobia (RCADS)

The unconditional means model for RCADS social phobia scores showed that 52.9% of variance was between subjects and 47.1% of variance was within subjects. The time variable indicated that social phobia scores decreased between pretest and two year follow-up (coefficient = -0.08, *SE* = 0.04, *p* = .02, ES: *d* = 1.01, CI [0.43, 1.98], this decrease did not differ between the three conditions (p-values between *p* = .06 and *p* = .24).

Test anxiety (Spielberger TAI)

For Spielberger TAI scores, the unconditional means model showed that 61.8% of variance was between subjects and 38.2% of variance was within subjects. No overall decrease in test anxiety was found between pretest and two year follow-up, however, a significant overall difference between CBT (ES: *d* = .98, CI [-1.86, 3.90]) and the control condition (ES: *d* = .56, CI [-2.53 - 4.83]; coefficient = -0.28, *SE* = 0.11, p = .01) and between CBM (ES: *d* = 1.04, CI [-1.91 - 4.79]) and the control condition (ES: *d* = .56, CI [-2.53 - 4.83];

Table 6.2. *Estimated time effects for the conditional models for all outcomes between pretest and two year follow-up*

	RCADS Social Phobia		TAI Test Anxiety		BFNE-II Fear of Negative Evaluation		stIAT Automatic Threat-related Associations		RCADS Internalizing Symptoms		RCADS Depression		RCADS Generalized Anxiety	
	β	*SE*	β	*SE*	β	*SE*	β	*SE*	β	*SE*	β	*SE*	β	*SE*
Intercept	12.42	0.20	38.87	0.53	21.94	0.48	-0.03	0.01	36.57	0.71	7.375	0.18	5.22	0.14
Time	-0.08*	0.04	-0.13	0.09	-0.12	0.10	< 0.01	< 0.01	-0.41***	0.13	-0.06*	0.03	-0.07**	0.02
CBM vs control	-0.04	0.05	-0.20*	0.12	0.01	0.13	< 0.01*	< 0.01	-0.05	0.16	< -0.01	0.04	0.03	0.03
CBT vs control	-0.08	0.05	-0.28**	0.11	-0.14	0.12	< -0.01*	< 0.01	-0.20	0.16	-0.02	0.04	-0.03	0.03
CBM vs CBT	0.04	0.05	0.08	0.11	0.15	0.12	0.01***	< 0.01	0.14	0.15	0.02	0.04	0.05*	0.03

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

coefficient = -0.20, *SE* = 0.12, *p* = .05), indicating that participants in the CBT and the CBM condition showed a larger decrease over time in level of test anxiety than control participants.

Fear of Negative Evaluation (BFNE-II)

Scores on the BFNE-II revealed that in the unconditional means model 60.1% of variance was between subjects and 39.0% of variance was within subjects. We did not find an overall time effect for fear of negative evaluation, nor a difference between the conditions.

Threat-related automatic associations (stIAT)

The unconditional means model for stIAT scores showed that 25.9% of the variance was between subjects and 74.1% of variance was within subjects. Overall, no time effects were found (coefficient < 0.01, *SE* < 0.01, p = .50). However, there was a significant time $\times$ condition effect for CBM (ES: *d* = 0.45, CI [0.38 - 0.55]) versus CBT (ES: *d* = .23, CI [0.16 - 0.31]; coefficient = 0.01, *SE* < 0.01, *p* < .001) CBM versus control (ES: *d* = 0.09, CI [0.02 - 0.18]; coefficient < 0.01, *SE* < 0.01, *p* = .02) and CBT versus control (coefficient < -0.01, *SE* < 0.01, *p* = .02). Thus, over time participants in the CBM condition were more likely to associate social threat-related words with a positive outcome. Participants in the CBT condition over time showed less positive associations to social threat-related words than participants in the control condition.

Presence of Social Anxiety (ADIS)

We performed a Pearson's χ^2 analysis using a dichotomic variable indicating a DSM-IV Social Anxiety Disorder (SAD) diagnosis, which is 0 when no SAD is present and 1 when SAD is present, in cases when all DSM-IV criteria are met including a CSR of 4 or higher on the ADIS-C. At pretest, 9 out of 84 (10.7%) participants in the CBT condition met criteria for SAD compared to 14 out of 86 (16.3%) in the CBM condition and 8 out of 70 (11.4%) in the CTRL condition. No differences were found between the conditions at pretest (χ^2 (2) = 1.36, *p* = .54). At two year follow-up 1 out of 45 (2.2%) participants in the CBT condition met criteria for SAD compared to 4 out of 42 (9.5%) in the CBM condition and 2 out of 32 (6.3%) in the CTRL condition. No differences were found between the conditions at two year follow-up (χ^2 (2) = 2.10, *p* = .33).

Differences Between CBM, CBT, and Control Condition over Time for Secondary Outcome Measures

Internalizing symptoms (RCADS)

The unconditional means model for RCADS internalizing symptoms scores showed that 56.8% of variance was between subjects and 43.2% of variance was within subjects. The time variable indicated that internalizing symptoms scores decreased between pretest and two year follow-up (coefficient = -0.41, SE = 0.13, *p* < .001, ES: *d* = 1.09, CI [-1.13 - 4.05]), this decrease did not differ between the three conditions.

Depression (RCADS)

The unconditional means model for RCADS depression scores showed that 56.3% of variance was between subjects and 43.7% of variance was within subjects. The time variable indicated that depression scores decreased between pretest and two year follow-up (coefficient = -0.06, *SE* = 0.03, *p* = .02, ES: *d* = 0.63, CI [0.09 - 1.39]), this decrease did not differ between the three conditions.

Generalized anxiety (RCADS)

The unconditional means model for RCADS generalized anxiety scores showed that 59.5% of variance was between subjects and 40.5% of variance was within subjects. The time variable indicated that generalized anxiety scores decreased between pretest and two year follow-up (coefficient = -0.07, *SE* = 0.02, *p* < .01, ES: *d* = 0.77, CI [0.33 - 1.33]). Next to that, a difference was found between the CBM (ES: *d* = 0.67, CI [-0.06 -

1.83]) and the CBT condition (ES: *d* = 1.04, CI [0.31 - 1.80]), with a stronger reduction of generalized anxiety symptoms in the CBT condition (coefficient = 0.05, *SE* = 0.03, *p* = .03).

Parent reported social anxiety

We performed *t*-tests on the multiple imputed data to look at differences at two year follow-up in social phobia between conditions as reported by the participants' parents. No significant differences were found between any of the conditions at two year follow-up (CBT-CTRL: *t* = .843, *p* = .40; CBM-CTRL: *t* = .48, *p* = .63; CBT-CBM: *t* = -.46, *p* = .65).

Influences of Gender and Treatment Attendance

Gender

We looked into gender differences over time for social anxiety from pretest tot two year follow-up. Overall gender differences over time were found, with girls showing less reduction in social anxiety (coefficient = 0.10, *SE* = 0.04, *p* = .01). Looking at gender differences over time between conditions no significant results were found (*p*-values between *p* = .12 and *p* = .46).

Treatment attendance

Next, we examined the influence of treatment attendance. The participants in the control condition were not included in the analysis, since they did not receive a training. Attendance was measured as the number of sessions participants attended. On average participants in the CBT condition participated in 6.7 sessions (out of 10 sessions; *SD* = 3.3) and in the CBM condition in 8.5 sessions (out of 20 sessions, *SD* = 6.9). For social anxiety no effect was found for attendance over time, coefficient = -0.05, *SE* = 0.06, *p* = .20. Thus, the number of attended sessions was not of influence on the future level of social anxiety.

Differences Between CBM, CBT, and Control Condition between one year follow-up and two year follow-up

In the following section, we focus on the time segment between one year follow-up and two year follow-up and test whether or not change in reported symptoms differs between the three conditions. Table 6.3 provides an overview of the primary outcome variables divided into the time segment pretest two year follow-up.

Social phobia (RCADS)

Looking at the time between one year follow-up and two year follow-up, no time difference was found for social anxiety symptoms, implying no overall decrease in symptoms of social anxiety between one year follow-up and two year follow-up. No significant differences were found between the three conditions at this time segment, but for the CBT condition social anxiety appeared to have decreased slightly more compared to the control condition (trend significant; coefficient = -1.87, *SE* = 1.21, *p* = .06).

Test anxiety (Spielberger TAI)

A significant overall increase in test anxiety was found between one year follow-up and two year follow-up (coefficient = 3.78, *SE* = 1.98, *p* = .03, ES: *d* = 0.02, CI [-1.82 - 2.12). However, in the time fragment between one and two year follow-up CBM (ES: *d* = 0.04, CI [-3.42 - 3.79]) as well as CBT (ES: *d* = 0.06, CI [-2.54 - 2.98]) conditions showed a significant decrease of test anxiety compared to the control condition (ES: *d* = 0.17, CI [-3.55 - 4.44]; CBM-ctrl: coefficient = -4.51, *SE* = 2.38, *p* = .03, and CBT-ctrl: coefficient = -5.34, *SE* = 2.33, *p* = .01).

Table 6.3. *Estimated effects for the conditional models for primary outcomes, two year follow-up compared to one year follow-up*

	RCADS Social Phobia		TAI Test Anxiety		BFNE-II Fear of Negative Evaluation		stIAT Automatic Associations	
	ß	*SE*	*ß*	*SE*	*ß*	*SE*	*ß*	*SE*
Intercept	10.35	0.042	32.86	0.94	18.92	1.00	-0.02	0.03
Time	0.50	1.00	3.78*	1.98	1.23	2.31	0.04	0.06
CBM vs CTRL	-1.30	1.249	-4.51*	2.38	-2.67	2.85	0.06	0.07
CBT vs CTRL	-1.87	1.21	-5.34*	2.33	-2.80	2.76	-0.10	0.07
CBM vs CBT	0.57	1.12	0.83	2.24	0.13	2.66	0.16**	0.06

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

Fear of Negative Evaluation (BFNE-II)

At time segment level no time effects were found, nor differences between conditions.

Threat-related automatic associations (stIAT)

There was no overall effect of time for threat-related automatic associations. Between one year follow-up and two year follow-up, participants in the CBM condition (ES: d = 0.02, CI [-0.06 - 0.11]) developed relatively more positive automatic associations compared to CBT (ES: d = 0.02, CI [-0.06 - 0.10]; coefficient = 0.16, SE = 0.06, p = .004). No differences were found between the control condition and CBM or CBT.

Discussion

In the present indicated prevention study we tested the relative efficacy of a CBM-intervention compared to a CBT group treatment and a no-intervention control group in adolescents with elevated levels of social anxiety, focusing on long-term effects that were evident two years after the start of the intervention period. First, looking at the long term effects between pretest and two year follow-up, the major findings can be summarized as follows: The mean level of symptoms of social anxiety decreased, regardless of condition. Participants in the active training conditions (CBM and CBT) showed a stronger improvement in test anxiety compared to the control condition. Automatic associations became more positive in the CBM condition compared to both other conditions, and more negative in the CBT condition compared to both other conditions. Over time, the mean level of overall anxiety symptoms, depression symptoms, and generalized anxiety symptoms decreased, with a stronger reduction in generalized anxiety in the CBT condition compared to the CBM condition. No difference was found between conditions with regard to DSM IV diagnosis of social anxiety disorder at two year follow-up; the number of diagnoses was quite small in all groups. Similarly, there was no difference between conditions in parent-reported symptoms of social anxiety.

In the one year time span between the one year follow-up and two year follow-up measurements, social anxiety symptoms seem to decrease more in the CBT condition than in the control condition, but this effect was only borderline significant. Test anxiety decreased over time for all conditions, but this decrease was significantly stronger in both active conditions than the control condition. Automatic associations became more positive in the CBM condition compared to the CBT condition.

These findings provide partial support for the efficacy of the studied prevention programs: although social anxiety decreases over time regardless of condition; the decrease in test anxiety was significantly stronger for both CBM and CBT compared to the no-intervention control group. This effect was present directly after

the training period and stable over time, and although the difference in effect sizes was quite small (range *d* = 0.98 for the control group compared to *d* = 1.04 for the active intervention groups), this prolonged benefit for the actively trained adolescents might be very meaningful at an individual level with less stress at exams and possibly improved academic performance. The absence of effects on social anxiety but presence of effects on test anxiety can be explained by the material used in both training conditions: scenarios in the CBM interpretation bias task and in the CBT training focused specifically on situations at school, which were quite often exams and tests. Social anxiety plays a role in various situations, including friends, clubs, and social life outside of school. The impact of our training conditions on social anxiety symptoms might be small because of the variety of factors in the adolescent's environment that can also provide a source for change. Making a meaningful change in social anxiety symptoms in adolescents with relatively few complaints (compared to clinical cases) might need a broader approach that also involves friends and parents (e.g., Masia-Warner et al., 2005).

The need for prevention programs has been put forward by policy makers and mental health institutions but the practice of testing prevention effects in research has some hurdles that are hard to tackle. First, even in an at-risk populations such as the high socially anxious adolescents selected in this indicated prevention program, the prevalence of social anxiety disorder is quite low, with low power to detect differences between groups as a complicating consequence. Second, in this at-risk group, the mean level of social anxiety symptoms decreased over time; many adolescents improve regardless of receiving a preventive intervention. The value that can be added by providing a training is only small. This decrease of symptoms in an at-risk group has been observed in other indicated prevention studies (Sheffield et al., 2006) or longitudinal studies as well (e.g., the TRAILS cohort, in which the anxiety scores of high-anxious youngsters also dropped from age 13-14 to age 15-16, personal communication, April 11th, 2011).

It would be premature to conclude from the lack of preventive effect on social anxiety in our study that prevention in this way is not worthwhile, since test anxiety has significantly decreased in both active conditions. Cognitive Bias Modification can be easily delivered through the internet and requires no therapist involvement, and thus seems to be a promising venue for further research. In time, CBM may be applicable in prevention as well as in treatment, although it is important to test which aspect of the training is most effective in modifying cognitive biases and decreasing or preventing symptoms of anxiety. Delivering an intervention by way of external psychologists seems to be less suitable, since they are very costly, which makes implementation of such a program less feasible. A CBT program such as studied by Aune and Stiles (2009) which targets not only adolescents but teachers, parents and the community as well, seems to be a fruitful approach, and fits with the idea that targeting adolescents' social environment could be important in the prevention of social anxiety.

Since power limitations are present in most universal and indicated prevention studies (Cuijpers, 2003) the effect of prevention efforts can best be tested by combining studies in a meta-analysis (e.g., Fisak et al., 2011; Neil & Christensen, 2009). Although the results of a single prevention study may be limited, it adds value to the available information on prevention.

Our study is the first to measure automatic associations in a longitudinal RCT design. The finding that automatic associations to threat diverge over time for both active conditions, with relatively more positive associations in the CBM condition and relatively negative associations in the CBT condition sheds some light on the meaning of automatic associations in the context of anxiety. Automatic associations are regarded as complementary to self-reported anxiety, and our findings fit with this idea such that anxiety decreases about equally in both groups while automatic associations diverge. These pathways might reflect different associations that are emphasized in both training conditions: while in most CBM tasks the relationship between threatening situations and positive outcomes was strengthened (e.g., ambiguous scenarios led to positive interpretations), the focus in CBT was on threatening situations and how to decrease anxiety while limiting avoidance, with much less focus on positive outcomes. Thus, relatively negative automatic associations may reflect past learning experiences which emphasized the relationship between social threat and negative

outcomes. Since positive associations between social cues and expected outcome might be protective of developing anxiety, CBT could probably be improved by adding components that strengthen positive associations. Furthermore, it would be interesting to test whether automatic associations to threat are related to actual performance in test situations. Unfortunately, we did not include a behavioral test of social anxiety (e.g., a stress task; Westenberg et al., 2009) or social exclusion game (Williams, Cheung, & Choi, 2000) in our design, but would recommend doing so in future studies to test this relationship as well as provide additional information on the level of social anxiety.

To conclude, although both active interventions did not lead to long-term changes in symptoms of social anxiety, both CBT and CBM interventions did reduce test anxiety at short and long term. Taken together with the finding that CBM was able to change automatic threat-related associations in the long term into a more positive direction, these findings implicate that CBM does seem to be a plausible intervention for test anxiety. Since it is easy to implement at a relative low cost, CBM could be used as an indicated as well as a nonindicated preventive intervention. Future studies, however, should find out which components of CBM are most effective and take care to include more behavioral tests of social anxiety.

Chapter 7

Modification of Cognitive Biases in the Prevention of Adolescent Social Anxiety

Abstract

The Cognitive Bias Modification (CBM) procedure described in this thesis aims to modify cognitive processes in high socially anxious adolescents into a more benign direction. Previous chapters already described the effects of this CBM training on symptoms of social anxiety; this chapter focuses on the change in cognitive processes in the CBM condition compared to CBT and no-treatment control group, both at short term (pretest – posttest) and long term (pretest – two year follow-up). Results indicate that CBM successfully decreased threat-related associations in the long term relative to CBT and control group; attentional bias to friendly faces increased during the training period, but no long-term effects for attentional bias to friendly or threatening faces or words were observed. Interpretive bias as measured by the recognition task changed into a more positive and less negative direction for the CBM group and this effect was maintained in the long term. This effect was less pronounced in the AIBQ interpretive bias questionnaire, which showed only a decrease in negative interpretive bias in the CBM group at short term, but no effects in the long term. These results indicate that our multifaceted CBM procedure did effectively change automatic associations and interpretive biases in both short and long term, but that there is less evidence that we were able to modify attentional biases. Future studies are needed to test which components of CBM are specifically effective in modifying cognitive biases in adolescents at risk for social anxiety.

Introduction

This chapter specifically focuses on the change in cognitive biases in high socially anxious adolescents who received a cognitive bias modification training (CBM), a cognitive behavioral group training (CBT) or no training (CTRL), as has been previously described in chapters 5 and 6. We developed a multifaceted CBM training which consisted of components specifically targeting automatic threat-related associations, attentional bias to threat and interpretive bias. Since each participant received all components, we cannot disentangle the effects of each component specifically. We anticipated that this multifaceted CBM training would decrease the strength of threat-related automatic associations, attentional bias to threat, and negative interpretive bias and would increase attentional bias to positive information and positive interpretive bias.

To test the central question whether the CBM training was able to change the targeted information processing biases, we measured automatic threat-related associations, attentional bias and interpretive bias at pretest and posttest, and at six months, one year, and two year follow-up. Changes in cognitive processes in the group that received the CBM training are compared to changes in the CBT group and the no treatment control group, at the short term (pretest to posttest) and at the longterm (pretest to two year follow-up).

Since the effects of the CBM training on cognitive processing biases may be influenced by treatment attendance, this chapter also provides insight in the actual number of training sessions carried out by participants as a function of treatment condition. Where treatment attendance was related to the change in cognitive processes, this will be highlighted. Although no causal relations can be inferred (number of treatment sessions was not experimentally manipulated), these highlights can provide clues about whether change in cognitive processes can also occur after performing only a few sessions of CBM instead of the complete 20-session training.

Method

Trial design, participants, interventions and procedures are detailed in chapters 5 and 6. This Methods section will therefore focus on the tasks and questionnaires used to assess cognitive information processing, data reduction and statistical analyses.

Automatic Associations to Threat

To examine threat-related automatic associations with social cues, we used a single-target Implicit Association Test (stIAT) that was specifically designed for this study. This task is described in detail in chapter 2, 5 and 6 of this thesis. The single-target variant of the IAT (Greenwald et al., 1998) is a computerized reaction time task that measures to what extent a single target category is associated with two attribute categories. Following the design of Wigboldus, Holland,van Knippenberg, den Hartog en Belles (2002) a social cues stIAT was constructed with the target category *social- or school activity*, and the attribute labels *positive outcome* and *negative outcome*. We chose to use these attribute labels to indicate threatening and safe associations with the target words. We labeled the target category *'social- or school activity'* to provide a neutral category that could contain cues that are feared by socially anxious people, such as *conversation* or *exam*. The instructions and format of the present stIAT were based on an IAT (de Jong, Sportel, de Hullu, & Nauta, 2011) that was tailored to the present age group and piloted extensively. In the stIAT, participants are asked to categorize words appearing in the center of the screen as quickly as possible into the target category or the attributes, by pressing the left or right button on a response-box. The test phase consists of two blocks of 64 trials, each preceded by a short practice phase of 24 trials. After a correct response, the next stimulus is presented after 500 ms. After an incorrect response a red X appears shortly above the stimulus. The stimulus remains on the screen until a correct response is given. For someone with a fear of social situations, associations between social cue words and negative outcome are assumed to be relatively strong, resulting in a fast response when the target category (*social- or school situation*) and *negative outcome* will be paired, and a relatively slow response time when the target category is paired with *positive outcome*. Single-target IAT effects were

computed according to the algorithm proposed by Greenwald, Nosek, and Banaji (2003). In this paper, we reported the so-called D_4-measure with a 600 ms error penalty. Positive stIAT effects represent relatively positive associations to social cue words. Practice trials have been discarded from the analyses (cf., Bluemke & Friese, 2008). The split-half reliability of the present stIAT was adequate, with a Spearman-Brown corrected correlation between test-halves of .76.

Attentional bias to threat

To examine attentional bias to social threat, we used two versions of a visual probe task that was specifically designed for this study: one using pictorial stimuli (Visual Probe task with Faces; VPF) and one using verbal stimuli (Visual Probe task with written Words; VPW). Both versions of this visual probe task are described in detail in chapter 3 of this thesis. Each visual probe task comprised 76 trials; 12 practice trials (neutral-neutral, stimuli not present in the critical trials) and 64 critical trials (32 positive-neutral and 32 negative-neutral). Trials ran in a fixed random order. Stimuli were presented supraliminally on a white background. On each trial a black fixation cross appeared for 500 ms followed by a stimulus pair presented horizontally for 500 ms. Probes were small black arrows pointing upwards or downwards (size 2.5 x 1.5 mm), presented immediately after the stimuli disappeared. In the VPF, stimuli were neutral, friendly (happy) and threatening (contempt) faces, selected from the Karolinska Directed Emotional Faces series (KDEF: Lundqvist, Flykt, & Öhman, 1998), showing straight profile images of 32 men and 32 women. Each stimulus pair consisted of two pictures of faces belonging to the same individual, either friendly-neutral or threatening-neutral. Pictures were sized 5.5 x 7.5 cm and positioned with the center of the picture 11.5 cm from the left and right border of the screen (28.5cm width). See appendix 1 for a list of all used stimulus faces. In the VPW, stimuli were 64 different word pairs, matched for number of characters (3-11), with fixed random presentation of 32 combinations of neutral (*spoon, curtain*)— friendly (*smile, success*) and 32 combinations of neutral (*stove, blanket*) — threatening (*shame, failure*) words. Words were printed in 18 point, Arial bold black font and placed in the same position as the pictures in the VPF. Left and right positions of the stimuli and probes and direction of the arrows were equally divided over the task. The visual probe task was delivered on a laptop computer, positioned at a table with the participant sitting in front of the laptop. The response-box with two buttons (up and down) was placed in front of the laptop. Screen size was 14 inch with 1024 x 768 pixels, refresh rate 60 Hz.

Interpretive bias

Recognition Task

The Recognition Task was adapted from earlier versions (Mathews & Mackintosh, 2000; Salemink & van den Hout, 2010b) such that the scenarios presented were appropriate for adolescents in a school environment. This version of the recognition task is described in detail in chapter 4 of this thesis. On the computer screen, participants read a scenario of a social situation, followed by a word fragment that they were asked to solve. The (social) situation remained ambiguous, and a comprehension question appeared which made sure that participants had read the text. Incorrect answers on the comprehension questions are an indicator that the participant did not read the scenario carefully, such that the answers to the recognition question will not reflect actual interpretations but guesses. After 10 trials describing various (social) situations, the title of the description was repeated and participants were asked to rate the similarity (1 = *very similar in meaning* to 4 = *very different in meaning*) of four different interpretations (positive, negative, neutral, or irrelevant) of the situation to the original situation that they have read before. Positive and negative interpretive biases are calculated from the ratings on positive and negative interpretations. Mean scores for the 10 situations are reversed such that higher scores indicate a higher (positive or negative) interpretive bias.

Adolescents' Interpretation and Belief Questionnaire

The AIBQ (Miers, Blöte, Bögels, & Westenberg, 2008) is a questionnaire designed to assess interpretations

and beliefs about both social and non-social ambiguous situations, specifically designed for adolescents. In this study, we assessed only the positive and negative interpretations of social situations. An example of an item measuring interpretive bias for social situations is as follows: *You've invited a group of classmates to your birthday party, but a few have not yet said if they're coming. Why haven't they said something yet?* After this description, three interpretations of the situation (positive, negative, and neutral) were presented individually and respondents were asked to rate how likely it is that this interpretation would pop up in their mind (1 = *does not pop up in my mind* to 5 = *definitely pops up in my mind*). Interpretive bias was calculated by adding up the scores from each interpretation/situation combination divided by the number of situations (5), resulting in a range with minimum 1 (no bias) to 5 (high bias).

Data Reduction

Since some adolescents performed poorly on the tasks that were used to assess information processing biases, we excluded scores when participants performed poorly on tasks as indicated by the exclusion criteria below. Excluded scores were replaced by missing value indicators. For the stIAT, scores were removed when participants showed response times faster than 300 ms in more than 10% of the trials; response times slower than 10.000 ms for more than 1% of the trials, or an error percentage greater than 2 SD above the mean (cf., Karpinski & Steinman, 2006). Table 7.1 provides an overview of excluded participants for each task and each condition. For the visual probe tasks, only RTs of correct trials were used in the analysis; incorrect responses and responses faster than 150 ms and responses larger than 2 standard deviations from a participant's mean in a specific trial category were excluded (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van IJzendoorn, 2007; Mogg, Philippot, & Bradley, 2004). Participants with missing data (excluded trials) on more than 4 trials of 16 trials in a specific category were excluded. In the recognition task we excluded scores of participants who correctly responded to less than 50% of the comprehension questions.

Due to technical problems during the assessments, several participants were not able to complete all tasks. In the CBT condition, one participant was excluded at 1 year FU for missing scores on the stIAT and the visual probe tasks; two participants were excluded at pretest for missing scores on the visual probe tasks and one participant was excluded at posttest for missing scores on the recognition task. In the CBM condition, two participants failed to perform the visual probe tasks with faces and words at pretest, and one additional participant did not finish the visual probe task with faces at pretest. At 6 months follow-up, one CBM participant did not complete the recognition task. No task scores were missing in the control condition.

Statistical Analyses

Multilevel analysis, using MLwiN Version 2.18 (Rasbash, Charlton, Browne, Healy, & Cameron, 2010) was used to answer the question whether information processing in the CBM condition developed differently from CBT and CTRL conditions in the short and long term.

Multilevel models were estimated for automatic associations to threat (stIAT 600ep D-measure), interpretive bias (Recognition task positive, negative and total interpretive bias; AIBQ positive, negative and total interpretive bias), and attentional bias (attentional bias to threatening and friendly faces and words). As a first step in the modeling the levels were defined, with test session at first level and participant at second level. Next, an unconditional model was employed to estimate the variance partitioned at each level. Then, an overall model was created, to get an idea of the overall long-term change within and between the groups. After adding time as a variable, group $\times$ time was added. In a more specific conditional model, looking into the short term change in cognitive processes (pretest to posttest), the categorical variable assessment point was added, with random slopes for level 2. The interaction variable time $\times$ training condition was added in a fixed manner, with control condition and pretest as reference categories.

Treatment attendance

On average, participants in the CBM condition completed 8.5 out of 20 CBM sessions (*SD* = 6.9) while

Table 7.1. *Excluded data and analyzed data for each task at all time points*

			Pretest	Posttest	Six months FU	one year FU	two year FU	Total
Single-Target IAT	Excluded	CBM	3	5	4	3	2	17
		CBT	4	3	1	1	1	10
		CTRL	5	2	3	0	3	13
	Analyzed	CBM	83	67	34	42	35	261
		CBT	80	66	56	51	43	296
		CTRL	65	53	41	35	31	225
Visual Probe Faces	Excluded	CBM	11	4	3	3	0	21
		CBT	6	1	5	0	0	12
		CTRL	7	1	5	2	2	17
	Analyzed	CBM	72	68	35	42	37	254
		CBT	76	68	52	52	44	292
		CTRL	63	54	39	33	32	221
Visual Probe Words	Excluded	CBM	6	6	1	3	1	17
		CBT	6	3	5	3	0	17
		CTRL	7	3	4	1	3	18
	Analyzed	CBM	78	66	37	42	36	259
		CBT	76	66	52	49	44	287
		CTRL	63	52	40	34	31	220
Interpretive Bias Recognition Task	Excluded	CBM	4	7	1	1	1	14
		CBT	1	0	3	1	0	5
		CTRL	4	2	0	0	0	6
	Analyzed	CBM	82	65	37	44	36	264
		CBT	83	68	53	52	44	300
		CTRL	66	53	44	35	34	232

participants in the CBT condition attended 6.7 sessions out of 10 CBT sessions (*SD* = 3.3). As can be seen in figure 7.1, there are quite a number of participants in the CBM condition who did not start treatment (16 participants completed 0 sessions), compared to CBT. Some of those did not manage to start the program due to technical difficulties in running the Authorware plugin in their browsers, even after technical assistance through e-mail or telephone. Getting the training to run properly was particularly difficult for users running Microsoft Vista (relative to Microsoft XP) or Apple operating systems. Since the tasks in the CBM condition were in mixed order, participants who dropped out early did complete all 5 components but performed fewer sessions of these tasks. This is different from drop-outs in the CBT conditions, who missed for example the last couple of sessions in which the focus was on exposure exercises. In the analyses, we checked whether treatment attendance in the CBM condition influenced change in cognitive processes, by running separate analyses for the CBM condition, adding completed number of CBM sessions as a continuous variable on top of the change in time.

As described in chapter 1 (general introduction) and in chapters 5 and 6, the CBM training consisted of several components, which were combined in a 20-session training. Each session consisted of one particular task (i.e., interpretive bias training), with, depending on the expected time the task took to complete, an

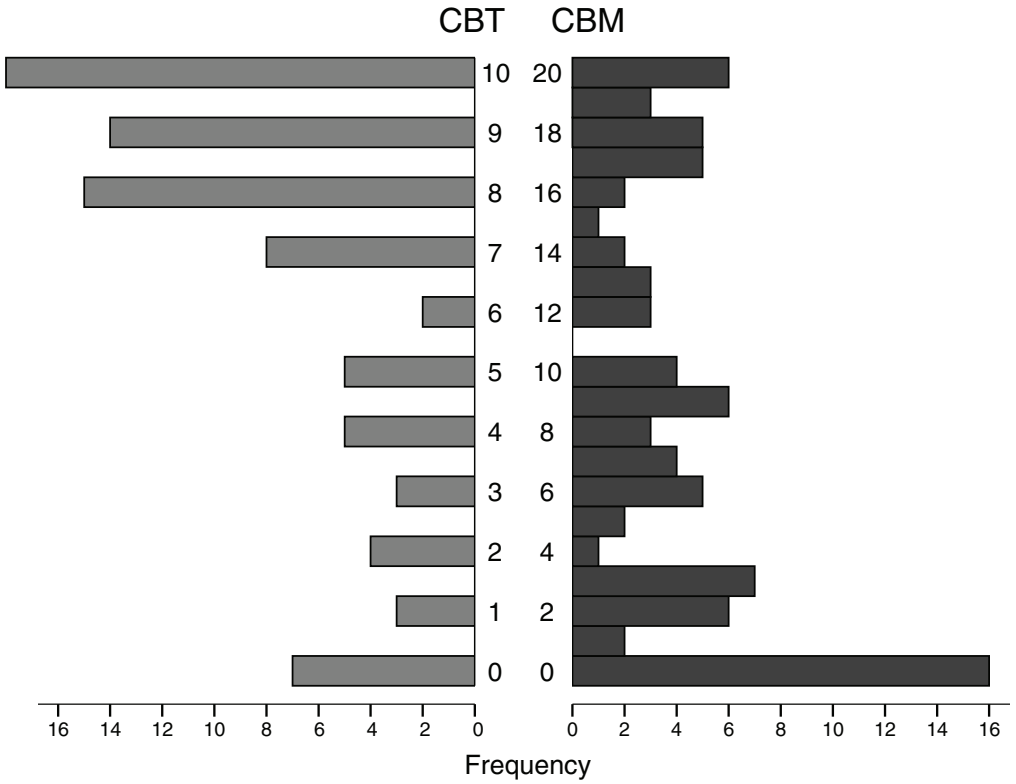

Figure 7.1. Overview of the number CBT (total: 10 weekly sessions) and CBM (total: 20 sessions, twice per week) sessions attended. Frequency relates to the number of participants that completed each number of sessions.

additional short implicit self-esteem task. An overview of the targeted processes and description of the tasks is provided in table 7.2, with the planned number of sessions in a completed training program and mean number of sessions completed in the actual CBM training. Table 7.3 provides insight into the order that the tasks were delivered to participants over the course of ten weeks.

Results & Discussion

Table 7.4 provides an overview of descriptives for each task used to measure cognitive processes in the high socially anxious adolescents that received either a CBT training, a CBM training, or a no-treatment control group (CTRL). Below, short term and long term changes in these processes will be described and discussed for targeted cognitive process separately.

Change in threat-related automatic associations

For automatic threat-related associations (see figure 7.2), the unconditional means model showed that 74.1% of variance was within subjects and 25.9% of variance was between subjects. In the training period (pretest-posttest), automatic associations to threat became more negative in the CBT condition relative to the control group (coefficient = -0.089, *SE* = 0.053, $p = .047$) and the CBM condition (coefficient = 0.097, *SE* = 0.05, $p = .026$). Over time, automatic associations became more positive in the CBM condition, relative to the control group (coefficient = 0.004, *SE* = 0.002, $p = .023$) and the CBT condition (coefficient = 0.008, *SE* = 0.002, $p < .001$).

This effect, described in chapters 5 and 6 in the context of changes in social anxiety, can be interpreted as a differential effect of both active training conditions. While in the CBM condition, automatic associations did not change at the short term, in the long term they may have changed as a consequence of the acquired ability to use a relatively positive cognitive processing style (e.g., interpreting ambiguous social situations in a more positive way). This may reflect that a relatively long time was needed before these altered processing

Table 7.2. *Description of tasks used in the CBM training condition with actual number of sessions completed by participants.*

Target process	*Description of training task*	*Number of sessions x trials per session*	*Mean number of sessions completed in CBM training (SD)*
Interpretive bias	Ambiguous social scenario + comprehension question, followed by feedback. 80% positive, 20 % neutral filler trials. Imagination instruction at the start of each session.	9 sessions x 60 trials	5.00 (2.57)
Attentional bias	Based on visual probe task and exogenous cueing task, verbal & pictorial stimuli. Stimulus shown for 500 ms, target timing varies. Two versions: stimulus disappears before target or target appears on top of stimulus.	8 sessions x 450 trials	3.71 (2.75)
Automatic Associations	Sorting task in which positive outcome words (Dutch) & feared cues share a response key, with English neutral words on the opposite side.	3 sessions x 500 trials	2.13 (0.80)
Implicit Self-Esteem	Short evaluative conditioning task in which personal stimuli are followed by positive smileys or words. Non-personal stimuli are followed by neutral pictures or words. This task was delivered after attentional bias and automatic association tasks.	10 short sessions x 240 trials	5.61 (3.08)

Note. Each training session took about 30-45 minutes to complete.

Table 7.3. *Order of tasks in the CBM training*

week	1	2	3	4	5	6	7	8	9	10
First task	IB	ABA	IB	AA SE	ABB SE	IB	IB	IB	AA SE	ABB SE
Second task	IB	ABA SE	AA SE	IB	ABB SE	ABA SE	ABA SE	ABB SE	IB	IB

Note. IB = interpretive bias; ABA = attentional bias, first version;
ABB = attentional bias, second version; AA = automatic associations; SE = implicit self esteem.

habits left a trace in the memory system such that the stIAT was able to measure them. In the CBT condition, automatic associations changed in the training period and became relatively negative compared to both CBM and control group, while in the long term they do no longer differ from the control group. These relatively negative automatic associations might be explained by the focus on anxiety and negative outcomes in the CBT group training, where quite often the fearful aspects of social situations are discussed. Adding a component to CBT aimed at changing these automatic threat-related associations into a more positive direction may ameliorate existing CBT treatment programs.

Table 7.4. *Descriptives (means and standard deviations) for instruments assessing cognitive processes in high socially anxious adolescents*

		pretest		*posttest*		*6 months FU*		*1 year FU*		*2 year FU*	
		Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*
Automatic threat-related associations	CBM	-0.027	0.33	-0.009	0.28	-0.010	0.28	0.077	0.28	0.081	0.28
	CBT	-0.027	0.29	-0.106	0.29	-0.075	0.33	-0.087	0.29	-0.082	0.27
	CTRL	-0.002	0.28	-0.017	0.29	0.001	0.29	-0.051	0.27	0.019	0.27
Attentional bias to threatening faces	CBM	15.15	43.03	22.01	42.18	26.86	55.40	17.11	48.81	17.46	39.25
	CBT	22.23	46.07	13.72	39.16	33.82	49.15	12.09	40.69	6.46	34.74
	CTRL	35.65	62.56	23.03	50.60	23.77	34.92	11.52	36.98	14.42	44.48
Attentional bias to friendly faces	CBM	0.19	54.02	14.27	49.77	8.41	48.43	0.88	39.86	6.22	40.79
	CBT	-1.46	54.08	1.03	40.27	4.86	37.38	20.25	49.36	-1.10	39.65
	CTRL	-0.35	101.21	-5.85	47.49	7.31	50.14	14.42	36.51	-0.20	33.31
attentional bias to threatening words	CBM	8.95	46.44	13.89	44.61	35.01	73.19	11.18	50.98	12.33	43.98
	CBT	4.79	50.99	18.67	41.60	8.95	47.29	18.38	38.57	8.92	51.84
	CTRL	34.56	61.37	9.53	53.95	14.47	44.09	22.73	45.01	7.55	41.57
attentional bias to friendly words	CBM	6.06	41.07	12.13	37.71	7.39	59.51	9.15	49.69	5.69	51.19
	CBT	-0.69	48.70	0.58	42.31	7.13	50.52	1.34	41.56	8.86	43.75
	CTRL	8.11	53.95	3.45	48.21	-3.45	49.43	6.92	51.33	4.10	39.89
Recognition Task negative interpretive bias	CBM	2.41	0.46	1.90	0.34	2.01	0.46	2.04	0.45	1.93	0.38
	CBT	2.41	0.53	2.37	0.43	2.39	0.47	2.34	0.53	2.14	0.52
	CTRL	2.31	0.47	2.39	0.39	2.29	0.40	2.23	0.39	2.19	0.49
Recognition Task positive interpretive bias	CBM	2.52	0.40	3.02	0.43	2.92	0.48	3.02	0.41	3.06	0.50
	CBT	2.55	0.46	2.58	0.45	2.61	0.44	2.73	0.36	2.69	0.41
	CTRL	2.57	0.38	2.59	0.40	2.58	0.48	2.61	0.48	2.73	0.48
AIBQ negative social interpretive bias	CBM	3.07	0.77	2.64	0.79	2.75	0.81	2.67	0.84	2.66	0.82
	CBT	2.94	0.72	2.75	0.79	2.76	0.72	2.62	0.82	2.62	0.83
	CTRL	3.15	0.83	2.97	0.76	2.97	0.72	2.81	0.66	2.84	0.76
AIBQ positive social interpretive bias	CBM	2.47	0.61	2.95	0.68	2.96	0.74	3.00	0.67	3.18	0.79
	CBT	2.51	0.77	2.85	0.67	2.94	0.65	2.91	0.63	2.97	0.57
	CTRL	2.66	0.73	2.87	0.66	2.72	0.62	2.97	0.66	2.93	0.70

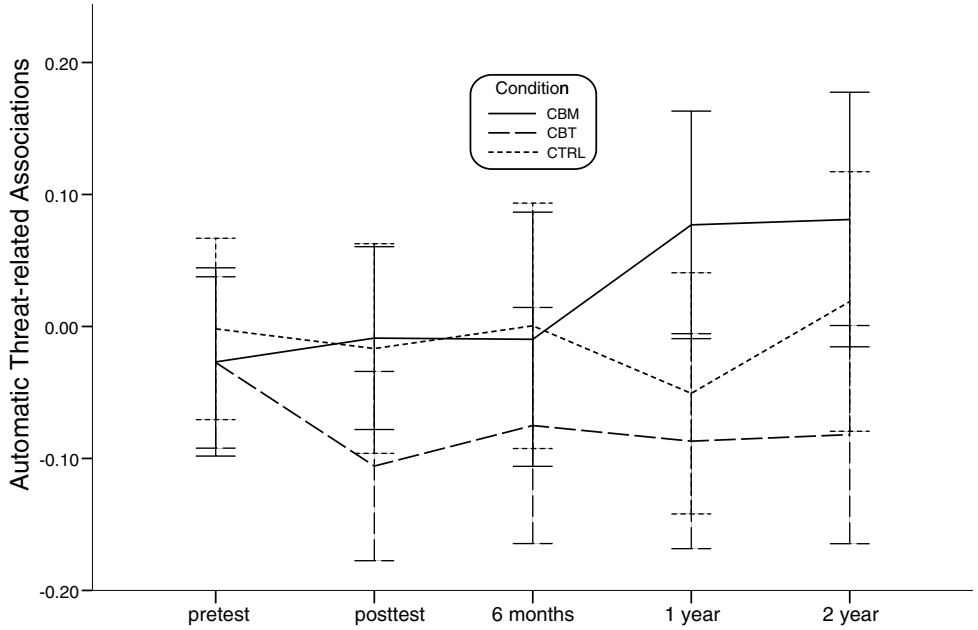

Figure 7.2. Change in automatic threat-related associations, as indexed by the single-target IAT.

Attentional bias to facial stimuli

For **attentional bias to threatening** faces (see figure 7.3) as measured by the visual probe task with facial stimuli, the unconditional means model showed that 100% of variance was within subjects and 0% of variance was between subjects. There were no significant effects of time or condition in the short term (pretest-posttest) or long term (slopes pretest two year follow-up). Treatment attendance, however, did influence attentional bias to negative faces in the CBM condition (coefficient = -0.72, *SE* = 0.41, *p* = .039). CBM participants showed less attentional bias to threatening faces when they completed more CBM sessions.

For **attentional bias to friendly faces** (see figure 7.4) as measured by the visual probe task with facial stimuli, the unconditional means model showed that 100% of variance was within subjects and 0% of variance was between subjects. In the training period (pretest-posttest), attentional bias to friendly faces increased in the CBM condition compared to the control group (coefficient = 20.12, *SE* = 9.53, *p* = .017). There were no significant effects of time or condition in the long term (slopes pretest — two year follow-up).

Attentional bias to verbal stimuli

For **attentional bias to threatening words** (see figure 7.5) as measured by the visual probe task with verbal stimuli, the unconditional means model showed that 93.6% of variance was within subjects and 6.4% of variance was between subjects. There were no significant effects of time or condition in the short term (pretest-posttest) or long term (slopes pretest two year follow-up). For **attentional bias to friendly words** (see figure 7.6) as measured by the visual probe task with facial stimuli, the unconditional means model showed that 89.8% of variance was within subjects and 10.2% of variance was between subjects. There were no significant effects of time or condition in the short term (pretest-posttest) or long term (slopes pretest — two year follow-up).

Since attentional bias to threat was hypothesized to be an important factor in adolescent social anxiety, we added a large number of attentional bias training sessions to the multifaceted CBM training in the current study. We expected attentional bias to change in the CBM condition into a more benign pattern of attention to friendly stimuli and attention away from threat. These expectations, however, are not confirmed. Although attentional bias to friendly faces did change in the short term, this change was very small and did not hold for the long term, and we did not find a similar change in attentional bias to friendly words. There were

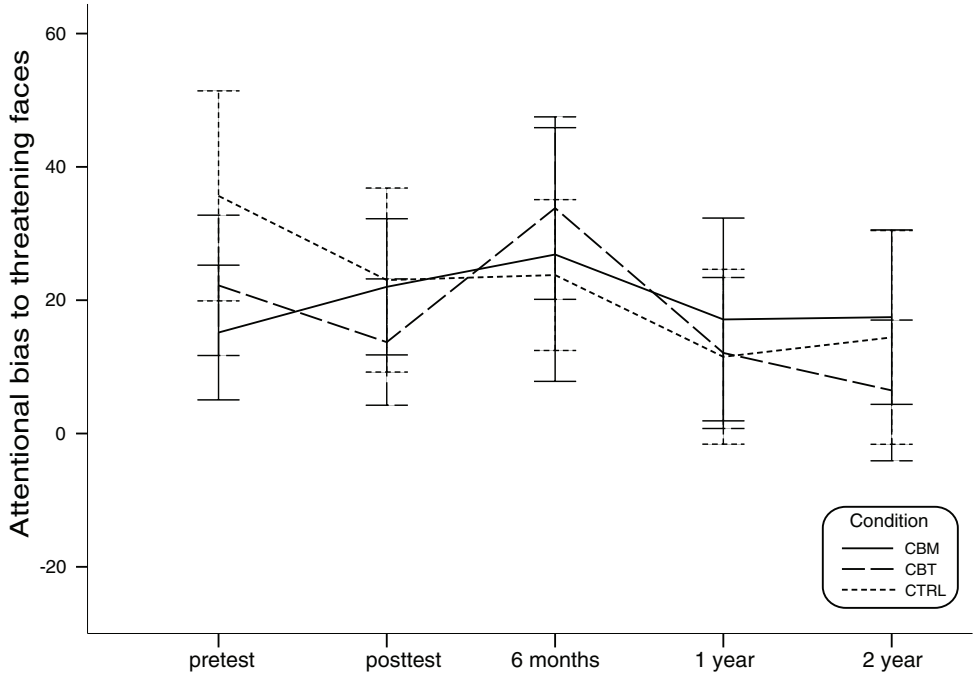

Figure 7.3. Change in attentional bias to threatening faces, measured using a visual probe task.

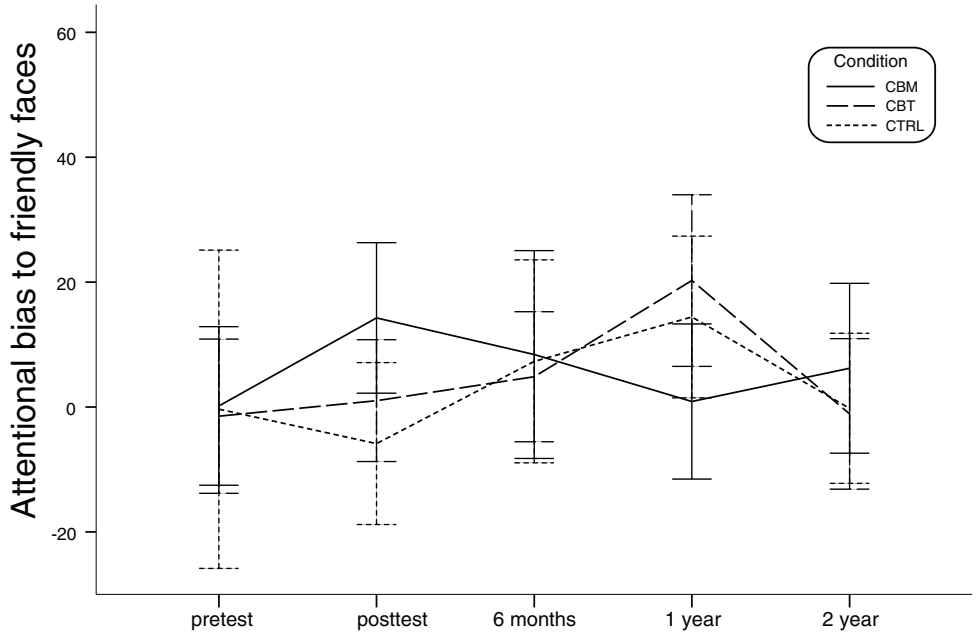

Figure 7.4. Change in attentional bias to friendly faces, measured using a visual probe task.

no long-term time effects for attentional bias, indicating that the existing bias to threat (see chapter 3) did not decrease significantly in the highly anxious adolescents. Treatment attendance in the CBM condition only influenced attentional bias to threatening faces in the expected direction. As can be seen in the graphs above, attentional bias did not show a consistent pattern over time. This could mean that attentional biases are quite inconsistent over time within subjects; they may not reflect a very stable characteristic. Another issue with attentional biases is that they are quite difficult to measure. Even though the visual probe task is the most used and probably most appropriate task to measure attentional biases (Cisler & Koster, 2010), the reliability of the visual probe task is quite low (Staugaard, 2009). These reliability issues make it difficult to compare repeated measures of attentional bias. However, if we were able to successfully change attentional bias through the CBM training, we would have expected to find group differences in attentional bias, as did other CBM studies

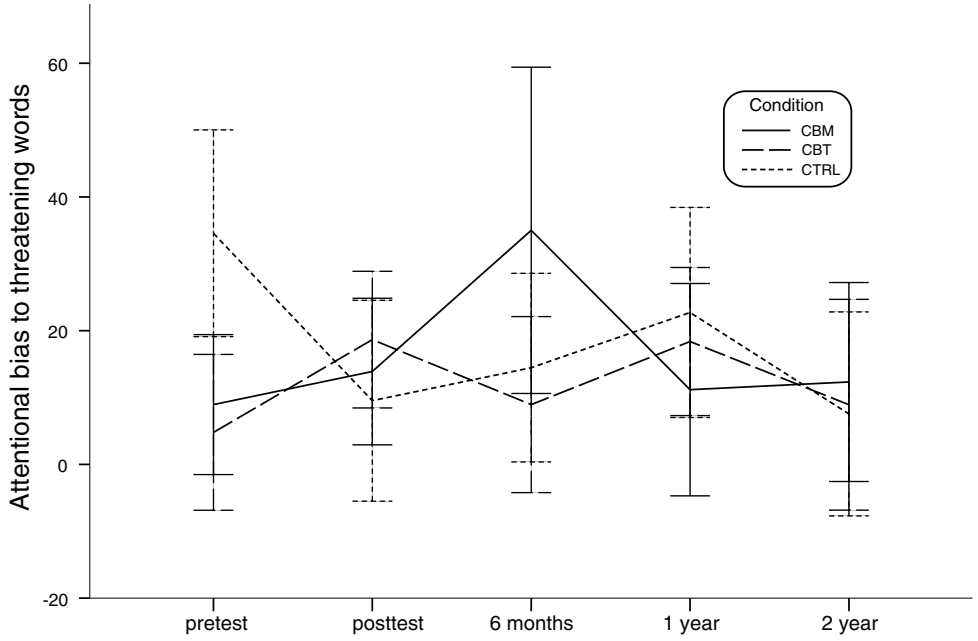

Figure 7.5. Change in attentional bias to threatening words, measured using a visual probe task.

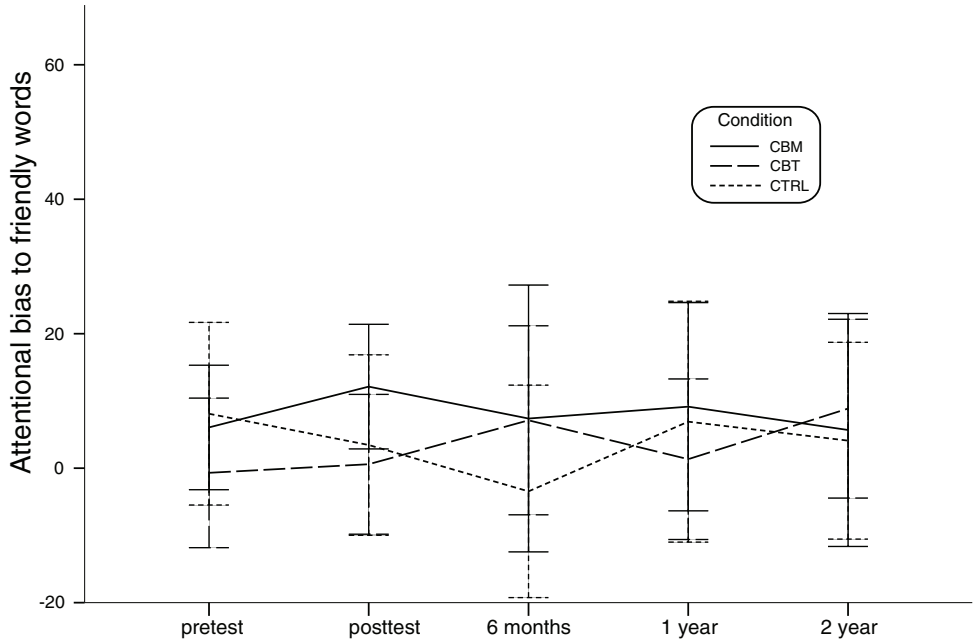

Figure 7.6. Change in attentional bias to friendly words, measured using a visual probe task.

(e.g., Amir et al., 2009; Bar-Haim, Morag, & Glickman, 2011). It seems therefore that we have to conclude that our multifaceted CBM training did not alter the direction of attentional bias. We could think of several explanations for this lack of effect. First, attentional bias to threat was found in all adolescents (see chapter 3), regardless of social anxiety. Since social evaluations are part of every adolescents' social life, attentional bias to rejecting information could be a functional process and therefore difficult to change with a minimal intervention such as CBM. This may be different in adult populations, where the social environment is quite different from adolescents. Second, half of our attentional bias training sessions were different from regular attentional bias modification paradigms, in that the stimuli stayed visible behind the target arrow, thus allowing for a prolonged effect of the stimulus. The effect of this version of the visual probe training paradigm has not been tested separately and could be less effective or even counterproductive. One important recommendation

for future CBM intervention or prevention studies would be to extensively pilot the components of the CBM training in advance, in order to assess the ability of the program to modify biases.

Recognition task interpretive bias

For **negative interpretive bias** (see figure 7.7) as measured by the recognition task, the unconditional means model showed that 67.3% of variance was within subjects and 32.8% of variance was between subjects. In the training period (pretest-posttest), interpretations became less negative in the CBM condition compared to the control group (coefficient = -0.48, *SE* = 0.08, $p < .001$) and the CBT condition (coefficient = 0.46, *SE* = 0.08, $p < .001$). Over time, negative interpretive bias decreased in the CBM condition, relative to the control group (coefficient = -0.02, *SE* = 0.01, $p = .001$) and the CBT condition (coefficient = -0.02, *SE* = 0.00, $p < .001$). Treatment attendance in the CBM condition did influence negative interpretive bias (coefficient = -0.015, *SE* = 0.004, $p < .001$). Interpretive bias decreased more when participants performed more CBM sessions.

For **positive interpretive bias** (see figure 7.8) as measured by the recognition task, the unconditional means model showed that 54.4% of variance was within subjects and 45.6% of variance was between subjects. In the training period (pretest-posttest), interpretations became more positive in the CBM condition compared to the control group (coefficient = 0.43, *SE* = 0.08, $p < .001$) and the CBT condition (coefficient = 0.43, *SE* = 0.08, $p < .001$). Over time, positive interpretive bias increased in the CBM condition, relative to the control group (coefficient = 0.02, *SE* = 0.00, $p < .001$) and the CBT condition (coefficient = 0.02, *SE* = 0.00, $p < .001$). Treatment attendance in the CBM condition did influence positive interpretive bias (coefficient = 0.008, *SE* = 0.004, $p = .023$). Positive interpretive bias increased more when participants performed more CBM sessions.

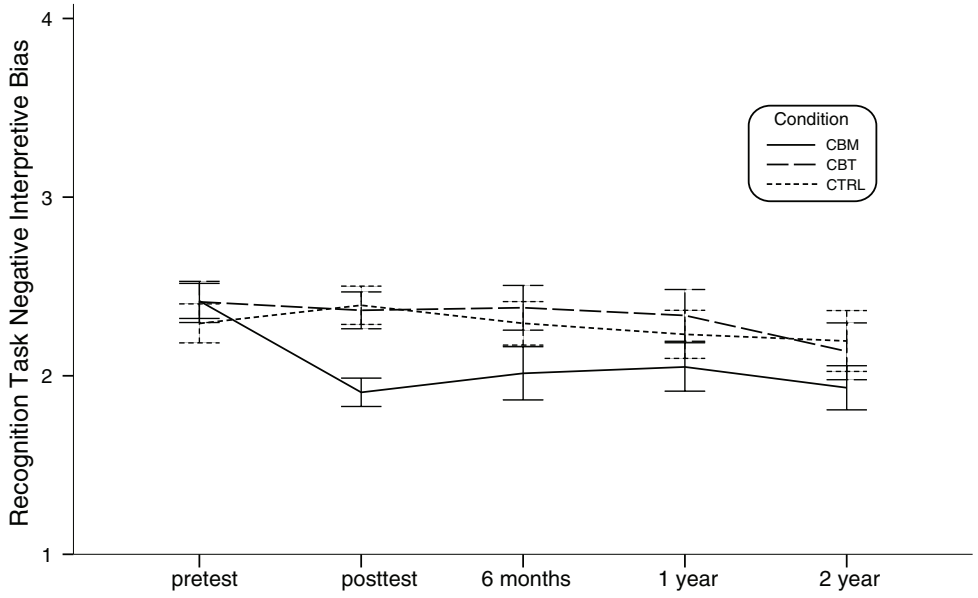

Figure 7.7. Change in negative interpretive bias measured by the recognition task

In summary, effects on interpretive bias as measured with the recognition tasks are as follows: In the CBM condition, interpretive bias became more positive and less negative during the training period and this effect was stable over time. CBM caused an enduring effect on interpretive bias in the expected direction. Our study is the first to measure changes in interpretive bias over such a long time span. Since we used a multifaceted CBM training, we cannot be certain whether this effect can be contributed to the interpretive bias training tasks or to the combination of tasks used in the training. Earlier research however, has shown that training interpretive biases using the training paradigm of Mathews & Mackintosh (2000) is effective in changing interpretive biases as measured by the recognition tasks (Salemink & Wiers, 2011) but also that

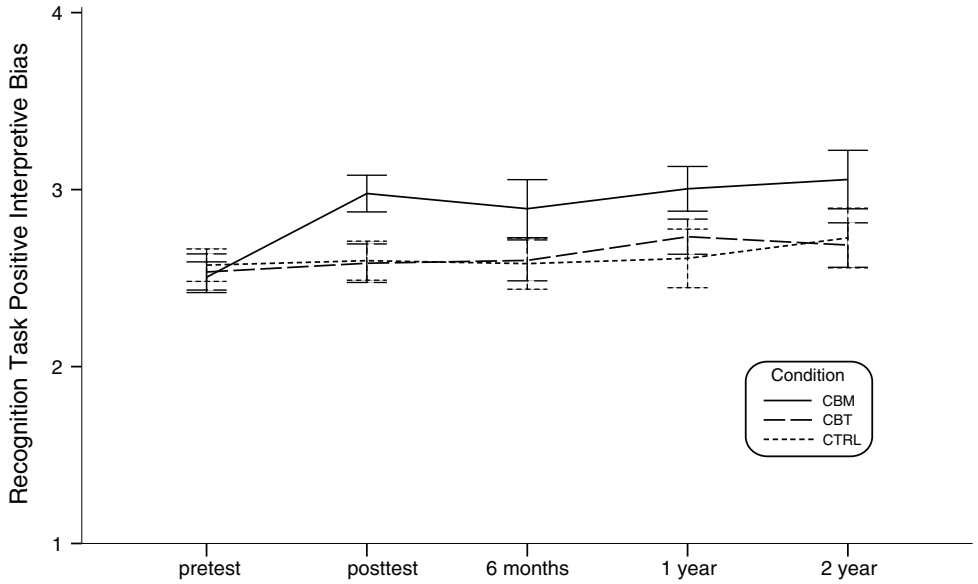

Figure 7.8. Change in positive interpretive bias, measured by the recognition task

this effect seldomly generalizes to other measures of interpretive bias (Salemink & van den Hout, 2010b; Salemink, van den Hout, & Kindt, 2010). In the next section, we will explore whether this was also the case in our study.

AIBQ interpretive bias in social situations

For **negative social interpretive bias** (see figure 7.9) as measured by the AIBQ, the unconditional means model showed that 48.3% of variance was within subjects and 51.7% of variance was between subjects. In the training period (pretest-posttest), interpretations became less negative in the CBM condition compared to the control group (coefficient = -0.33, SE = 0.14, p = .008). In the long term, negative interpretive bias did not change significantly over time or in the active conditions compared to the control group.

For **positive interpretive bias** (see figure 7.10) as measured by the AIBQ, the unconditional means model showed that 55.4% of variance was within subjects and 44.6% of variance was between subjects. In the training period (pretest-posttest), interpretations became more positive in general (time effect coefficient = 0.33, SE = 0.10, p = .001) but there was no effect of condition. In the long term, positive interpretive bias did not change significantly over time or in the active conditions compared to the control group.

In summary, interpretative bias as measured by the AIBQ changed in the short term; negative interpretive bias decreased in the CBM condition relative to the control condition and all groups developed a more positive interpretation style. In the long term, interpretive bias did not change over time and there were no differences between conditions. The changes as measured by the AIBQ were less pronounced than the recognition task results, but they were in line with our expectations and with the results of the recognition task. CBM may be more effective in changing the aspect of interpretive bias that is measured in the recognition task, namely biased interpretations in memory, compared to the biased judgments of ambiguous social situations that is measured in the AIBQ (see chapter 3 for a discussion of the differences between these two instruments). Also, earlier studies in interpretive bias modification failed to find effects on questionnaires measuring interpretive bias (Salemink & van den Hout, 2010b; Salemink et al., 2010). In chapter 8, the general discussion section of this thesis, we will further discuss the implications of the results presented in this chapter.

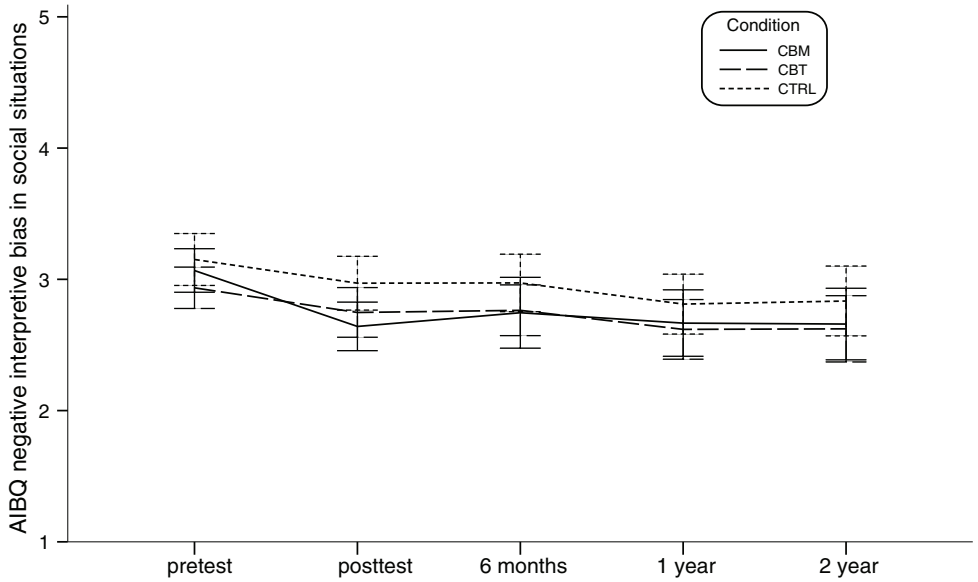

Figure 7.9. Change in negative interpretive bias, measured by the AIBQ.

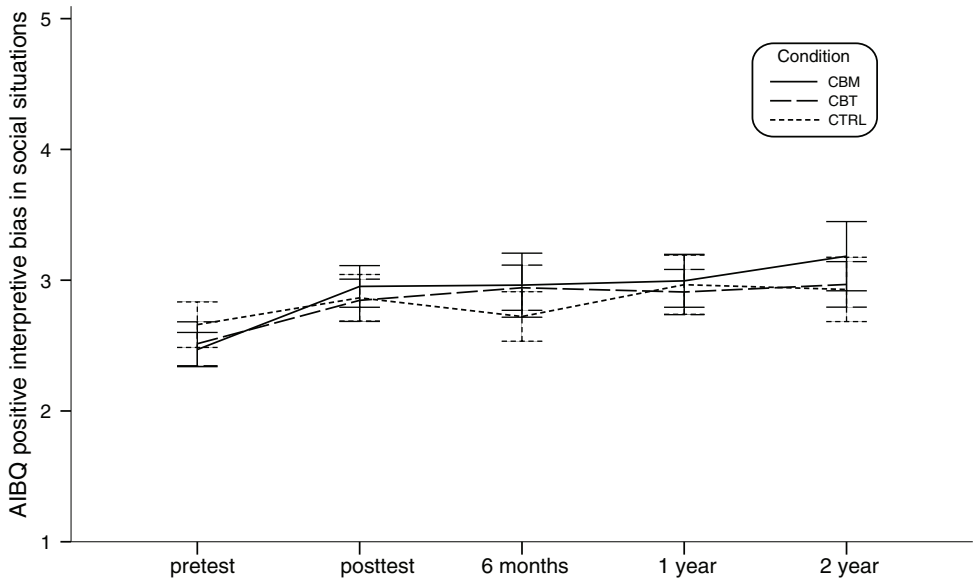

Figure 7.10. Change in positive interpretive bias, measured by the AIBQ.

Chapter 8

General Discussion

It is a well-established research finding that socially anxious adults are characterized by biased information processing. The way socially anxious people view the world confirms their fears and plays an important role in the maintenance of social anxiety. Recent studies have shown that induction of specific information processing biases increases anxiety vulnerability and reduction of biases in adults with a clinical level of social anxiety results in a significant reduction of social anxiety. Since social anxiety usually develops during adolescence, it would be important to investigate whether adolescents with an elevated level of social anxiety symptoms already show biased information processing. Furthermore, since the reduction of information processing biases or induction of positive biases could limit the development of social anxiety, the possibilities of cognitive bias modification in prevention of adolescent social anxiety should be investigated. The studies reported in the first part of this thesis tested whether adolescents with a high level of social anxiety display social-threat-confirming information processing biases. Insight in relevant processing biases might help to explain why they might eventually develop social anxiety disorder, and would provide clues for the proper targets in preventive interventions. More specifically, in part I we tested whether high socially anxious adolescents show (i) a relatively strong tendency to associate social information with negative outcomes (Chapter 2), (ii) a relatively strong tendency to point their initial attention to signs of social rejection (Chapter 3), and finally, (iii) whether they show a relatively strong tendency to interpret ambiguous social information in a more negative or less positive way (Chapter 4).

The second part of this thesis describes a study that was designed to test the efficacy of a Cognitive Bias Modification (CBM) procedure that aimed to change cognitive biases in high socially anxious adolescents into a more benign direction. More specifically we used a cluster randomized design, and compared adolescents who received a multifaceted CBM to adolescents who received a cognitive behavioral group training (CBT) or no-treatment at all (control group; CTRL). Accordingly, we tested whether multifaceted CBM (i) attenuated symptoms of social and test anxiety directly after the training period, 6 months after the training period, and after 1 year (Chapter 5), (ii) reduced symptoms of social anxiety, test anxiety and related symptomatology in the long term, 2 years after the training period (Chapter 6), and finally, we investigated whether (iii) was successful in modifying the targeted information processing biases in socially anxious adolescents both in the short and the long term (Chapter 7).

In this final chapter, the results of the empirical chapters will be summarized and subsequently discussed with regard to their theoretical and clinical implications. Next to that, I will elaborate on limitations of the current studies and present suggestions for future research. In the introduction of this thesis, I used the multi-process model of cognitive vulnerability to anxiety (Ouimet, Gawronski, & Dozois, 2009) as a framework to understand the role of information processing biases in anxiety. It is important to note that this model is not tested in this thesis; we did not investigate the specific relationship between different stages of information processing. Yet, we used this model as a heuristic framework and to place our empirical findings in a single theoretical model.

Summary and integration of findings in part I: information processing in high socially anxious adolescents

Adolescents at risk for social anxiety

To test whether dysfunctional information processing is already evident in adolescents who are vulnerable for developing social anxiety disorder, we screened a large sample of adolescents at 25 secondary schools in the Northern part of the Netherlands and selected those who reported a relatively high level of symptoms of social anxiety and/or test anxiety. Those selected were interviewed using a structured clinical interview (Anxiety Disorders Interview Schedule for Children ADIS-C; Silverman & Albano, 1996) and we subsequently selected adolescents who showed symptoms of social anxiety (i.e., afraid to speak in class or talk to strangers), but indicated only moderate or mild interference of social anxiety with their daily life. This group was assessed again, and based on self-report measures of social anxiety we finally selected 179 adolescents (age 12-15 years; 71.5% girls) who were considered at-risk for developing social anxiety disorder based on their

relatively high level of symptoms of social anxiety. During the assessment immediately before the start of the intervention, we also included measures of information processing.

Adolescents with a low level of social anxiety

To compare this high socially anxious group to adolescents who were not socially anxious, we selected three other schools and assessed adolescents using self-report questionnaires of social anxiety and performance measures of information processing. We then selected those adolescents who showed few or no symptoms of social anxiety, scoring below the 25th percentile cutoff on the social anxiety questionnaire. This low socially anxious group ultimately consisted of 205 adolescents (age 12-16; 47.3% girls).

Automatic threat-related associations

Automatic threat-related associations are considered to be at the basis of dysfunctional information processing in anxiety. It has been proposed that through threat-related associations, ambiguous social situations elicit feelings of fear and anxiety. This state of fear, in turn, enhances the occurrence of cognitive biases and further strengthens the associations between the threatening situation and anxious feelings in memory (Huijding, Wiers, & Field, 2010). Recent dual process models (e.g., Ouimet et al., 2009), emphasize the importance to differentiate between initial automatic associations elicited by a threatening stimulus and explicit associations, formed afterwards in the deliberate, rule-based memory system. Automatic associations and explicit associations may diverge, when the initial automatic associations are being discarded as irrelevant or untrue. The more deliberate, reflective explicit associations are assumed to guide the more controllable behaviors, whereas the initial, reflexive automatic associations are more important for driving more spontaneous feelings and behaviors (Back, Schmukle, & Egloff, 2009).

In **chapter 2**, we tested whether (enhanced) threat-related automatic associations were indeed evident in the high socially anxious adolescents who were included in the intervention study. We used a single-target implicit association test (stIAT) to measure threat-related automatic associations to social cues (e.g., *exam – failure*). Results showed that indeed in high socially anxious adolescents, social cues automatically elicited relatively strong threat-related associations. High socially anxious adolescents were faster in associating cues related to social anxiety (e.g., *presentation, conversation*) with indicators of a negative outcome (e.g., *failure, awkward*) relative to a positive outcome (e.g., *success, compliment*). The finding that this type of social threat-confirming automatic associations are already evident in the age range during which social anxiety disorder typically starts, is in line with the view that automatic associations may contribute to the development and maintenance of social anxiety rather than being merely the result of prolonged suffering from social fears. In support of dual-process models (e.g., Gawronski & Bodenhausen, 2006; Ouimet et al., 2009), we found that the implicit and explicit indices of associations (stIAT vs. a two-item questionnaire) were largely unrelated, but independently associated with social anxiety. This lends support to the idea that it is important to differentiate between automatic and explicit measures in the context of anxiety, and that both might be independently involved in the development and maintenance of social anxiety.

It should be acknowledged that the cross sectional design of this study does not allow any firm conclusion regarding the direction of the present relationship between social anxiety and enhanced negative associations between social events and negative outcomes. On the basis of the present findings it cannot be ruled out that enhanced threat-related automatic associations in adolescence are a component or consequence of social anxiety symptoms rather than a causal agent. The prognostic value of automatic associations for the onset of social anxiety disorders should be tested in a longitudinal design (e.g., Engelhard, van den Hout, Weerts, Hox, & van Doornen, 2009; Glashouwer, de Jong, & Penninx, 2011). To test the alleged causal influence of automatic associations in the maintenance of social anxiety, it is important to examine whether experimental reduction of these threat-related automatic associations results in a reduction of socially anxious concerns (cf., Clerkin & Teachman, 2010). The second part of this thesis describes a study in which we aimed to experimentally reduce negative automatic associations as a part of a multifaceted cognitive bias modification

training (CBM). We found that automatic threat-related associations changed in the long term as a result of CBM or CBT training, while children in the CBM condition indeed showed more positive associations to social-threat words. However, symptoms of social anxiety decreased equally in CBM and CBM and control condition, while automatic threat-related associations diverged. Modification of automatic threat-related associations may be one pathway to change anxiety, but a decrease in anxiety does not necessary co-occur with an increase in positive automatic associations. More details of this study will be discussed in part II of this chapter.

In interpreting results of the stIAT, we have to take into account that this is not an absolute index of automatic associations. The stIAT effects rather reflect the relative speed in which categorizations are made in the first block compared to the second block. Socially anxious adolescents were faster in categorizing social- or school related stimuli when this category shared the response button with negative outcome words. However, since the category combinations of the stIAT was fixed for all participants and during all assessments, we cannot conclude that socially anxious adolescents show negative associations in an absolute manner, only that they showed more negative/less positive associations than their low-anxious peers.

In addition, it is important to note that the stIAT is only one of several instruments that are often used to index automatic associations (for a critical overview, see De Houwer, Wiers, & Stacey, 2006) and the (st)IAT is not without its critics (e.g., Fiedler, Messner, & Bluemke, 2006). Perhaps most importantly, it has been shown that non-associative processes may influence the IAT effects (Rothermund & Wentura, 2004). For example, to high socially anxious adolescents target words indicating a negative outcome (e.g., *failure*) and social- or school category words (e.g., *test*) may be more salient because both are a daily concern. Since salient stimuli are more easily connected than non-salient stimuli, the stIAT effect could be partly due to salience effects and not to strong automatic associations between threat and outcome. Moreover, both groups differed in the context in which they completed the computer tasks. High socially anxious adolescents knew that they were enrolled in a study about social and test anxiety, and were tested in small groups with only selected participants. Low socially anxious adolescents knew they participated in a single study session about adolescent mental health and were tested in non-selected groups. This method may have created a context in which social anxiety was activated more strongly for the high social anxiety group. Replication of the current effect in other samples without this method of selection is therefore important. Also, conceptual replication of the present findings using other tasks, such as the go/no-go association task (Nosek & Banaji, 2001) or Affective Simon Task (De Houwer & Eelen, 1998) remains important.

Attentional bias to threat

According to the multi-process model of cognitive vulnerability to anxiety by Ouimet et al. (2009), following the onset of orientation responses, threat-related associations in the associative system will enhance attentional engagement with the stimulus. This engagement in turn increases the activation of threat-related associations, implying a positive feedback loop with rather dysfunctional consequences. For example, the capture of attention distracts from the task at hand or anxiety increases while that is unwarranted in the current context. This attentional engagement is reflected in the initial attentional bias for threatening information that is usually found in the context of anxiety (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenburg, & van IJzendoorn, 2007; Cisler & Koster, 2010; Staugaard, 2010). Anxious people tend to direct their initial attention towards threatening information in the environment.

As a first step in determining the role of attentional bias in adolescent social anxiety, it would be important to test whether high socially anxious adolescents are characterized by enhanced initial attentional bias to socially threatening information. In **chapter 3**, we tested whether adolescents with a high level of social anxiety differed from their low-anxious peers with respect to their attentional bias to threatening faces and words. We used both a pictorial and verbal version of a visual probe task, in which two stimuli (e.g., a rejecting face and a neutral face) were presented simultaneously. Previous research in adults showed that attentional biases are most consistently found within the time frame of 350-500 ms (Cisler & Koster, 2010),

capturing the phase of initial attention to threat. In line with this, we used a 500 ms presentation time. When the stimuli disappeared from the screen, a small arrow (probe) was presented on the former location of the positive, neutral or negative stimulus. The instruction for the participants was to focus on the fixation cross in the center of the screen and indicate as fast as possible whether the arrow appearing was directed upwards or downwards, by pressing the appropriate key on the response box. We expected socially anxious adolescents to show a stronger attentional bias compared to low socially anxious adolescents, but found that they showed an equal attentional bias to threat; both groups displayed enhanced attention to threatening faces and words compared to neutral faces and words. This attentional bias to disapproving information thus appears to be a general characteristic of early adolescents, and seems to be unrelated to social anxiety. There was no evidence of an attentional bias towards or away from positive stimuli.

Although there was no cross-sectional association between social anxiety and attentional bias, prospective and longitudinal studies are needed to test whether attentional biases might nevertheless have predictive value for future levels of social anxiety. People with a high level of attentional bias might experience a more threatening environment than people without this attentional bias. Cumulatively, these threatening experiences may well increase state anxiety in such environments and give rise to subsequent avoidance behavior, in people who already show symptoms of anxiety and react differently to threatening environments than people without anxiety. While low socially anxious adolescents deal with social evaluative threat by appraising it as irrelevant or not dangerous, adolescents with an elevated level of anxiety are likely to interpret these signs of threat in a negative way. Thus, a currently high level of attentional bias may not be associated with current anxiety level in adolescents, but may nevertheless increase the chances of developing anxiety in interaction with other information processing factors (cf., Hirsch, Clark, & Mathews, 2006).

Since we found that adolescents on average did attend to threat relative to neutral stimuli, while in adult samples, attention to threat is only found in anxious people and not in low-anxious controls, there must be a mechanism that explains the persistence of attentional bias in high socially anxious people. One obvious candidate is the more general ability to control ones attention. Attentional control is a factor that is correlated with anxiety in childhood (Muris, de Jong, & Engelen, 2004; Muris & Ollendick, 2005; Muris, Meesters, & Rompelberg, 2007). Furthermore, anxious people who show less ability to switch and control their attentional focus also showed a greater cognitive interference by emotional faces (Reinholdt-Dunne, Mogg, & Bradley, 2009). Perhaps, then, attentional control moderates the relationship between attentional bias and anxiety symptoms, such that attentional bias persists in those who are not able to control their attention. There is some evidence for such a moderating relationship of attentional control on attentional bias in anxiety (Derryberry & Reed, 2002; Helzer, Connor-Smith, & Reed, 2009; Lonigan & Vasey, 2009). Upon encountering social threat, those with impaired attentional control will not be able to switch their attention away from threat (i.e. impaired attentional disengagement) and thus attention to the threatening stimulus will fuel activation of threat-related associations (see Ouimet et al, 2009), which increases state anxiety. The relationship between impaired attentional control and attentional bias could be tested in cross-sectional studies. We tested whether attentional control moderated the relationship between attentional bias and symptoms of social anxiety in early adolescents. Contrary to our expectations, we found that the interaction of habitual attentional control and attentional bias to threat was not related to symptoms of social anxiety. However, we measured attentional control with a self-report questionnaire that may be insensitive to the subtle differences that could exist at the level of information processing. A reaction-time based task to assess attentional control skills would be more suitable (e.g., the Attentional Network Task; Fan, McCandliss, Sommer, Raz, & Posner, 2002).

The absence of a relationship between social anxiety and attentional bias in high socially anxious adolescents in the current study does not rule out that modification of attentional biases can have beneficial effects on anxiety symptoms, as has been shown in other studies (see Hakamata et al., 2010; Hallion & Ruscio, 2011). It has been shown that modification of attentional bias procedures was able to reduce social anxiety symptoms particularly in adults with a high level of attentional bias (Amir, Taylor, & Donohue, 2011). Our finding that attentional bias to threat was evident in both high and low socially anxious adolescents implicates that

reducing attentional bias through CBM in an early stage could possibly limit detrimental effects of attentional bias on anxiety in the future. Another mechanism through which attention modification training paradigms could influence anxiety symptoms is through affecting a moderating variable such as attentional control. Currently, changes in attentional control are not usually studied in CBM studies but future CBM studies should consider adding sound measures (e.g., reaction time-based tasks) of attentional control. Another way to test the moderating effects of attentional control could be through experimental modification of attentional control (cf., Houben, Wiers, & Jansen, 2011; Klingberg et al., 2005).

During the present visual probe task threat stimuli were always presented for 500 ms in a visual probe task without neutral-neutral trials. Therefore our scope of attentional bias was limited to a pattern of vigilance to threat, without looking at attentional avoidance or attentional disengagement. As suggested by Ouimet's model (2009), these different components of attention are all involved in the maintenance of anxiety and future studies should test whether high socially anxious adolescents are differentially characterized by enhanced avoidance or impaired disengagement in the attention to threatening stimuli. In adult samples, however, a relationship between attentional bias to threat and anxiety has been most consistently found when stimuli were presented for 500 ms (Cisler & Koster, 2010). Also in children and adolescents, presentation times of 500 ms have rendered the most consistent results (Garner, 2010). As noted by Van Damme and Crombez (2009), the use of visual probe tasks to measure attentional bias in children could be problematic because of generally longer reaction times and a large variability of response times. The low reliability of visual probe tasks in general (Staugaard, 2009) might (partly) explain the relatively low correlations between indices of attentional bias and will make it more difficult to detect significant relationships between attentional bias and social anxiety. Although the visual probe task has its limitations (Schultz & Heimberg, 2008; Staugaard, 2010), it is still the most effective and most widely used paradigm for exploring information processing biases in childhood anxiety (Dalgleish et al., 2003). Although a low reliability might decrease the power of the visual probe task used in our study to find subtle differences between high and low socially anxious adolescents, our finding that adolescents in general reacted faster to probes appearing behind threat compared to neutral stimuli indicates that our task was at least sufficiently sensitive to detect global patterns of attentional bias.

One of the main differences between our study and other studies into attention to threat in (socially) anxious adolescents, is our use of stimuli expressing contempt, rather than anger. Our use of rejection-relevant stimuli was motivated by the notion that it is important to match stimuli to the content of emotional concern in social anxiety (Mathews, May, Mogg, & Eysenck, 1990) and a negative evaluation is more likely to be expressed with contempt rather than anger. There is ample evidence that stimuli used in attentional bias paradigms could be matched to specific disorders in children (Beck et al., 2011; e.g., In-Albon, Kossowsky, & Schneider, 2010), which suggests that stimuli referring to social rejection as we did in the current study is the proper choice for testing attentional bias in the context of social anxiety. Concluding, we investigated whether high socially anxious adolescents showed an initial attentional bias to threat, using an extensive design with large groups, a pictorial and verbal version of the visual probe task and stimuli matched to the emotional concerns of socially anxious adolescents and a conventional stimulus presentation time. As yet, we found no evidence that enhanced initial attentional bias to rejecting information is crucial in adolescent social anxiety. Future studies however, should examine more in depth whether attentional control moderates the relationship between attentional bias and social anxiety (i.e. by using behavioral measures of attentional control and a prospective design) or whether high socially anxious adolescents show difficulties in other aspects of attention to threat, such as a difficulty to disengage attention.

Interpretive bias

Interpretive bias is the tendency to interpret ambiguous situations in a relatively negative way. In the context of social anxiety, this situation is usually a social situation in which it is unclear whether the situation is threatening or safe. Since most social situations contain an element of ambiguity (e.g., in most cases it is impossible to know for certain what other people think of you), interpretive bias is viewed as an important

aspect of information processing in social anxiety. Interpretive bias could also be a vulnerability factor for social anxiety (e.g., in the model described by Ouimet et al, 2009). If interpretive bias is indeed involved in the development of social anxiety, it is expected to exist already in adolescents with symptoms of social anxiety.

In **chapter 4**, we explored whether indeed high socially anxious adolescents show a stronger tendency to interpret ambiguous social information in a negative or less positive way compared to adolescents with few or no symptoms of social anxiety, using two instruments to assess interpretive bias. In the Recognition Task (Mathews & Mackintosh, 2000), participants are asked to rate the similarity of positively or negatively biased interpretations to ambiguous vignette stories that they read earlier. In the Adolescents' Interpretation and Belief Questionnaire (AIBQ), participants rated the likelihood that a (biased) interpretation would pop up in their mind after reading an ambiguous scenario. We used two separate measures of interpretive bias since the Recognition Task is in many ways similar to the interpretive bias modification procedure we were planning to use, in that it uses ambiguous scenarios and word-fragments. Secondary, we adapted the scenarios used in the task to fit the social situation of adolescents, and therefore did not have a comparison to the task in the literature. The AIBQ is used in other studies as well (e.g., Miers, Blöte, Bögels, & Westenberg, 2008) and could also serve as a measure of generalization of induced interpretive bias to other measures. It should be acknowledged, however, that both instruments may be influenced by both more automatic and more deliberate processes. As such these measures may not provide an accurate reflection of the more instantaneous on-line interpretations of people when being confronted with an ambiguous situation. Clearly then it would be interesting for future research to test whether perhaps the more automatic interpretations may be differentially involved in social anxiety. One way to more directly assess people's on-line interpretations would be to measure their reaction time when solving word fragments to positive, negative, and neutral word fragments after reading ambiguous scenarios (e.g., Mathews & Mackintosh, 2000).

In the context of social anxiety, there is both evidence for a strong negative interpretive bias (Amir, Foa, & Coles, 1998; Amir, Beard, & Bower, 2005; Beard & Amir, 2009; Brendle & Wenzel, 2004; Huppert, Foa, Furr, Filip, & Mathews, 2003; Kanai, Sasagawa, Chen, Shimada, & Sakano, 2010; MacLeod & Cohen, 1993; Voncken, Bögels, & Peeters, 2007) and a lack of positive interpretations (Beard & Amir, 2009; Constans, Penn, Ihen, & Hope, 1999; Hirsch & Mathews, 2000; Hirsch et al., 2006). For socially anxious children and adolescents specifically, there is less evidence but the pattern is similar (Bögels & Zigterman, 2000; Cannon & Weems, 2010; Miers et al., 2008; Muris, Merckelbach, & Damsma, 2000; Rheingold, Herbert, & Franklin, 2003; Vassilopoulos & Banerjee, 2008). In line with this, the AIBQ results showed that high socially anxious adolescents interpreted ambiguous social situations both more negatively and less positively than low socially anxious adolescents. We found a similar pattern using the Recognition Task, although the difference with regard to negative interpretations did not reach significance. These results support the view that high socially anxious adolescents are characterized by biased interpretations of socially ambiguous situations. They tend to interpret these situations as being more negative (AIBQ) and less positive (AIBQ, Recognition Task).

Theoretical implications of chapter 2, 3, and 4

Integrating the findings from chapter 2, 3, and 4 (see table 8.1), we can conclude that adolescents with a high level of social anxiety are characterized by relatively strong automatic threat-related associations, and relatively negative and less positive interpretations of ambiguous social situations. Contrary to our predictions, enhanced vigilance for social threat was not characteristic of high socially anxious adolescents but early adolescents in general tended to point their initial attention towards socially disapproving information. In the context of the multi-process model of cognitive vulnerability to anxiety by Ouimet et al. (2009), these findings are consistent with the hypothesized role of dysfunctional information processing in the development and maintenance of social anxiety in adolescents who are at risk for developing social anxiety disorder. When presented with a socially relevant stimulus, these adolescents are likely to associate this stimulus with threatening outcomes (e.g., *test – failure*) in the associative system, and interpret this information as threatening (*I will fail on this test, it is too difficult*) in the rule-based system. Although attention to threat

Table 8.1. *Overview of the most relevant findings in part I of this thesis*

Cognitive process	*Differences between high and low socially anxious adolescents*
Chapter 2 Automatic threat-related associations	Social cues automatically elicited relatively strong threat-related associations in high socially anxious adolescents Automatic and explicit associations were independently associated with self-reported social anxiety
Chapter 3 Attentional bias to threatening faces and words	Both high and low socially anxious adolescents showed initial attentional bias to threatening faces and words, no difference between groups. No effect of (self-reported) attentional control on relationship attentional bias – social anxiety No relation between attentional bias and (self-reported) symptoms of social anxiety
Chapter 4 Interpretive bias for ambiguous social situations	High socially anxious adolescents interpreted ambiguous social situations in a more negative and less positive way than low socially anxious adolescents Most pronounced in AIBQ: high socially anxious adolescents showed a more negative and less positive interpretive bias. Recognition task: high socially anxious adolescents showed a less positive interpretive bias and tended to show a stronger negative interpretive bias.

was not found to be characteristic of socially anxious adolescents, we found that a general attentional bias to threatening information exists in early adolescents. This does fit the model in that once the associative system and rule-based system are activated, attentional engagement will occur, leading to impaired disengagement and the behavioral decision to avoid the threatening stimulus, leading to facilitated disengagement. The response conflict that will occur as a result of the opposite effects of the associative and rule-based system is a central factor in social anxiety, where the initial attention is captured by the threatening stimulus (*concentrate on this difficult test*) while the behavioral decision is to avoid concentrating on the test (*this test is too difficult*) and disengagement is simultaneously facilitated and impaired. One important conclusion from our findings however, is that attentional bias to threat does not seem to be specific for social anxiety and thus does not seem to be impaired or dysfunctional in socially anxious adolescents. The part of the model by Ouimet et al. that describes attention in the context of anxiety seems to be a 'normal' information processing mechanism, which does play a role in the processing of anxiety-relevant information but does not independently add to the maintenance or development of anxiety. The difference between high and low socially anxious adolescents is the way that ambiguous information related to social threat (e.g., *exam*, *conversation*) automatically triggers associations with negative outcomes in socially anxious adolescents, who are also more likely to interpret this information on a more explicit level as threatening. As mentioned before, we did not explicitly test the Ouimet model, but use it as a framework to link the studied processes together. A next step in improving our understanding of the role of information processing biases in vulnerability for social anxiety, would be to test the functional relationships between information processing biases. As a first step in this process, we already cross-sectionally investigated the role of these biases in socially anxious vs. low socially anxious adolescents. As a next step, we could study the relationship between information processing biases in the high socially anxious sample specifically. For example, the model predicts that interpretive biases are enhanced specifically

in adolescents with strong threat-related automatic associations. In an ideal situation, these biases would be measured on-line, such that after the appearance of a single stimulus, automatic associations, interpretations and attention would be measured simultaneously. It would however be technically very difficult to set up such a design.

Another approach would be to experimentally increase one component of the model, and measure subsequent changes in other components, i.e. strengthen automatic associations and measure effects in interpretations and anxious behavior. Such an approach has not been used very often yet; most CBM studies focus on a single component in information processing. However, Amir, Bomyea, and Beard (2010) increased benign interpretive bias in high socially anxious participants and found that this procedure also increased attentional disengagement from social threat cues. According to the authors, the interpretation modification procedure provided practice for the participants to inhibit negative social information and inferences, while accessing more benign information. This may have led to a greater ease in switching attention away from negative information, which became evident in the Posner task that measured attentional disengagement. In the second section of this chapter, further aspects of cognitive bias modification will be discussed.

Implications for treatment

According to the multi-process model of cognitive vulnerability to anxiety, one way out of this fear-enhancing cycle is to reappraise a given stimulus as a sign of something other than threat. This will deactivate threat-related associations through the validation process and when simultaneously a behavioral response is executed to disengage attention, the feared stimulus will not be regarded as threatening anymore and anxiety will decrease. Reappraisal of information that is regarded as threatening is an important component of cognitive restructuring in cognitive therapy, where patients learn to think of non-threatening or positive alternative meanings of situations that appear to be dangerous. In addition, patients can be involved in behavioral experiments testing their feared expectations, which can help them to find meaning to threatening situations. Another possible way to limit or prevent anxiety is through reducing threat-related associations in the associative system. Although there is not much research yet on how this type of automatic associations can be changed, there is some evidence that repeated exposure to the threatening situation in the absence of feared negative outcomes strengthens positive associations (Teachman & Woody, 2003). As such, these findings provide support for the application of core components (cognitive restructuring and exposure) in Cognitive Behavioral Therapy (CBT) in the context of early symptoms of social anxiety.

Another recent development in psychotherapy research is the application of procedures that directly modify cognitive biases in order to decrease anxiety symptoms. These Cognitive Bias Modification (CBM) procedures aim to decrease anxiety through repetitive tasks that guide participants to point their attention away from threat and towards positive information and interpret ambiguous information in a less negative and more positive way. CBM-induced positive biases may also serve as a 'cognitive vaccine' (Holmes, Lang, & Shah, 2009) and thus promote resilience in vulnerable individuals. In the same way, these kinds of procedures could probably be used to strengthen automatic associations between threatening stimuli and positive outcomes and decrease the strength of negative associations. The results presented in chapters 2, 3, and 4 provide partial support for the application of CBM in adolescents with early symptoms of social anxiety. Negative threat-related associations and interpretive bias were identified as characteristics of high socially anxious adolescents and thus seem to be a proper target for CBM. If these processes could be trained in such a way that they are more similar to low-anxious adolescents, this could decrease early symptoms of social anxiety and probably prevent the development of a full-blown social anxiety disorder. For attentional bias however, the implications are less clear. Although thus far the focus of most CBM studies is on the modification of attentional bias, we found no evidence that enhanced attention to threat is a dysfunctional process in adolescents. Adolescents in general were characterized by enhanced attention to socially threatening information. Nevertheless, some CBM studies in adults (e.g., Amir et al., 2009; Schmidt, Richey, Buckner, & Timpano, 2009) have found that modification of attentional bias can have impressive effects on anxiety symptoms.

Part II. CBM in the prevention of adolescent social anxiety

Based on promising results of earlier Cognitive Bias Modification studies, we developed a CBM training to decrease and prevent symptoms of social anxiety in adolescents with a high risk for developing social anxiety disorder. Based on the idea that information processing biases may mutually influence each other (Hirsch et al., 2006), we constructed a multifaceted CBM training, which consisted of tasks targeting automatic associations, attentional bias, interpretive bias, and implicit self-esteem. The training consisted of 20 sessions that could be completed over the internet (at home). We selected a large group of adolescents with symptoms of social anxiety and/or test anxiety (n = 240; age 12-15) at a series of representative secondary schools in the Northern part of the Netherlands and randomly allocated schools into three conditions. In order to test the preventive effect of the CBM intervention, we compared this CBM to both a no-treatment control group (CTRL) and a Cognitive Behavioral (CBT) group treatment that took place at school, after school hours, in ten weekly sessions. **Chapter 5** described the study design in detail and focused on the relative efficacy of CBM in reducing symptoms of social anxiety immediately after treatment and at one year follow-up. In **chapter 6**, we addressed the longer term efficacy (two year after the training period). We also compared the number of DSM-IV diagnoses of social anxiety disorder between the three groups two year after the intervention period as the ultimate test of a preventive effect. Table 8.2 provides an overview of the main results presented in chapters 5 and 6, which will be discussed below.

Summarizing the results of the effect of multifaceted CBM in the prevention of adolescent social and test anxiety, we can conclude the following: (i) In the short run (6 months follow-up) participants in the CBM condition showed a (nonsignificant) trend towards a stronger reduction in social anxiety symptoms than participants in the control condition; CBT showed a similar differential effect, whereas the strength of the reduction in symptoms of social anxiety did not differ between CBT and CBM. (ii) In the long run (one and two year follow-up) the control condition showed a similar reduction in social anxiety symptoms as both CBM and CBT conditions. (iii) In the short term (posttest, 6 months FU), test anxiety showed a larger decrease in CBT than in both CBM and the control condition but in the long term (one and two year follow-up) the decrease in test anxiety was similar for CBT and CBM and significantly larger than the decrease of test anxiety in the no-treatment control group. (iv) Automatic associations between social cues and negative or positive outcomes became more positive in the CBM condition relative to the control condition and CBT in the short term and this effect was stable over time. From post-test to two year follow-up the CBM group showed a stronger decrease of negative automatic associations compared to both the CBT and the no-intervention control condition. (v) No difference was found between conditions with regard to DSM IV diagnosis of social anxiety disorder at two year follow-up; the number of diagnoses was quite small in all groups. Similarly, at two year follow-up there was no difference between conditions in parent-reported symptoms of social anxiety.

In **chapter 7**, we described changes in the targeted cognitive processes as a function of condition (CBM, CBT or CTRL). An overview of the results is presented in table 8.3.

Table 8.2. *Overview of significant change in outcome variables through CBT or CBM at different time intervals*

Time segment	*Change in symptoms over time*	*Differential change in symptoms across conditions*
Pretest to posttest	Self reported social anxiety symptoms decreased over time Test anxiety decreased over time	Decrease in test anxiety greater in CBT than in CTRL Automatic associations became more positive in CBM compared to CBT Automatic associations became more negative in CBT compared to CTRL More diagnoses of DSM –IV Social Anxiety Disorder in CBM condition compared to CBT and CTRL
Posttest to 6 months FU	Self reported social anxiety symptoms decreased over time	Decrease in social anxiety symptoms greater in CBT than in CTRL Decrease in test anxiety greater in CBT than in CTRL
6 months FU to 1 year FU	Self reported social anxiety symptoms decreased over time Test anxiety decreased over time Fear of negative evaluation decreased over time	Automatic associations became more positive in CBM compared to CBT and CTRL
Pretest to 1 year FU		Decrease in test anxiety greater in CBT than in CTRL Decrease in fear of negative evaluation in CBT greater compared to CBM Automatic associations became more positive in CBM compared to CBT
1 year FU to 2 year FU	Test anxiety decreased over time	Decrease in test anxiety greater in CBT compared to CTRL Decrease in test anxiety greater in CBM compared to CTRL Automatic associations became more positive in CBM compared to CBT
Pretest to 2 year FU	Self reported social anxiety symptoms decreased over time Internalizing symptoms decreased over time Depression symptoms decreased over time Generalized anxiety symptoms decrease over time	Decrease in test anxiety greater in CBT compared to CTRL Decrease in test anxiety greater in CBM compared to CTRL Automatic associations became more positive in CBM compared to CTRL and CBT Decrease in generalized anxiety symptoms greater in CBT compared to CBM No difference in DSM-IV Social Anxiety Disorder diagnoses between conditions Parent-perspective social anxiety symptoms showed no difference between conditions at 2 year FU

Table 8.3. *Overview of changes in cognitive processes through CBT or CBM at different time intervals*

Time segment	*Automatic Threat-related associations*	*Attentional bias*	*Interpretive bias*
Short term effect: Pretest to posttest	Automatic threat-related associations became more negative in CBT compared to CTRL and CBM	Attentional bias to friendly faces increased in CBM compared to CTRL	Recognition task negative interpretive bias decreased in CBM compared to CTRL and CBT Recognition task positive interpretive bias increased in CBM compared to CTRL and CBT AIBQ negative interpretive bias decreased in CBM compared to CTRL
Long term effect: Pretest to 2 year FU	Automatic threat-related associations became more positive in CBM compared to CTRL and CBT		Recognition task negative interpretive bias decreased in CBM compared to CTRL and CBT

To summarize, automatic threat-related associations became more negative in CBT compared to CBM and CTRL in the short term; in the long term automatic associations in the CBM condition also differed from CTRL and became more positive compared to both the CBT and control condition. Few effects were found for attentional bias to threatening faces or words; the variance of these measures was quite large and the stability within participants over time was extremely low. Only in the short term, we found a significant increase in attention to friendly faces in the CBM condition compared to the control group, but since we confirmed only one out of several hypothesized changes, we should take care in interpreting this finding. Interpretive bias as measured using the recognition task changed considerably in the short term and this change was stable in the long term: as hypothesized, negative interpretive bias decreased and positive interpretive bias increased in CBM compared to CBT and CTRL. In the short term, this change also generalized to the AIBQ interpretive bias questionnaire, which showed a significant decrease in negative interpretations for CBM compared to the control condition.

Theoretical and clinical implications of chapter 5, 6 and 7

Our finding that both threat-related associations and interpretive bias changed as a result of the multifaceted CBM procedure but attentional bias to threat did not systematically change, corroborates our findings in part I that attentional bias to threat may be involved in anxiety in a different way than both other processes.

Our study is the first to measure automatic associations in a longitudinal design in the context of a randomized controlled trial. Relative to both control and CBT condition, automatic threat-related associations in the CBM group became more positive over time, while symptoms of social anxiety decreased about equally in all three groups. Since implicit measures of anxiety such as the stIAT tend to diverge from explicit measures of anxiety (i.e. self-report questionnaires) and are more closely related to behavioral measures of anxiety, future studies should include behavioral measures such as automatic fear responses (cf., Huijding & de Jong, 2006) or interviewer ratings of anxious responses (cf., Spalding & Hardin, 1999). We would expect changes in automatic associations to be more closely related to changes in behavioral measures of anxiety than to self-report measures. Looking at the content of both training conditions, we could speculate that automatic associations in the CBT condition became more negative due to the relationship between fear-provoking situations and a negative outcome that may be (implicitly) expressed in the group sessions. Participants are encouraged to share their automatic negative thoughts during the module of cognitive restructuring. Also, during exposure sessions, identifying the expected negative outcome is part of the procedure. In the CBM treatment, this negative relationship was absent in the interpretive bias tasks, and instead, the relationship between feared situations and positive outcomes was often emphasized. This finding provides an option to test possible improvements to current CBT treatments by adding components that highlight positive outcomes of feared situations, e.g., through adding CBM sessions or ingredients from positive psychology (Seligman & Csikszentmihalyi, 2000) that focus on individual strengths rather than weaknesses. It would be interesting to test whether such additions improve the efficacy of CBT treatments and also prevent the increase of negative automatic associations.

Although the CBT intervention (and as a trend, CBM as well) led to a faster decline of symptoms of social anxiety in the short term, the absence of long-term effects on symptoms of social anxiety or diagnoses of social anxiety implies that our prevention programs had no additional effect in preventing adolescent social anxiety. Social anxiety symptoms decreased significantly over time, regardless of treatment or no treatment, which left little room for improvement specifically in the active treatment conditions. Taking into account the relatively low level of anxiety symptoms at pretest compared to regular treatment studies and the decrease of power in the long term caused by a significant drop-out of participants over time, this lack of effect is not surprising in the context of prevention studies (Cuijpers, 2003).

We did, however, find a significant effect of both CBM and CBT compared to the control condition with regard to test anxiety. This specific aspect of social anxiety improved significantly in the short term in the CBT condition and in the long term for CBT as well as the CBM condition. Although the effect size is quite small,

test anxiety is a common problem in adolescence and can have long lasting impact on academic performance and career perspectives. Limiting the development or impact of test anxiety at an early stage would be worth the effort. With cost-effectiveness in mind, an internet-delivered CBM program tailored to test anxiety could be a wise investment for schools. This possible application of our CBM program would need further study, since we do not know yet which aspects of the treatment were specifically helpful in decreasing test anxiety. Also, since we selected participants in the current study on aspects of both test anxiety and social anxiety, we cannot generalize these results to test-anxious adolescents without other symptoms of social anxiety. Test-anxious adolescents often catastrophize ambiguous signs of failure (i.e., *one mistake means that I failed this test*), which indicates that cognitive bias modification targeting such interpretations would be helpful in providing alternative thoughts and decrease test anxiety.

The social environment is a large factor in the development of social anxiety in adolescence. Influences from peers, parents, schools, teachers, sports, clubs, and friendships are at work and limit the impact of a single program on social anxiety. This could have been the case in our selective prevention program, which targeted only individual participants without taking into account parents and school environment. A prevention study that included a more broad approach, also focusing on the social environment of adolescents is the NUPP-SA program by Aune and Stiles (2009), which was effective in the prevention of social anxiety in subsyndromal participants. They used a shorter CBT-based universal intervention, delivered to non-selected adolescents at school and also included teachers, parents and communities by providing information about social anxiety at a large scale. Broadening the approach by also involving parents and schools might increase the efficacy of interventions to prevent adolescent social anxiety (cf., Masia-Warner et al., 2005).

Limitations and suggestions for future studies

It should be acknowledged that the cross-sectional design of the studies presented in part I of this thesis precludes any firm conclusion regarding the direction of the relationship between social anxiety and dysfunctional information processing. Although the presence of cognitive biases in adolescents with subclinical symptoms of social anxiety is consistent with the view that these biases play a role in the development of social anxiety, on the basis of the current findings it cannot be ruled out that these processes are in fact a component or consequence of social anxiety, rather than a causal agent. Prognostic studies should further test the role of automatic associations, attentional biases and interpretive biases in the onset of social anxiety disorder (e.g., Glashouwer, de Jong, & Penninx, 2011).

In the studies described in part I of this thesis we tested whether adolescents with a high risk of developing social anxiety are characterized by biased information processing. By selecting high socially anxious adolescents without a clinical level of social anxiety symptoms, we intended to focus on adolescents at risk for developing social anxiety. In our longitudinal studies however, it became clear that symptoms of social anxiety in this sample generally declined over time; two years after the intervention period, the mean score on social anxiety symptoms had decreased significantly. Although drop-out could be a factor in this effect, this is unlikely given the finding that adolescents with a lower level of pretest social anxiety had a higher chance of dropping out, so that relatively more high scoring participants remained in the study. This raises the question whether the population studied in part I is indeed an at-risk population. Various factors co-determine a high risk for developing social anxiety disorder such as genetic, neurobiological and temperamental vulnerabilities, dysfunctional parenting and negative life events (Higa-McMillan & Ebesutani, 2011). Symptoms of social anxiety are relatively stable over time (Hayward et al., 2008), which makes a high level of symptoms of social anxiety a reasonable predictor of future social anxiety, but perhaps the selection of participants could be improved by also taking into account other risk factors such as being a victim of bullying (van Oort, Greaves-Lord, Ormel, Verhulst, & Huizink, 2011).

The longitudinal design with a follow-up assessment two years after the end of the intervention period, was a particular strength of the current prevention study. However, we were confronted with considerable drop-out over time with about half of the participants not participating in the follow-up assessments. As re-

quired by ethics guidelines, participants were explicitly told that they could quit participation in the study at any time without providing a reason. When participants did not explicitly tell us that they wanted to quit, we phoned or mailed them asking whether they wanted to continue with the study, and scheduled new appointments for assessments up to three times when participants did not show up. Some participants moved to schools that were not involved in the study and did not return the paper & pencil questionnaires that we sent them. After we noticed the high dropout rate at posttest, we started to provide participants with a €5 voucher for every assessment, which they received after they completed the assessment. Participants did appreciate this incentive but as they grew older, the value of the voucher might have decreased for them. At the start of the study, we provided extensive information about the time course of the study. However, some adolescents complained that it was not clear to them how often we would approach them for follow-up assessments. While pretest and posttest assessments were scheduled during regular school hours, most schools did not agree to schedule follow-up assessments during regular classes so participants had to wait after their last classes for the assessment. Drop-out could probably be limited if assessments took place during school hours, at free periods between classes. Another option would be to deliver part of the assessment over the internet. Although motivation to stay involved in a longitudinal study is a difficult task for adolescents, future studies might benefit by taking additional measures such as (i) scheduling assessments during school hours as much as possible or over the internet, (ii) providing clear information on what effort is expected from participants at multiple points in time, (iii) offering incentives that increase over time so that each assessment is worth more than the last one, and (iv) by keeping participants involved by sending them newsletters that include incentives such as raffles or goodies.

During treatment, drop-out was also considerable and larger in the CBM condition than in the CBT condition. Those who provided reasons to quit had various explanations, such as that they felt better already and did not see the need to continue the training or that they disliked doing the tasks in the CBM condition. We did encourage those who dropped out of treatment to stay in the study to complete the assessments. Treatment attendance could probably be improved by limiting technical difficulties in the CBM condition and offering (financial) incentives to complete CBM (or CBT) sessions. External support through e-mail or telephone to help overcome motivation difficulties remains essential to help participants complete the CBM program.

The drop-out rate in the current study decreased power to detect small differences between groups over time, but besides drop-out, the small gains in symptom reduction or differences in diagnoses per conditions represent a larger power problem in prevention studies (Cuijpers, 2003). In a single study, it is difficult to reach significant results when the incidence of a disorder is quite low, even in an at-risk population. Meta-analyses of multiple prevention studies are thus needed to assess the ultimate effect of efforts in the prevention of social anxiety disorder.

Our multifaceted approach to CBM is unique and pays respect to the notion that information processing biases may mutually influence each other in maintaining anxiety (Ouimet et al., 2009). This approach, however, makes it impossible to disentangle the influence of each component separately on changes in information processing or symptoms of social anxiety. To improve our understanding on the efficacy of each component to change information processing, it might be helpful to first test each component separately, before applying it in a multifaceted training. Most current clinical CBM studies focus on attentional bias modification, while studies into the efficacy of interpretive bias modification lag behind (Hallion & Ruscio, 2011). Future developments in the field will show whether interpretive bias modification proves equally effective. In targeting attentional bias and interpretive bias, we chose to use tasks that are commonly used in CBM research such as the visual probe paradigm and ambiguous scenario paradigm. In order to improve the attractiveness of a multifaceted CBM training, the possible addition of other tasks should be explored, such as the face-in-the-crowd paradigm (Dandeneau, Baldwin, Baccus, Sakellaropoulo, & Pruessner, 2007) to change attentional bias or tasks using homophones (Wilson, MacLeod, Mathews, & Rutherford, 2006) to change interpretive bias.

Also, most attentional bias CBM studies used 500 ms stimulus presentation times, but it is yet unclear whether this is the best time frame to train attentional bias in socially anxious adolescents. For example, if impaired disengagement to threat is a crucial issue, a training with longer stimulus presentation times could help directing attention away from threatening stimuli when attention is captured for a longer period.

Simultaneously, several other developments in the context of information processing in anxiety and mood disorders might provide interesting additions to current CBM options, such as training effortful control (cf., Houben et al., 2011; Klingberg et al., 2005) or trained forgetting of negative material (Joormann, Hertel, LeMoult, & Gotlib, 2009). Another interesting option might be to use tasks that target interpretations of intrusive thoughts (Clerkin & Teachman, 2011), focusing more on the metacognitive meaning (*having this thought means that I'm crazy/normal*) than content of thoughts. We used a short instruction at the beginning of interpretive bias tasks to encourage imagination of the described social situation (e.g., *the task is easier if you imagine yourself in the described situation*) and included a short imagination exercise (imagining eating and tasting a lemon) at the first interpretive bias training. Since imagining yourself in the descriptions seems to be an important aspect of CBM interpretive bias training (e.g., Blackwell & Holmes, 2010; Holmes & Mathews, 2010), future CBM interventions could be improved by repeated instructions or exercises that enhance imagination. Since a verbal or visual processing style could probably explain difficulties to engage with interpretive bias training scenarios, measures of processing style should be added to investigate possible mediators of CBM efficacy (Blackwell & Holmes, 2010).

Our study is the first to use CBM in the prevention of mental illness. Our finding that the efficacy of CBM in preventing test anxiety is about equal to the effects of a standard CBT training is promising for the development of CBM as a valuable addition to existing prevention options. In comparison to CBT, CBM is more easily applied without high costs of therapist training and could be delivered over the internet. To improve the feasibility of CBM in adolescents with a relatively low level of symptoms, future prevention studies should put effort in bringing CBM to a higher level. First, dropout in our study at the start of the CBM tasks was quite high, partly due to technical difficulties starting the program on their home computers. We chose to develop our training in a visually attractive software environment (Macromedia Authorware) which is unfortunately no longer supported by the software company and thus could not be used in future studies. Although internet-delivery of CBM is preferable to CD-ROM delivery or training in a laboratory, it is difficult to choose the right software that combines visual attractiveness with accuracy in timing, and runs on the most common operating systems. Recent developments in mobile devices also suggests that a CBM training should run on phones or tablet computers, emphasizing the need for a program that works on the internet regardless of operating systems. Second, some participants complained about the CBM tasks being quite boring and irritating; especially the attentional bias modification tasks. Although we provided a rationale before the start of each task, indicating the direction of arrows seemed to some adolescents very much unrelated to improving their well-being. Extending the CBM arsenal with more game-like tasks (cf., Baldwin & Dandeneau, 2009), more diverse stimuli and more variation in tasks could be a way to increase attendance and motivation in CBM participants. Our program was quite extensive compared to other CBM studies and sessions were quite long. It would be wise to test in separate pilot studies how many sessions are needed to change a specific cognitive bias and then move on to another task. In an advanced technical environment in which performance on tasks is tracked and biases are measured at regular intervals, it would even be possible to tailor the program to participants such that the program moves on after they reach a level on a certain cognitive bias that is comparable to low-anxious participants. Third, adding booster CBM sessions after the training period could probably also increase effects of the training.

Several CBM studies used control conditions in which tasks similar to the active condition were used without the positive contingency (e.g., an equal amount of positive and negative trials). We did not add such a control condition and therefore cannot rule out that the effects we found are due to non-specific factors. However, the change in information processes in the expected direction for automatic associations

and interpretive bias argues against a placebo effect. Also, other studies using similar CBM paradigms have shown to be effective compared to non-contingent control conditions.

In part I and II of this thesis, we used reaction-time based measures of processes in adolescents such as the stIAT and visual probe task. These tasks seem to work properly in adolescents but there is room for improvement. Specifically for the visual probe task, reliability is an issue. Over time, within-subject variance was very large, indicating a high instability of attentional bias or unreliability of the visual probe task. However, the visual probe task is widely used and remains the most obvious choice for investigating attentional bias.

The current research project provided a wealth of data on information processing in high socially anxious adolescents and the possibilities of using CBM as a preventive intervention for social anxiety. Some questions that could have been investigated using the current data have not yet been fully explored. First, it would be interesting to test the prospective relationship between information processing biases and symptoms of anxiety after two years in the high socially anxious sample, regardless of treatment condition. For example, relatively negative automatic associations could be predictive of a higher level of social anxiety symptoms at the long term. The same prediction would apply for relatively negative interpretive biases at pretest for anxiety at two year follow-up. Second, predictors of treatment response could be investigated, such as pretest level of information processing biases, in order to provide clues for future CBM studies. For example, Amir et al. (2011) found that higher pre-CBM attentional bias to threat (vigilant attention, measured at 500 ms) was associated with greater reductions of symptoms of social anxiety, while Price, Tone, and Anderson (2011) found that pretreatment avoidant attention was associated with reduced response to CBT for social anxiety disorder, compared to patients with vigilant biases. Thus far, it is unclear whether CBM is effective only when pretreatment biases are present, or that it could also be used to enhance resilience without a pre-existing bias (cf., Dandeneau et al., 2007).

Many studies on automatic associations focus on the role of self-relevant automatic associations, such as self-anxiety or depression associations (Glashouwer & de Jong, 2010) or self-associations in the context of self-esteem (de Jong, 2002; de Jong, Sportel, de Hullu, & Nauta, 2011). The strength of the association between self and indicators of anxiety seems to be involved in the prognosis of the disorder (Glashouwer et al., 2011), but dual-process models of anxiety (e.g., Ouimet et al., 2009) focus on the relevance of associations between particular threatening stimuli and expected negative outcomes. By measuring associations between cues relevant to social anxiety (*exam, conversation*) and expected outcomes (*failure, shame*) using a single-target IAT, we were able to investigate automatic associations that are called forth by stimuli that are specifically threatening to socially anxious people. In this thesis, we showed that relatively negative social threat-related automatic associations are characteristic of high socially anxious adolescents and are subject to change through interventions. It would be interesting to investigate whether these disorder-specific automatic associations are also involved in other anxiety disorders such as separation anxiety (e.g., *alone – fear*) or specific phobias such as fear for dental treatment (e.g., *treatment – pain*).

Our finding that CBM was effective in decreasing symptoms of test anxiety provides interesting options for future studies. Test anxiety is highly prevalent outside of the clinical domain, among adolescents in school or students in general, and associated with high costs for society and the individual (failed tests, loss of academic potential). It would be worthwhile to further test the efficacy of a short CBM intervention for test anxiety in a variety of populations, using interpretive bias modification tasks or experimenting with other paradigms (e.g., evaluative conditioning tasks).

Although CBM is effective in some studies as a stand-alone treatment, differential effects compared to CBT on automatic associations suggest that CBM works through different mechanisms than CBT and could be used in addition to existing CBT treatments. Future clinical studies should test the additive value of CBM during the wait-list period to test if treatment time can be shortened or mental health gains improved.

Conclusion

Adolescents at risk for developing social anxiety are characterized by biased information processing. Com-

pared to low socially anxious peers, high socially anxious adolescents show relatively negative automatic threat-related associations and interpret socially ambiguous information in a more negative and less positive way. These findings nicely fit current models of information processing in anxiety (Ouimet et al, 2009). Initial attentional bias to social threat seems to be a general phenomenon in adolescents and not specific to high socially anxious adolescents. The presence of biased information processing in adolescents at risk for social anxiety supports the application of cognitive bias modification (CBM) in the prevention of social anxiety disorders. Our extensive, multifaceted CBM program was not effective in preventing social anxiety in at-risk adolescents, but this lack of effect was also present in the group that received a standard CBT group treatment. Furthermore, CBM was effective in decreasing symptoms of test anxiety in the long term, suggesting that CBM might be a feasible, low-cost option for the prevention or treatment of test anxiety. Given large effects of CBM on change in interpretive bias, this component of our multifaceted CBM training seems to be the most promising ingredient. Since limited power due to small expected effect sizes, even in relatively large samples, is associated with prevention studies, future efforts in this direction should take care to retain their samples and prevent drop-out. On the basis of our experience in the present CBM prevention study we provided several suggestions to limit these problems such as improving technical aspects of the training and providing incentives for participation. The small effect sizes could probably be limited by increasing treatment attendance and adding booster sessions.

Since cognitive bias modification procedures have proven to be effective in ameliorating symptoms of anxiety in a number of studies, it has been suggested that CBM would be the way forward for prevention in at-risk populations (March, 2010). Our study was the first to test this premise and we have shown that although CBM did not significantly decrease or prevent social anxiety, we were able to significantly decrease test anxiety. Given the relatively low cost of CBM as an internet-delivered and therapist-free program, the application of CBM in the prevention of test anxiety seems worth considering. However, proving the efficacy of prevention programs in itself is very difficult and further efforts are needed to improve and strengthen CBM procedures before it can be successfully applied as a preventive intervention.

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Nederlandse Samenvatting

Dankwoord

Curriculum Vitae

Publications

Nederlandse Samenvatting

Dutch Summary

Sociale angst bij adolescenten

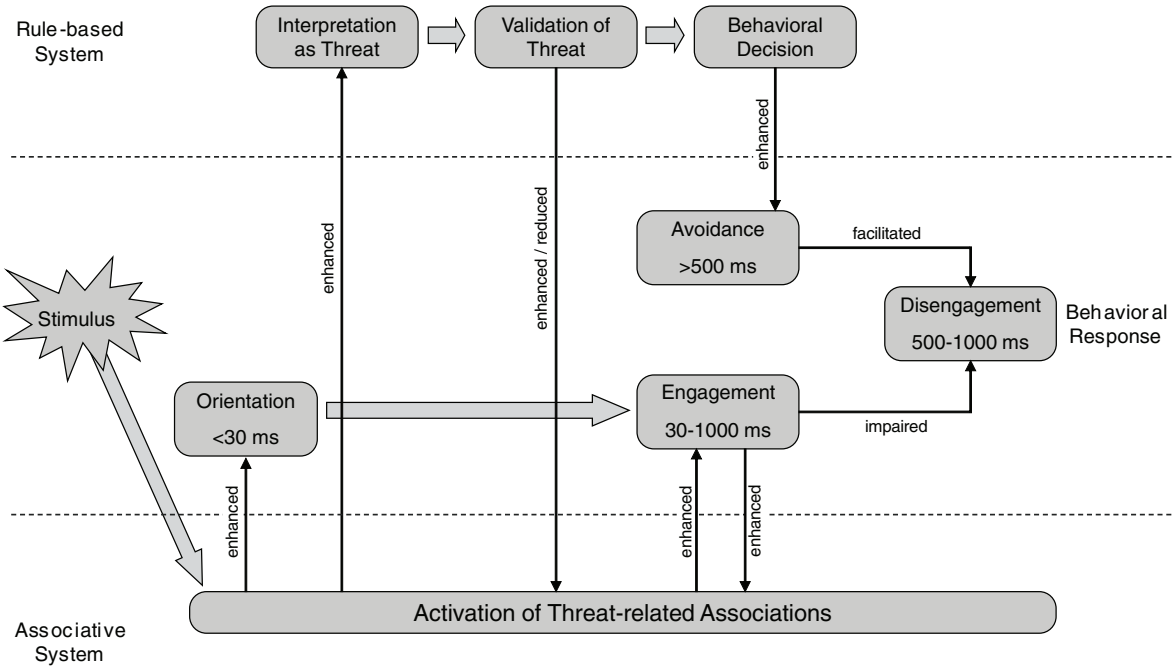
In de adolescentie buitelen de veranderingen in jongeren over elkaar heen. Hormonale veranderingen, seksualiteit, uitbreiding van sociale netwerken en steeds hogere eisen die door de omgeving gesteld worden; zowel sociaal als wat betreft schoolprestaties. In deze context zijn sommige jongeren kwetsbaarder dan anderen voor het ontwikkelen van sociale angst; ze zijn bang om door anderen afgewezen te worden of een slechte beoordeling te krijgen. Vaak gaat het dan om situaties die voor de meeste jongeren heel gewoon zijn: een plekje zoeken in de kantine, door de hal lopen, of een gesprek voeren met mensen die je niet zo goed kent. Voor sommigen gaat het specifiek om faalangst en is de angst beperkt tot toetsen, proefwerken en spreekbeurten. Onder adolescenten is sociale angststoornis de meest voorkomende psychische stoornis, met ongeveer 9,5% van de meisjes en 4,9% van de jongens die tijdens hun adolescentie voldoen aan de klinische criteria voor deze stoornis. De stoornis gaat gepaard met veel vermijdingsgedrag: sociaal angstige jongeren melden zich vaak ziek voor proefwerken en gymles en spreken weinig af met klasgenoten uit angst afgewezen te worden. Daardoor kan de stoornis op langere termijn grote gevolgen hebben. Sociale angst kan leiden tot minder sociale vaardigheden, een lagere zelfwaarde en slechtere schoolprestaties, of aanleiding geven voor het ontstaan van andere psychische stoornissen zoals overige angststoornissen, depressie of alcoholmisbruik.

Cognitieve processen in sociale angst

Sociale angst is een hardnekkige stoornis die niet gemakkelijk vanzelf verdwijnt. Eén van de factoren die mogelijk bijdraagt aan het voortduren van sociale angst is de manier waarop mensen sociale informatie verwerken. Wanneer je bijvoorbeeld je aandacht vooral richt op negatieve aspecten van sociale situaties of wanneer je heel gevoelig bent voor signalen van sociale afwijzing zoals een fronsend gezicht, dan ervaar je de buitenwereld als dreigender dan iemand die meer op positieve informatie let. Een dergelijke negatieve bias, een vertekening van de waarneming, is kenmerkend voor sociaal angstige mensen. Zo blijken sociaal angstige mensen in hun omgeving vooral te letten op signalen van dreiging; afkeurende gezichten worden eerder opgemerkt dan neutrale gezichten. Deze neiging om vooral negatieve informatie op te merken staat bekend als *aandachtsbias*. Ambigue sociale informatie wordt vaak negatief geïnterpreteerd: als iemand zonder te groeten langs je loopt dan betekent dit dat hij je stom vindt en niet dat hij druk is met iets anders en je daardoor niet gezien heeft. Deze neiging om automatisch negatieve interpretaties te geven aan ambigue, onduidelijke informatie staat bekend als *interpretatiebias*.

Dergelijke vertekeningen in de informatieverwerking maken relatief onschuldige sociale situaties bedreigend en verhogen daarbij de kans dat sociaal angstige personen zich angstig zullen voelen, en deze situaties zullen gaan vermijden. Een model dat de rol van cognitieve vertekeningen bij het in stand houden van angst beschrijft is het multi-process model van cognitieve kwetsbaarheid voor angst, van Ouimet,

Gawronski en Dozois (2009). Dit model maakt ook onderscheid tussen de meer impliciete, automatische verwerking van informatie en de meer expliciete, gecontroleerde informatieverwerking. Naast aandachtsbias en interpretatiebias is er ook een grote rol voor automatische associaties; de associaties die een bepaalde stimulus (bijv. een proefwerk dat wordt uitgedeeld) automatisch oproept. Als deze associaties negatief zijn (bijvoorbeeld mislukken, falen), dan zal dit vervolgens aandachtsbias en interpretatiebias versterken waardoor de angst toeneemt. Dit model gebruik ik in dit proefschrift als een kapstok om de verschillende onderdelen van mijn onderzoek te plaatsen. Hieronder wordt dit model weergegeven met vertaling en uitleg in de tekst.



Figuur 8.1. Multi-process model van cognitieve kwetsbaarheid voor angst, van Ouimet, Gawronski en Dozois (2009).

Het ervaren van een relevante stimulus (bijvoorbeeld *proefwerk*) leidt tot de activatie van dreiging-associaties (bijvoorbeeld *falen*, *mislukken*) in het associatieve systeem. Hierdoor wordt de initiële aandacht (*orientation*) gericht op de dreigende stimulus en daar ook vastgehouden (*engagement*). Doordat de aandacht gericht blijft op de stimulus, worden de dreiging-associaties verder versterkt. Het is moeilijk om de aandacht weer los te laten (*disengagement*), omdat de stimulus nog steeds als dreigend wordt ervaren. Tegelijkertijd versterken de dreiging-associaties de neiging om de stimulus te interpreteren als dreiging, in het meer bewuste propositionele (*rule-based*) systeem. Hier wordt gekeken of de stimulus ook inderdaad dreigend is (*validation*), en als de dreiging bevestigd wordt, dan volgt ook de gedragsmatige keuze (*behavioral decision*) om de stimulus te vermijden door de aandacht weg te richten (*avoidance*). Een angstwekkende stimulus leidt op deze manier tot activatie van dreiging-associaties, versterkte initiële aandacht naar de dreigende stimulus en interpretatie en validatie van de stimulus als dreigend. Op deze manier wordt de ervaring van angst versterkt. De angst neemt af wanneer de cyclus wordt doorbroken, bijvoorbeeld doordat de stimulus als goedaardig wordt geïnterpreteerd en gevalideerd of als de aandacht actief wordt weggericht waardoor de associaties niet meer worden geactiveerd.

Opzet van dit proefschrift

De titel *Threat is in the Eye of the Beholder - Cognitive Bias Modification in the Prevention of Adolescent Social Anxiety* geeft aan wat de focus van dit proefschrift is. Ten eerste gaat het om de waarneming van dreiging, met de boodschap dat de dreiging niet per se van de situatie uitgaat, maar vooral door de blik van de waarnemer. In dit proefschrift gaat het specifiek om de waarneming van sociaal angstige adolescenten;

verwerken zij sociale informatie in de omgeving op een meer negatieve manier dan jongeren die geen last hebben van sociale angst? Een belangrijke vraag die hierop voortborduurt, is of we de informatieverwerking van sociaal angstige adolescenten ook kunnen veranderen, en of dit dan hun angst vermindert of voorkomt dat ze angst gaan ontwikkelen. Daar verwijst het tweede deel van de titel naar, en deze vraag staat centraal in het tweede deel van het proefschrift.

Deel I: Vertekende informatieverwerking

Vertekeningen in aandacht in interpretatie zijn kenmerkend voor sociaal angstige volwassenen, zo blijkt uit veel onderzoeken waarin sociaal angstige volwassenen met een niet-angstige controlegroep werden vergeleken. Dat deze vertekening in de informatieverwerking kenmerkend is voor mensen die al angstig zijn, maakt aannemelijk dat deze vertekeningen een rol spelen bij de instandhouding van sociale angst. Als vertekeningen in de informatieverwerking ook betrokken zijn bij de ontwikkeling van sociale angst, dan zou je verwachten dat deze biases ook gevonden worden bij mensen die wel een hoog risico hebben voor het ontwikkelen van een sociale angststoornis, maar die nog niet jarenlang last hebben van sociale angst. Sociale angst ontstaat meestal tijdens de adolescentie, en dus lijkt dit de meest geschikte leeftijd om te onderzoeken of jongeren met een verhoogde kans op het ontwikkelen van sociale angst inderdaad de kenmerkende vertekeningen in de informatieverwerking vertonen.

Automatische associaties met sociale dreiging

In **hoofdstuk 2** onderzoeken we of jongeren met een hoog risico op het ontwikkelen van sociale angst gekenmerkt worden door sterkere associaties tussen sociale angst -relevante stimuli en negatieve verwachtingen. Bijvoorbeeld of ze de stimulus *schoolfeest* sterk associëren met *afwijzing*. Hiervoor hebben we een groep jongeren (12-15 jaar oud) met subklinische symptomen van sociale angst vergeleken met jongeren die weinig of geen symptomen vertonen van sociale angst. De automatische dreiging-associaties zijn gemeten met behulp van een single-target Impliciete Associatie Taak (stIAT). In deze computertaak moet je zo snel mogelijk woorden categoriseren die in het midden van het scherm staan. Bovenin het scherm staan de labels voor de attributen: links *negatief gevolg* en rechts *positief gevolg*. De categorie *sociale- of schoolsituatie* staat in het begin van de taak bij het label van negatief gevolg. Als in het midden van het scherm het woord *toets* verschijnt, moet je zo snel mogelijk op de linkerknop drukken omdat dit een schoolsituatie is. Als het woord *falen* verschijnt, druk je ook links. Als *succes* verschijnt, druk je rechts. Als je sterke associaties hebt tussen de sociale situaties en een negatieve uitkomst dan is het makkelijk om deze taak uit te voeren, omdat je steeds links moet drukken bij deze situaties en negatieve gevolgen. Halverwege de taak wisselen de attribuut-labels van plek, en staat *sociale- of school activiteit* ineens rechts, naast *positief gevolg*. Als je sterke associaties hebt tussen de sociale situaties en een negatieve uitkomst, is het moeilijk om bij sociale situaties rechts te drukken, omdat je deze eerder zou koppelen aan een negatief gevolg. Door de reactietijden in het eerste gedeelte van de taak te vergelijken met het tweede gedeelte krijg je een maat voor de relatieve sterkte van de automatische associaties. Op deze manier meten we op een impliciete manier, zonder er rechtstreeks naar te vragen (zoals met een vragenlijst), hoe sterk de automatische positieve of negatieve associaties zijn met sociale situaties.

Het bleek dat de negatieve automatische associaties in sociaal angstige jongeren inderdaad relatief sterk waren ten opzichte van niet-sociaal angstige jongeren, zowel in de stIAT zoals hierboven beschreven als met een meer expliciete vragenlijst die vroeg hoe sterk ze bepaalde woorden met positieve of negatieve gevolgen associeerden. Vervolgens bleek dat automatische associaties en expliciete associaties beiden betrokken zijn bij symptomen van sociale angst; in een regressieanalyse hadden beiden onafhankelijke predictieve waarde. Hieruit kunnen we concluderen dat zowel automatische als expliciete associaties een rol spelen in sociale angst; een bevinding die consistent is met het model van Ouimet et al. (2009). Automatische en expliciete associaties met sociale stimuli lijken daarom een logisch aangrijpingspunt voor vroegtijdige interventies voor sociale angst.

Aandachtsbias voor sociale dreiging

In **hoofdstuk 3** onderzoeken we of jongeren met een hoog risico op het ontwikkelen van sociale angst gekenmerkt worden door een aandachtsbias voor sociaal dreigende informatie. Dezelfde groepen als beschreven in hoofdstuk 2 hebben we twee taken laten uitvoeren waarin de initiële aandachtsbias wordt gemeten voor afkeurende gezichten en woorden die afwijzing impliceren. In de visuele probe taak is de opdracht om zo snel mogelijk aan te geven of een pijltje dat links of rechts op het scherm verschijnt naar boven was gericht (↑) of naar beneden (↓). Voordat het pijltje op het scherm verschijnt, worden héél kort (500 ms) twee gezichten (eerste taak) of woorden (tweede taak) getoond. Eén daarvan is positief of negatief, de tegenoverliggende neutraal. De positieve en negatieve aandachtsbias wordt gemeten door de reactiesnelheid op trials waarin het pijltje verschijnt achter de positieve of negatieve stimulus te vergelijken met trials waarin het pijltje achter een neutrale stimulus verschijnt. We hadden verwacht dat sociaal angstige adolescenten een sterkere negatieve aandachtsbias zouden vertonen dan niet-sociaal angstigen, maar het bleek dat zowel sociaal angstigen als de controlegroep hun aandacht sterker richten op negatieve informatie dan op neutrale informatie, zonder verschil tussen de groepen. Dit gold zowel voor afwijzende gezichten als afwijzende woorden. We vonden geen aanwijzingen voor een positieve bias in beide groepen; vriendelijke gezichten of woorden trokken de aandacht niet sterker dan neutrale gezichten of woorden.

Sommige onderzoekers betogen dat aandachtsbias vooral een rol speelt bij mensen die een slechte aandachtscontrole hebben; wanneer je je aandacht moeilijk bewust kan richten heeft de automatische aandachtsbias vrij spel. Om die hypothese bij jongeren te onderzoeken lieten we een deel van de groep een vragenlijst naar aandachtscontrole invullen en keken we of de interactie van aandachtscontrole en aandachtsbias naar dreiging gerelateerd was aan symptomen van sociale angst. Dit bleek niet het geval; aandachtsbias correleerde niet met sociale angst en de hoeveelheid aandachtscontrole veranderde niets aan die relatie.

Aandachtsbias voor afkeurende gezichten en woorden lijkt daarom een kenmerk te zijn voor adolescenten in het algemeen, niet specifiek voor sociaal angstige jongeren. Daardoor geven onze resultaten geen ondersteuning voor de aanname dat aandachtsbias een belangrijke rol speelt in de ontwikkeling van sociale angst. Doordat we de stimuli (gezichten en woorden) steeds 500 ms lieten zien, kunnen we echter geen uitspraken doen over hele vroege aandachtsbias (bijvoorbeeld binnen 30 ms) of vastgehouden aandacht (bijvoorbeeld tot 1500 ms). Hoewel de initiële aandachtsbias die gemeten wordt op 500 ms in de literatuur de meest consistente samenhang laat zien met sociale angst, kunnen we niet uitsluiten dat er verschillen zijn tussen sociaal angstige en niet sociaal angstige jongeren met betrekking tot andere aspecten van selectieve aandacht.

Interpretatiebias voor ambigue sociale situaties

In **hoofdstuk 4** onderzoeken we of jongeren met een hoog risico op het ontwikkelen van sociale angst gekenmerkt worden door een negatieve interpretatiebias voor sociale situaties. Jongeren met symptomen van sociale angst en jongeren zonder symptomen van sociale angst hebben een taak uitgevoerd die vaak wordt gebruikt om interpretatiebias te meten, de zogenoemde 'Recognition Task'. Hierin krijgen deelnemers 10 verhaaltjes te lezen over sociale situaties, waarbij ze een woordfragment moeten invullen. De verhaaltjes blijven ambigu; je weet niet of ze goed of verkeerd aflopen. Daarna moeten ze per verhaaltje van 4 verschillende 'oplossingen' aangeven in welke mate deze bij het verhaaltje passen. Als jongeren hierin vooral de negatieve oplossing waarschijnlijk vinden, duidt dit op een negatieve interpretatiebias. Naast deze computertaak vulden de jongeren ook een vragenlijst in, de Adolescent Interpretation and Belief Questionnaire (AIBQ), waarin ze bij verschillende sociale en niet sociale ambigue situaties moeten aangeven wat ze in zo'n geval zouden denken.

De aanwezigheid van een negatieve interpretatiebias bij sociaal angstige volwassenen en kinderen is al vrij uitgebreid onderzocht en ook in ons onderzoek bleek er sprake te zijn van een interpretatiebias bij de kwetsbare groep. In vergelijking met niet sociaal angstige jongeren, blijken jongeren met symptomen van so-

ciale angst ambigue sociale situaties meer negatief en minder positief te interpreteren. Dit was vooral duidelijk zichtbaar in de resultaten van de AIBQ. In de Recognition Task vonden we wel dat sociaal angstigen minder positief interpreteerden, maar geen verschil in negatieve interpretaties. De aanwezigheid van een interpretatiebias in jongeren met een hoog risico op het ontwikkelen van sociale angst ondersteunt het toepassen van preventieve interventies die gericht zijn op het veranderen van de interpretaties.

Discussie deel I

In **hoofdstukken 2, 3** en **4** bleek dat sociaal angstige jongeren inderdaad gekenmerkt worden door een vertekening in de informatieverwerking; zij hebben relatief sterke associaties tussen sociale situaties en negatieve uitkomsten en interpreteren ambigue sociale situaties op een meer negatieve en minder positieve manier. Hun aandacht wordt vooral getrokken door afwijzende informatie, maar hierin verschillen ze niet van niet-angstige adolescenten. Deze resultaten zijn gedeeltelijk in lijn met cognitieve modellen zoals het hierboven beschreven model van Ouimet et al. (2009), wat betreft automatische associaties en interpretatiebias. Aandachtsbias naar sociale dreiging lijkt niet specifiek te duiden op sociale angst, maar te passen binnen een normale ontwikkeling van adolescenten. Onze cross-sectionele studies zijn een eerste stap in het onderzoek naar de rol van informatieverwerking in sociaal angstige jongeren. We kunnen nu geen harde conclusies trekken over de richting van het verband tussen disfunctionele informatieverwerking en sociale angst. Het zou kunnen zijn dat deze processen een onderdeel zijn van sociale angst, of een resultaat van angst; door prognostisch onderzoek zouden we hier meer over kunnen zeggen. Ook zou toekomstig onderzoek zich kunnen richten op het onderling verband van deze processen, bijvoorbeeld door te kijken of interpretatiebias bijzonder sterk is in adolescenten met relatief negatieve automatische associaties.

Deel II: Cognitieve Bias Modificatie in de preventie van sociale angst

Een recente ontwikkeling in het onderzoek naar psychologische interventies is de mogelijkheid om vertekende informatieverwerking direct te beïnvloeden door het gebruik van computertaken. Door in verschillende taken deelnemers te trainen om meer te letten op positieve informatie en informatie positief te interpreteren, zou het mogelijk zijn om symptomen van angst af te laten nemen. Deze zogenaamde Cognitieve Bias Modificatie (CBM) procedures hebben in onderzoek de afgelopen jaren een grote vlucht genomen. In studies met angstige volwassenen en kinderen zijn aanwijzingen gevonden dat het veranderen van aandachtsbias en interpretatiebias invloed heeft op het niveau van angst. Er zijn enkele klinische gerandomiseerde trials geweest waarin het modificeren van aandachtsbias leidde tot een significante afname van sociale angst symptomen of diagnoses. Deze veelbelovende resultaten riepen de vraag op of CBM ook kon dienen als preventieve interventie voor risicogroepen, zoals jongeren met een hoog risico op het ontwikkelen van sociale angst.

Op basis van de resultaten van eerdere CBM studies hebben we een training ontwikkeld die gericht is op het verminderen van symptomen van sociale angst in adolescenten door specifiek de informatieverwerking te veranderen. We hebben een meerzijdige (*multifaceted*) cognitieve bias modificatietraining ontwikkeld met verschillende taken, gericht op het veranderen van automatische associaties, aandachtsbias, interpretatiebias en impliciete eigenwaarde (self-esteem). Deze training bestond uit 20 sessies die via het internet thuis konden worden uitgevoerd, 2 keer in de week in sessies van ongeveer 40 minuten.

Door een uitgebreide screening en selectieprocedure selecteerden we 240 jongeren met een hoog risico op het ontwikkelen van sociale angst. Tijdens de screening op 25 middelbare scholen bij 1811 jongeren, scoorden deze jongeren hoog op een vragenlijst voor sociale angst en/of faalangst en in een klinisch interview gaven zij aan bang te zijn voor negatieve beoordeling door anderen en in meerdere sociale situaties angstig te zijn of vermijdingsgedrag te vertonen. Jongeren die een klinische (ernstige) mate van sociale angst vertoonden werden doorverwezen en namen geen deel aan het verdere onderzoek. Door middel van loting per school werden de geselecteerde jongeren toegewezen aan één van de drie condities in het onderzoek. Eén groep werd ingedeeld in de Cognitieve Bias Modificatie training en volgde thuis via internet het CBM programma; één groep kreeg tien weken lang op school een groepstraining (1 keer per week na schooltijd)

waarin ze met technieken uit de cognitieve gedragstherapie (CGT) leerden omgaan met hun sociale angst en faalangst en één groep diende als controlegroep en kreeg geen training aangeboden. De jongeren deden computertaken om informatieverwerkingsprocessen te meten en vulden vragenlijsten in vóór de trainingsperiode, direct daarna en na een half jaar, 1 jaar en na 2 jaar.

Preventie van sociale angst door middel van CBM en CGT

In **hoofdstuk 5** beschrijven we de details van de selectieprocedure en de interventies en focussen we op de relatieve effectiviteit van de trainingen in het reduceren van sociale angstsymptomen direct na de training, na een half jaar en na één jaar. In **hoofdstuk 6** richten we ons op de lange termijn effecten na twee jaar. Samengevat kunnen we het volgende concluderen:

(i) Op korte termijn (na een half jaar) lijken de deelnemers in de CBM conditie minder sociale angstsymptomen te vertonen dan de controlegroep, maar deze trend is niet significant. Dit effect was ook aanwezig voor de groep die de CGT groepstraining ontving; daar was het effect wel significant verschillend van de controlegroep. De CGT en CBM groepen verschilden niet significant van elkaar. (ii) Op lange termijn (één en twee jaar follow-up) daalden de symptomen van sociale angst in de controlegroep even sterk als die van de beide trainingsgroepen. (iii) Op korte termijn (direct na de training en na een half jaar) daalden de score voor faalangst significant voor de groep die CGT ontving, sterker dan de CBM groep en de controlegroep, maar op lange termijn (één en twee jaar follow-up) was deze daling gelijk voor de CBM en de CGT groep, en significant verschillend van de controlegroep. (iv) Automatische associaties tussen sociale situaties en positieve of negatieve gevolgen werden positiever in de CBM conditie ten opzichte van de CGT conditie en de controlegroep. Dit effect was zichtbaar direct na de trainingsperiode en bleef stabiel over de tijd, tot twee jaar na de training. Als je kijkt naar de verandering van automatische associaties in de periode direct na de training tot twee jaar na de training, blijkt dat de CBM groep een sterkere afname van negatieve automatische associaties heeft ten opzichte van de CGT groep en de controlegroep. (v) We vonden geen verschillen tussen de groepen wat betreft DSM-IV diagnoses van sociale angst stoornis; in alle groepen was het aantal diagnoses twee jaar na de trainingsperiode zeer laag. Evenzo was er bij de twee-jaar follow-up geen verschil tussen de condities in de door de ouders gerapporteerde symptomen van sociale angst (over hun kind).

Veranderingen van informatieverwerkingsprocessen

Hoofdstuk 7 beschrijft in meer detail de veranderingen in de informatieverwerkingsprocessen die we hebben gemeten met de verschillende taken op alle meetmomenten. Zoals ook al bleek in hoofdstuk 5 en 6, werden de automatische associaties veel negatiever in de CGT conditie en positiever in de CBM conditie. Voor aandachtsbias vonden we weinig consistente effecten; de variantie in de maten voor aandachtsbias was groot met weinig stabiliteit binnen proefpersonen. Alleen op de korte termijn vonden we een toename van aandachtsbias voor vriendelijke gezichten in de CBM conditie, vergeleken met de controlegroep. Interpretatiebias gemeten met de Recognition taak veranderde sterk op de korte termijn en deze verandering bleef stabiel over tijd. Zoals we hadden bedoeld, vertoonde de CBM groep een afname van negatieve interpretatiebias en een toename van positieve interpretatiebias ten opzichte van de controlegroep en de CGT groep. Op korte termijn was dit effect ook zichtbaar op de AIBQ vragenlijst, waarin negatieve interpretatiebias significant afnam ten opzichte van de controlegroep. De bevinding dat aandachtsbias niet systematisch beïnvloed werd door onze trainingprocedures bevestigt de bevindingen in hoofdstuk 3, dat aandachtsbias mogelijk op een andere manier is betrokken bij sociale angst dan interpretatiebias en automatische associaties.

Discussie deel II

Onze studie is de eerste waarin automatische dreig-associaties longitudinaal worden gevolgd in een randomized controlled trial (RCT). Automatische associaties werden relatief positief in de CBM conditie en relatief negatief in de CGT conditie. Automatische associaties hangen vaak weinig samen met vragenlijstmaten en meer met gedragsmaten zoals reacties op een stresstaak. Een dergelijke maat voor angstig gedrag hebben

we in deze studie niet meegenomen, en zou een waardevolle aanvulling zijn in toekomstig onderzoek. Dat de CGT training leidde tot relatief negatievere automatische associaties impliceert dat deze therapie mogelijk verbeterd kan worden door meer aandacht te geven aan positieve associaties, bijvoorbeeld door de focus meer te leggen op mogelijke positieve uitkomsten van gedragsexperimenten dan op wat er mis kan gaan.

Hoewel de CGT interventie leidde tot een snellere afname van symptomen van sociale angst (en de CBM interventie bijna, net niet significant), bleken onze preventieprogramma's geen toegevoegd effect te hebben op de lange termijn in de preventie van sociale angst onder adolescenten. Sociale angst nam over het algemeen sterk af in de hoog-risico adolescenten, en er was daardoor ook weinig ruimte voor een additioneel effect van onze interventies. Als we rekening houden met het relatief lage niveau van sociale angst van de jongeren in de studie (ten opzichte van klinische studies) en de verminderde power door een grote drop-out in de follow-up metingen, is het niet zo verrassend dat we geen significante effecten vinden op sociale angst. Dit is een probleem dat in meer preventiestudies een rol speelt. Meta-analyses van meerdere preventiestudies kunnen dan uitkomst bieden (Cuijpers, 2003).

Een andere preventiestudie (Aune en Stiles, 2009) die wel significante vermindering van sociale angstsymptomen bewerkstelligde, had een brede aanpak, waarin ook klasgenoten, ouders en scholen werden betrokken en voorlichting kregen over sociale angst en CGT technieken. Een dergelijke brede aanpak lijkt te verkiezen boven onze smalle focus in de preventie van sociale angst; juist omdat de sociale omgeving een grote rol speelt in deze stoornis.

Wat betreft faalangst, echter, waren de interventies wel succesvol in het verminderen van klachten op korte (CGT) en lange termijn (CGT én CBM). Dit specifieke aspect van sociale angst komt veel voor bij adolescenten en het verminderen van klachten op dit gebied zou veel leed kunnen besparen en impact kunnen hebben op de schoolcarrière. Als je kijkt naar kosteneffectiviteit, dan zou een CBM programma via internet dat zich richt op faalangst een goede investering kunnen zijn voor scholen. Alvorens dit te implementeren lijkt het echter zinvol eerst nader te onderzoeken welke componenten van ons meerzijdige CBM programma effectief hebben bijgedragen aan het verminderen van faalangst.

Het volgen van deelnemers over een vrij lange periode (2 jaar) was een sterk punt van de huidige preventiestudie. Er was echter ook sprake van een grote uitval van deelnemers; bijna de helft van de deelnemers bleek gestopt met het onderzoek ten tijde van de twee-jaar follow-up metingen. Toekomstige studies zouden kunnen proberen deze drop-out te voorkomen door meer metingen tijdens schooltijd te plannen, hogere beloning of oplopende beloningen aan te bieden voor deelname aan de metingen en door op meerdere momenten duidelijk te maken wat er wordt verwacht van de deelnemers en wat het ze op kan leveren. Tijdens de interventieperiode was de uitval in de CBM groep aanmerkelijk hoger dan in de CGT groep. Dit lag mogelijk vooral aan de moeite die het sommige scholieren kostte om het programma op de thuis-pc aan de gang te krijgen. Voor toekomstige internet-based CBM studies is het belangrijk om te zoeken naar een vorm waarin de CBM taken aangeboden worden in een softwareomgeving die draait op verschillende systemen met zo min mogelijk storingen.

De meeste studies naar de effecten van Cognitieve Bias Modificatie (CBM) richten zich op één enkel proces, bijvoorbeeld alleen aandachtsbias. Onze meerzijdige aanpak is uniek, en doet recht aan het idee dat de verschillende processen elkaar beïnvloeden in de instandhouding van sociale angst. Deze benadering maakt het echter moeilijk om de effecten van de verschillende componenten los van elkaar te zien. De grote verandering in interpretatiebias lijkt veelbelovend voor dit component van de training, maar we weten niet of deze verandering ook daadwerkelijk door de interpretatiebias taken werd bewerkstelligd. In toekomstige studies zou het zinvol zijn om de effectiviteit van de verschillende componenten om biases te veranderen te toetsen, alvorens de effectieve componenten samen te voegen tot een training.

Cognitieve Bias Modificatie is een vrij recente ontwikkeling en zou op veel punten nog verbeterd kunnen worden. Het uitvoeren van de taken is voor deelnemers een nogal saaie aangelegenheid. Het afwisselen van taken zou hierin verbetering kunnen brengen. De focus ligt nu nog vooral op het veranderen van aandachtsbias en interpretatiebias, maar het zou ook zinvol kunnen zijn om bijvoorbeeld aandacht te geven aan

het trainen van bewuste controle over de aandacht of het beter gebruiken van de verbeelding in het oproepen van positieve situaties. Ook zou de training nog veel meer op maat kunnen worden gesneden voor individuele deelnemers. Sommige deelnemers zijn wellicht sneller of juist trager in het aanleren van een positieve bias; je zou 'levels' kunnen introduceren waardoor een deelnemer pas verder kan als de informatie positief verwerkt wordt. Hoewel hier natuurlijk technische uitdagingen zijn, zouden zulke ontwikkelingen CBM taken in de toekomst veel aantrekkelijker en mede daardoor mogelijk ook effectiever kunnen maken.

Conclusie

Nadat meerdere studies hadden laten zien dat Cognitieve Bias Modificatie procedures effectief zijn in het verminderen van angstsymptomen in klinische populaties, werd gesuggereerd dat CBM ook de toekomst zou kunnen zijn van preventie in at-risk populaties (March, 2010). Onze studie was de eerste die deze aanname onderzocht en hoewel we er niet in slaagden om sociale angst te verminderen of te voorkomen, lukte het wel om faalangst te verminderen. Omdat CBM relatief eenvoudig en met lage kosten kan worden ingezet via het internet, lijkt het toepassen van dergelijke programma's tegen faalangst het overwegen waard.

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Ik heb me bijzonder thuisgevoeld in de werkomgeving van de universiteit, maar ons onderzoek heeft zich voor een groot deel afgespeeld op scholen in Groningen en de omliggende provincies. Het is voor scholen geen gemakkelijke stap om 'ja' te zeggen tegen wetenschappelijk onderzoek. Dat we op 28 scholen ons onderzoek mochten uitvoeren, is dan ook een kostbaar geschenk. De steun die we kregen van de zorgcoördinatoren bij het regelen van de metingen en de assistentie van conciërges bij het regelen van steekwagentjes en het optrommelen van kinderen was onmisbaar. Ook de vele kinderen die met ons onderzoek hebben meegedaan, kan ik niet genoeg bedanken.

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Verre Oma en Dichtbije Oma. Ik heb geluk met zulke slimme en betrokken omas, die me lieten en laten ervaren wat belangrijk is als je aan het einde van je leven terugkijkt.

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Curriculum Vitae

Eva de Hullu werd op 7 november 1980 geboren te Wageningen. Haar jeugd bracht zij door in Zutphen, waar ze in 1999 haar Vrije School diploma haalde. Na een jaar VWO begon ze in 2000 aan de studie Psychologie aan de Radboud Universiteit Nijmegen. In 2006 studeerde ze af in de Klinische Psychologie met een scriptie over de rol van overgeneralisatie in de regulatie van affect. In juni 2006 vertrok ze naar Uffelte, in Drenthe, samen met haar vriend Joost en begon als promovendus bij Accare, centrum voor kinder- en jeugdpsychiatrie in Groningen. Zij was als extern promovendus gedetacheerd aan de Rijksuniversiteit Groningen. Samen met Esther Sportel werkte Eva gedurende 5 jaar aan een project om de effectiviteit van twee interventies in de preventie van sociale angst te onderzoeken: Project Pasta. Naast dit promotieonderzoek rondde Eva de basiscursus Cognitieve Gedragstherapie van de VGCT af en werkte ze gedurende een jaar als docent voor de afdeling klinische psychologie, één dag per week. Ook was zij actief in de belangenbehartiging voor promovendi psychologie op de faculteit Gedrags- en Maatschappijwetenschappen, in de promoraad. Dochter Ilva werd in juli 2009 geboren. In het najaar van 2011 rondde Eva haar proefschrift af en werd zoon Rune geboren. Vanaf maart 2012 is Eva werkzaam als universitair docent klinische psychologie aan de Open Universiteit Nederland op het studiecentrum Nijmegen.

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