Investigating new process-focused treatments for posttraumatic stress disorder : attentional bias modification and mindfulness-based cognitive therapy

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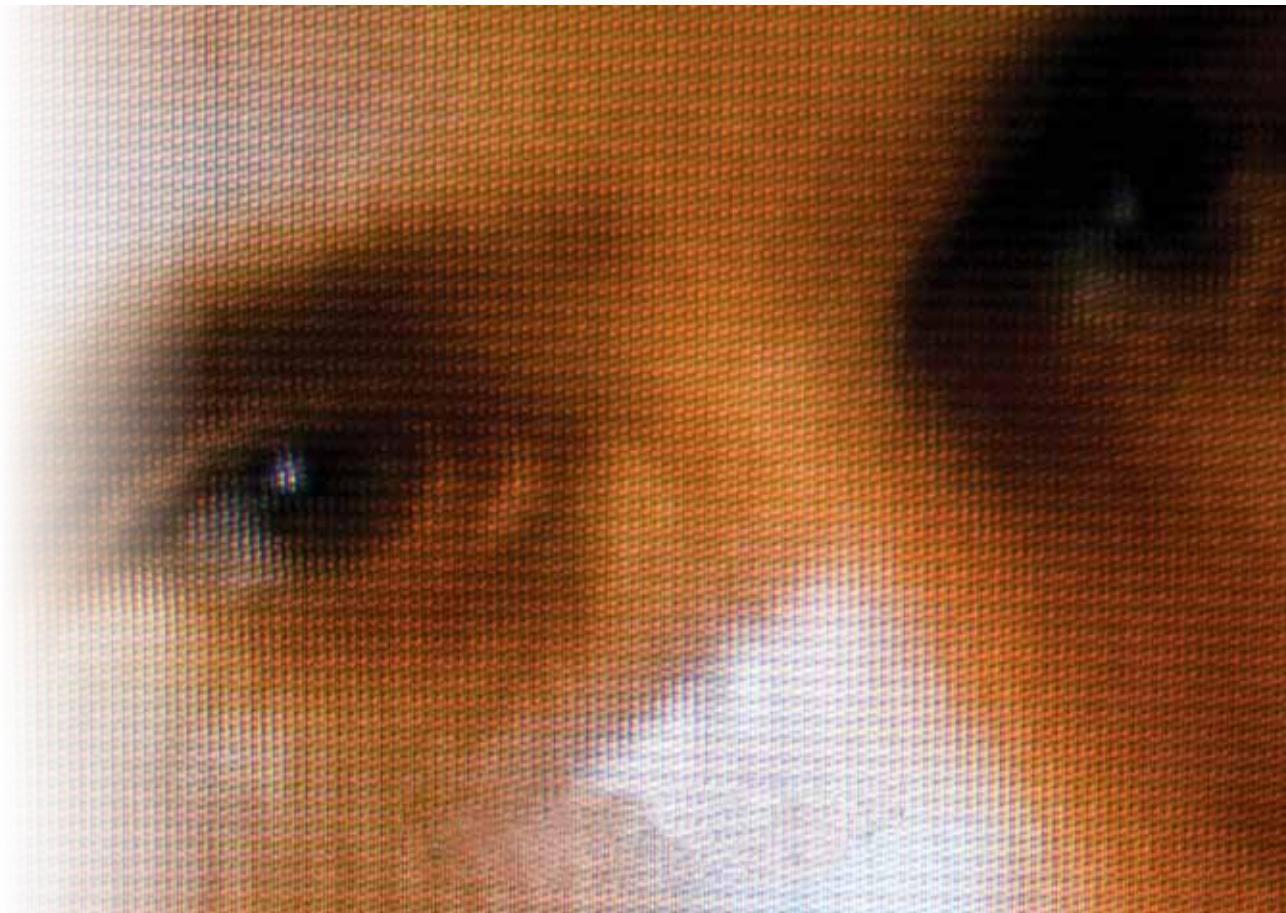
General introduction



Introduction

Recently I moved into a new room at my workplace; a mental health care department for treatment of posttraumatic stress disorder (PTSD). Interestingly, this new office seems designed for detecting attentional problems in patients. Next to the door, there is a narrow window partly covered with foil. There is a small part uncovered, through which you can see the feet of people passing my office. During therapy, some patients are not able to ignore the images of these moving feet, and they turn their head almost every time someone passes by (which is actually quite often). Other patients don't even seem to notice the shadows.

Ms. B was a 21-year-old student from Nigeria. In childhood, she had been severely molested by her parents. Ms. B had nightmares, was afraid to go to sleep and had very vivid re-experiences of the occurred events. She had never talked to anyone about the physical abuse. Furthermore, she said she was ''unable to relax''. Her scores on a self-report questionnaire for PTSD were very high. When she first entered treatment (exposure therapy; Keijsers, van Minnen, & Hoogduin, 2004), she expressed the need to have the occurred events erased from her memory. She also indicated that her studies were very important to her, and that she felt competent at university, for the first time in her life.
At the start of treatment, I had noticed that Ms. B was very vigilant. She would keep her jacket and hat on and she sat on the edge of the seat. However, she was not distracted by the feet passing by.

Therapy did not result in quick symptom relief. We reached agreement on the treatment method but Ms. B stated that she hated to think back of the traumatic experiences, the details of which were indeed horrifying. Nonetheless, she did do her homework (listening to the audio taped version of the therapy sessions).
After the fourth session no progress seemed to have been made yet, as the scores on the self-report questionnaire for PTSD symptoms that she filled in every session were unchanged. Although I did not tell Ms. B, at that time I began to doubt that exposure therapy would help her. I noticed that I attributed this supposed failure of the therapy to the extremity and duration of the abuse.

Since the protocol for exposure therapy contains ten sessions, we continued therapy. When Ms. B came in for the fifth session, the scores on her homework showed that her anxiety had gone down for the first time after listening to the tapes. She confirmed this change, and told that she had also experienced fewer flashbacks during the past week.
Her improvement continued rapidly after this session. Her PTSD symptoms reduced and she was able to sleep and had fewer nightmares. She also reported that she experienced herself as more outgoing. She said she felt finally as a ''normal'' student; she went out with friends and had fun.

At the end of treatment we evaluated the therapy process. I mentioned the observation that I made at the start of treatment (her not being distracted) and Ms. B confirmed that she had a strong ability to stay focused, even when she was bothered by her PTSD symptoms. I wondered how her high level of attentional control might have contributed to the effect of therapy. But regardless of the mechanisms involved, this case illustrates the increasing awareness in clinical psychology that cognitive problems or strengths deserve more attention when diagnosing and treating patients.

Posttraumatic stress disorder

Posttraumatic stress disorder (PTSD) is a syndrome that may develop after exposure to a traumatic event. It is the only psychiatric disorder mentioned in the DSM-IV (APA, 2000) that is also defined by an etiologic factor. The event(s) have to involve life threatening danger or injury or have to have been physically threatening to oneself or others (for a description, see table 1). A subjective negative emotional reaction to the event is also part of the diagnostic criteria.

In the Netherlands, about 80% of all individuals experience one or more traumatic event(s) during lifetime. About 7% of these individuals develop symptoms as described in table 1 (De Vries & Olff, 2009). In the United States (US), about 90% of the population is exposed to at least one traumatic event during lifetime. Lifetime prevalence of PTSD is an estimated 6.8% (Kessler et al., 2005) to 9.2% (Breslau et al., 1998), depending on the nature of the traumatic event. Assaultive or interpersonal violence is associated with the highest rate of subsequent PTSD (20.9% chance). However, the type of trauma most likely to cause PTSD is the sudden unexpected death of a loved one; about 60% of all individuals in the US experience this type of event during lifetime, and the chance of consequently developing PTSD is 14.3% (Breslau et al., 1998).

Approximately 82% of all individuals diagnosed with PTSD fulfil the criterion of chronicity (duration at least three months) and about 74% continue to have symptoms after 6 months (Breslau, 2001). Median time to remission of PTSD is an estimated 24.9 months, and PTSD persists for more than 60 months in more than one third of the diagnosed cases (Breslau et al., 1998).

Of all patients diagnosed with PTSD, 92% also meet the diagnostic criteria of another Axis I disorder, e.g., major depressive disorder (MDD, 77%), generalized anxiety disorder (GAD, 38%), or alcohol abuse/dependence (31%; Friedman, Keane, & Resick, 2007). PTSD has a large impact on most patients; debilitating effects of the disorder are reported in several life areas (family, work, financial and health problems) (e.g., Foa, Keane, & Friedman, 2004).

Risk factors include biological factors (genetic factors, neuroendocrine responses), cognitive factors (e.g., premorbid intelligence, cognitive functioning and cognitive

biases) but also characteristics of the event(s), peri-traumatic responses, premorbid psychiatric diagnosis and family history, (a lack of) social support, and the experience of traumatic events in childhood (Brewin, Andrews, & Valentine, 2000; Ozer, Best, Lipsey, & Weiss, 2003, Bomeay, Risbrough, & Lang, 2012).

Treatment

Effective treatments for chronic post-traumatic stress disorder (PTSD) include pharmacotherapy (antidepressants) and cognitive-behavioral therapy (CBT) (Foa et al., 2004). CBT can be applied in several different ways and under different labels; most frequently used methods are exposure therapy (Dancu & Foa, 1992), cognitive processing therapy (Resick & Schnicke, 1993) and Eye Movement Desensitization and Reprocessing (EMDR; Shapiro, 1995).

However, a significant proportion of patients fail to respond or show only partial improvement (Sherman, 1998; van Etten & Taylor, 1998). Twenty-five to 45% of patients treated for PTSD continue to meet the criteria at the end of exposure treatment (CBT) (Van Minnen & Hagenaars, 2002). Although only a few studies on PTSD treatments examined exacerbation, results are not encouraging; rates as high as 10% in CBT are reported (Schottenbauer, Glass, Arnkhoff, Tendick, & Hafter Gray, 2008). Moreover, problems with treatment tolerability are common. Drop out rates vary from 21% (CBT) to 32% (antidepressants) (Hembree et al., 2003), and overall drop out rates from PTSD treatments range from 0 to 50% (Schottenbauer et al., 2008; Imel, Laska, Jakupcak, & Simpson, 2013).

One of the underlying reasons for suboptimal treatment outcomes is suggested in research into attitudes of PTSD therapists. It was observed that a significant proportion of clinicians feel uncomfortable or not capable when using exposure techniques (Van Minnen, Hendriks, & Olff, 2010). Infrequent use of this empirically validated intervention is likely to have negative clinical consequences.

The development of additional effective therapies for PTSD therefore seems imperative. For both clinicians and patients, therapy feasibility is an important focus in designing novel therapy approaches. Furthermore, recent theoretical developments in cognitive research offer promising insights in working mechanisms of anxiety which are currently applied to new treatments (Bomyea & Lang, 2012).

Information processing in PTSD

Criteria of PTSD

From a clinical perspective, all anxiety disorders are characterized by problems with attention and concentration. In PTSD, these phenomena are part of the diagnostic criteria (APA [DSM-IV-TR], 2000, see table 1). Problems in cognitive functioning are

Table 1. Diagnostic criteria for posttraumatic stress disorder according to the DSM-IV (APA, 2000)

Criterion A: stressor
The person has been exposed to a traumatic event in which both of the following have been present:

1. The person has experienced, witnessed, or been confronted with an event or events that involve actual or threatened death or serious injury, or a threat to the physical integrity of oneself or others.
2. The person's response involved intense fear, helplessness, or horror. Note: in children, it may be expressed instead by disorganized or agitated behavior.

Criterion B: intrusive recollection
The traumatic event is persistently re-experienced in at least **one** of the following ways:
Recurrent and intrusive distressing recollections of the event, including images, thoughts, or perceptions. Note: in young children, repetitive play may occur in which themes or aspects of the trauma are expressed.

1. Recurrent distressing dreams of the event. Note: in children, there may be frightening dreams without recognizable content
2. Acting or feeling as if the traumatic event were recurring (includes a sense of reliving the experience, illusions, hallucinations, and dissociative flashback episodes, including those that occur upon awakening or when intoxicated). Note: in children, trauma-specific reenactment may occur.
3. Intense psychological distress at exposure to internal or external cues that symbolize or resemble an aspect of the traumatic event.
4. Physiologic reactivity upon exposure to internal or external cues that symbolize or resemble an aspect of the traumatic event

Criterion C: avoidant/numbing
Persistent avoidance of stimuli associated with the trauma and numbing of general responsiveness (not present before the trauma), as indicated by at least **three** of the following:

1. Efforts to avoid thoughts, feelings, or conversations associated with the trauma
2. Efforts to avoid activities, places, or people that arouse recollections of the trauma
3. Inability to recall an important aspect of the trauma
4. Markedly diminished interest or participation in significant activities
5. Feeling of detachment or estrangement from others
6. Restricted range of affect (e.g., unable to have loving feelings)
7. Sense of foreshortened future (e.g., does not expect to have a career, marriage, children, or a normal life span)

Criterion D: hyper-arousal
Persistent symptoms of increasing arousal (not present before the trauma), indicated by at least **two** of the following:

1. Difficulty falling or staying asleep
2. Irritability or outbursts of anger
3. Difficulty concentrating
4. Hyper-vigilance

Exaggerated startle response

Criterion E: duration
Duration of the disturbance (symptoms in B, C, and D) is more than one month.

Criterion F: functional significance
The disturbance causes clinically significant distress or impairment in social, occupational, or other important areas of functioning.

included in all three symptom clusters. First, involuntary intrusive recollections can alter perception and disturb a normal sense of reality.
These experiences are often described as sensory, vivid flashes of the traumatic event, overwhelming normal cognitive processing and causing a sense of current ongoing threat (Ehlers & Clark, 2000). For a clinical example of severe re-experiencing, see the case description of Mr. X.

Mr. X

Mr. X is a 25-year-old student. He seeks treatment after being exposed to a violent attack in his house, during which he was held hostage by three masked men for a few hours. They were looking for drugs and when they could not find any, they threatened to kill him with their guns. He was badly injured with a knife. The police released him, but not after he thought he was going to die and said specific prayers related to dying. The police told him later that the attackers mistook him for his neighbor.

After the events, Mr. X was no longer able to sleep for more than three hours consecutively. He had severe nightmares and only slept during daytime, surrounded with weapons. At night, he would stay awake to watch over the house. He experienced intrusive recollections and he sometimes found himself fighting an imaginary attacker.

Mr. X was no longer able to concentrate and discontinued his studies soon after the event. He had severe memory problems. He forgot for example that he had to stop his study grant and as a consequence had to pay a large fine. His mother had to help him with his mail and she called him every morning to help him remember his appointments for that day.

Mr. X started treatment a year after the traumatic events. During intake he expressed serious doubts about the effects of therapy. He was preoccupied by his financial problems and asked for direct help with these problems. He also felt ashamed about seeking mental help for his problems. I observed that he had trouble sitting still on his chair and he could not concentrate when he had to fill in a self-report questionnaire for PTSD.
After three sessions preparing for exposure-based therapy, mr. X did not show up for his appointment. Despite several attempts, I was not able to reach him by phone, mail or letters, and he had to be considered a drop out. I contacted his general practitioner and informed him about the diagnosis and therapy drop out of mr. X. I also emphasized that mr. X should be encouraged to enter therapy again.

One of the criteria defining the second cluster of PTSD symptoms (i.e., pervasive avoidance) is a form of thought suppression; the attempt to avoid cognitions about the traumatic event(s). Furthermore, behavioral avoidance is often observed in

patients; most often places and people that remind of the occurred event(s) are no longer visited. Avoidance also comprises the inability to remember important aspects of the experienced events. Although research in this field is characterized by controversy and inconclusive evidence (e.g., recovered memories, dissociaton, see Bennet & Wells, 2010), this form of amnesia seems typically reported by individuals with early onset trauma (Goodman et al., 2003). In a recent study, memories of the worst moments of the experienced events were found to be disorganized (Jelinek et al., 2010). Interestingly, in clinical practice, a substantial amount of patients respond emotionally when they are asked whether they forgot details of the event(s); an often heard reaction is, ''I wish I could''.

The last cluster of PTSD symptoms is increased or excessive arousal, thought to maintain and even exacerbate other PTSD symptoms (Constans, 2005). One of the five criteria is concentration problems. In clinical practice, it is noticed that these symptoms often lead to severe impairments in (occupational) functioning. Although treatment can improve symptoms, clinical experience indicates that attention and concentration problems are still frequently reported at the end of treatment. For a clinical example of these problems, see the case description of Mrs. A.

Mrs. A

Mrs. A is a 32-year-old single mom. Her boyfriend had recently left her and she since then lost her job as a nursing assistant because she repeatedly forgot her work schedule. From the age of 4 she suffered from severe physical abuse from her stepfather that only stopped when she was sixteen and moved out of the house.

She did not show up for intake because she forgot the appointment. During the second appointment, Mrs. A wanted to keep her jacket on, although it was quite warm in the therapy room. She clearly had problems focusing on the questions framed and asked the therapist to repeat them several times. Mrs. A also was distracted easily and looked at the covered window of the room whenever she saw a shadow of a person passing by. She reported severe sleeping problems because she was afraid of nightmares when she would finally fall asleep. She also avoided getting close in relationships and she had never told anyone about the violence she had experienced in childhood. A decline in her symptoms had occurred when her boyfriend recently left her.

During therapy, Mrs. A had trouble telling about the occurred events, which was the main goal of treatment. Also, most of the time she forgot to listen to the audiotaped therapy sessions at home. We decided to take a pause in treatment and we first focused on practical ways to help her in doing her homework. Although after two sessions Mrs. A reported that she forgot less appointments and she was better able to do her homework, her concentration during the sessions seemed not improved when we continued exposure therapy.

However, mrs. A experienced significantly less sleeping problems after ten sessions. Furthermore, she finally confided in her best friend about the abuse of her stepfather. She felt she was doing much better, but she still was not able to read a book or watch a movie and stay concentrated, in the way she was before (e.g., at school). Extra sessions of exposure therapy did not bring about any further change. Mrs. A found a new job and together we discussed how to deal with her ''handicap''; the concentration problems. She would discuss this with her new boss, and she hoped that her being aware of these problems would help her to prevent mistakes. At the last appointment, two months after she started her new job, she reported that she still couldn't concentrate in the way she was used to. But the planned strategy was very helpful and she felt she was able to accept the remaining problem.

Hyper-vigilance is defined by excessive alertness and a constant attitude of being ''on guard''. Patients often display ''safety seeking behavior'', e.g., they check the locks in their homes continuously or sit with their back to the wall in public places to be able to oversee the room. This attentional vigilance for potential threat is thought to occupy working memory. Also, debilitating effects on the ability to focus attention are consequences of this alert mode; simply stated, an individual with these symptoms is constantly shifting attention away from goal-related information to inspect the surroundings.
Exaggerated startle response is another automatic reaction to (perceived) threat. The symptom seems determined by reflexive threat association, followed by a misinterpretation of the stimulus involved (looming, see below), which in turn activates a range of physiological reactions. The case description of Mr. V illustrates the clinical presentation of hyperarousal symptoms.

Mr. V

A 48-year-old male veteran seeks help for his trauma-related problems. He has served on two peacekeeping missions in Libanon and Bosnia. Especially in Bosnia, he experienced an intense form of helplessness when he had to witness the deportation of muslim men. Later he found out that the men were executed.

Since then Mr. V had trouble functioning in the army. He was aggressive and came in conflict with his superiors several times. He had trouble falling asleep and had nightmares every night, which in turn made him more irritable. He was on sickness leave for two years now. He felt alienated from his family and frequently visited internet discussions to find support from other veterans.

Mr. V mentioned feeling as if he was still living in a war zone. During long walks through the woods, to stay in shape, he would inspect his surroundings constantly. Small movements (e.g., a bird) would immediately lead to a feeling of being attacked. He also noticed that his perceptions were disturbed; one time during a walk, he had perceived a falling leave for a hand grenade and he had ducked to the ground.

During intake, the fire alarm unexpectedly went off. Mr. V jumped up, looked around, and inspected the room, with his back to the wall. Although almost immediately it became clear that the fire alarm was false, Mr. V was not able to continue the intake procedure because he felt very upset.
In the next appointment, we were able to finish the intake. But Mr. V indicated that he was very angry about what had happened during the first appointment. He wandered if this would happen again during treatment (''this is very unprofessional in a clinical setting'', he stated) and my reassurance did not seem to make a difference. He was referred for exposure therapy to a colleague, but I found out a few weeks later that he had ended therapy prematurely.

Cognitive phenomena in PTSD

Many cognitive experimental studies have also reported attention (and memory) abnormalities in PTSD (for reviews, see Buckley, Blanchard, & Neill, 2000; McNally, 2006, Moore, 2008). These difficulties appear to be related to both the development and the maintenance of the disorder. In addition, cognitive impairments might have negative effects on therapy outcome (Buckley et al., 2000).

Memory deficits

Many forms of memory dysfunction have been examined in PTSD. The most consistent finding is that PTSD is associated with poor verbal memory (Brewin, Kleiner, Vasterling, & Field, 2007; Ferreri, Lapp, & Peretti, 2011). It is hypothesized that executive control may buffer against these specific memory problems which are developed immediately after exposure to a traumatic event (Vasterling, Brailey, Constans, & Sutker, 1998; Johnson & Asbjornsen, 2009). Other evidence indicates that reduced verbal memory is a pre-existing risk factor for PTSD (Moore, 2008).
Another memory process associated with PTSD is autobiographical memory (for a review, see Moore & Zoellner, 2007). Patients with PTSD tend to have difficulties in producing specific, personal memories, and instead generate more overgeneral memories. This memory bias is also found to be related to depressive disorders (Williams et al., 2007). Since depressed individuals are not capable of retrieving specific positive personal memories to counteract against their negative personal schemata activated by the depressive symptomatology, impaired autobiographical memory might also maintain depression. There is considerable evidence suggesting that memory impairments in general are (co-)dependent of comorbid depressive symptomatology, or related to symptoms that are overlapping in depressive disorder and PTSD (Moore, 2008; Johnson, Kanagaratnam, & Asbjornsen, 2008b; Johnson & Asbjornsen, 2009).

Attentional biases

Automatic threat processing

Patients with anxiety disorders demonstrate distinctive patterns of attentional bias (AB); attention is drawn automatically to information relevant to patients' current concerns (MacLeod, Campbell, Rutherford, & Wilson, 2004; Yiend & Mackintosh, 2004). This tendency is thought to consume valuable cognitive resources and strong evidence exists that this bias is associated with anxiety vulnerability, although AB tends to be smaller or even absent in recovered anxiety patients after treatment (Bar-Haim, Lamy, Pergamin, Bakermans-Kranenbrug, & IJzendoorn, 2007).

AB has been demonstrated in many anxiety disorders to the extent that in a meta-analysis, the authors state: ''With over 150 studies that have established the existence and typical magnitude of the threat-related bias in anxious individuals from different populations and with a variety of experimental conditions, it appears as if little will be gained from additional studies of threat-related bias […]'' (Bar-Haim et al., 2007, p. 18).

Different paradigms have been used to measure AB. One of the most widely used tasks is the Emotional Stroop Task (EST, Devineni, Blanchard, Hickling, & Buckley, 2004). In this task, emotional and neutral words are presented consecutively in different colors on a computer screen. Participants are required to name the color of the presented words as quickly as possible. Anxious individuals name colors of negative and threatening words which are relevant to their conditions more slowly than colors of neutral words. AB is then defined as the difference in reaction times needed to name the color of the emotional and the neutral words (interference). This interference is thought to represent increased selective attention to the anxiety-related information, at the cost of task-relevant processing (i.e. colour-naming). Williams and colleagues (1996) concluded that the effect size for AB in PTSD appeared to be much larger than in any other anxiety disorder. A more recent meta-analysis of data of all existing studies on AB in PTSD based on 22 studies (of which 19 EST studies) showed an effect size of 0.36 (small to moderate)(Bar Haim et al., 2007).

Over the years, the EST has been criticized. In particular, it was pointed out that the increase in interference could arise from several non-attentional processes (MacLeod, Mathews, & Tata, 1986; Harvey, Watkins, Mansell, & Shafran, 2004). For example, a longer response time to the stimulus may reflect a mood-dependent response bias of the participant. MacLeod, Mathews, and Tata (1986) adapted the Dot-probe task (DPT; Posner, Snyder, & Davidson, 1980) to measure AB in a more direct way. The DPT is regarded as a better method for measuring selective spatial attention, because it is indexed by a shorter response time and does not suffer from interpretative difficulties (Harvey et al., 2004). Nowadays, multiple different but conceptually similar DPT's exist. In the most widely used adaptation of the DPT (Mathews & Macleod, 2002), two words (one neutral and one threat-related word) are presented simultaneously for 500ms, one above and one below the fixation

location. The next screen shows a target in the spatial location of either word. In half of the trials the target appears in the location of the threat-related word, and in half of the trials in the location of the neutral word. Participants are instructed to discriminate the target as fast as possible by pressing one of two response keys.

Figure 1. Schematic example of one trial of the Dot-probe test

Note: time in milliseconds

Figure 1 is an example of a trial with pictorial stimuli (see chapter 2). If attention is drawn towards threat-related information, reaction times will be shorter in trials
drawn towards threat-related information, reaction times will be shorter in trials where the target replaces the threat-related word (a so-called congruent trial) than in trials where it replaces the neutral word (an incongruent trial). AB score is calculated by deducting the mean reaction time to congruent trials from the mean reaction time to incongruent trials; a positive bias score reflects AB toward threat-related stimuli (vigilance), and negative congruency scores reflect attentional avoidance of threat.

Research shows that participants with pathological anxiety, as well as non-clinical individuals with high trait anxiety, are quicker to detect the probe in the same spatial location as the threatening word than to detect the probe in the spatial location of the neutral word (Mathews & Macleod, 2002). Individuals with PTSD after a motor vehicle accident also demonstrated AB to mildly threatening words (Bryant & Harvey, 1997). However, in another study, no significant group differences in AB on the DPT were observed among patients with PTSD, trauma victims with acute stress disorder (ASD) and healthy controls (Elsesser et al., 2004). Moreover, AB as measured with the DPT was not demonstrated in recent trauma victims and AB also was not found to predict PTSD symptom development after trauma (Elsesser et al., 2005).

Mathews and MacLeod (2002) were the first who tried to induce AB. The participants in their study were students with medium range trait anxiety. The

training task was an adapted version of the DPT described above. In the positive training condition, the probe always appeared in the location of the neutral word. In the negative training condition, the probe almost always appeared in the location of the threatening word. Positive and negative biases were successfully induced.
MacLeod, Rutherford, Campbell, Ebsworthy, and Holker (2002) did a similar experiment, also with middle range trait anxiety students. A stress task was added before and after the training session, to investigate if the training influenced emotional vulnerability. The results of Mathews and MacLeod (2002) were replicated: positive and negative AB was successfully induced. Furthermore, compared to the negatively trained group, the group in the positive training condition showed a smaller increase in anxious mood during the stress task. These results suggested that AB can be trained, and that AB *causally* affects emotional vulnerability. Based on these results, the first clinical trials into the effects of attentional bias modification (ABM) in anxiety disorders were initiated (Amir, Beard, Burns,& Bomyea, 2009a; Amir et al., 2009b, Schmidt, Richey, Buckner, & Timpano, 2009, see below).

Effortful threat processing
The first studies on sustained attention in PTSD were based on neuropsychological tests. Compared to veterans without PTSD, veterans with PTSD were found to be less capable maintaining focused attention (Vasterling, 1998; Vasterling, 2002).
Recent theories (see below) suggest that attentional control (AC) might be of much importance in the regulation of attentional bias (Eysenck, Santos, Derakshan, & Calvo, 2007; Derakshan & Eysenck, 2009). AC is defined as the ability to use voluntary and effortful attention to constrain cognitive and affective responses to emotional stimuli (Derryberry & Rothbart, 1997). It is hypothesized that AC is a top-down regulatory process, whereas AB can be seen as a habitual, reflexive response to threatening stimuli. Derryberry and Reed (2002) developed the Attentional Control Scale (ACS), a self-report questionnaire measuring AC, to investigate such issues. They observed that AB in high trait anxious participants was moderated by their self-reported AC. High AC in anxious participants was found to limit the impact of threatening information (Derryberry & Reed, 2002).
Several experimental studies also focused on the link between involuntary intrusion, AB and AC. For example, a significant relationship between AC and unwanted memories was found in undergraduate students, independent from trait depression and coping styles, suggesting a unique contribution of AC to this PTSD-related phenomenon (Verwoerd & Wessel, 2007).
Verwoerd, De Jong and Wessel (2008) asked a small group of students to keep a diary for a week after watching a stressful film fragment. Results demonstrated that low AC predicted self-reported intrusive recollection. In a next study (Verwoerd, Wessel, De Jong, & Nieuwenhuis, 2009), ''pre-film'' AC predicted the relationship between later preferential processing of threatening stimuli and intrusive

recollection. The authors suggest that individual AC can influence the development of AB related to traumatic events, by inhibiting intrusive recollection.
In another analogue study (Bardeen & Orcutt, 2011) the relationship between AC, AB (as measured with the DPT) and PTSD symptoms were investigated in a student sample. AC was found to moderate the relationship between symptoms and AB. Participants low in AC and high in symptoms demonstrated AB (vigilance), also identifying low AC as a risk factor for AB in PTSD.
Taken together, accumulating laboratory evidence suggests that AC might play a role in PTSD, possibly through inhibiting unwanted intrusive memories, and/or by attenuating automatic attentional reactions in the aftermath of a traumatic event. Although multiple risk factors for PTSD are identified (see above), little is known about the underlying mechanisms. Research into the role of AC in the development of AB and intrusions in the aftermath of trauma can add importantly to this field. More specifically, replication of the abovementioned analogue results in clinical trials would strengthen the recent theoretical considerations on the significance of strategic information processing in anxiety.

Cognitive biases

There is compelling evidence that cognitive biases contribute to PTSD. Negative perceptions of the self and/or of the world are linked to PTSD (Foa et al., 2004) and multiple theoretic models indicate that these negative cognitions account for the sense of ongoing threat that characterizes PTSD patients (e.g., Ehlers & Clark, 2000, Janoff-Bulman, 1992).
Recently, focus in research on cognitive biases is shifting towards cognitive styles and metacognitions to explain the development and maintenance of PTSD symptoms. For example, specific negative attributional styles are found to be related to symptoms of PTSD in both cross-sectional and longitudinal studies. Rumination and looming cognitive style (the anticipation that threatening stimuli are rapidly approaching and intensifying) are also marked as cognitive vulnerability factors in PTSD (for an overview, see Bomeay et al., 2012).
An example of metacognition – the thoughts and beliefs about one's thoughts and beliefs – is anxiety sensitivity (AS); the fear of fear and of anxiety related symptoms. AS is also considered as a vulnerability factor in the development of PTSD (Bomyea et al., 2012). In a prospective design, AS was measured before childbirth and found to predict PTSD postpartum (Keogh, Ayers, & Francis, 2002). Moreover, AS measured immediately after a traumatic event predicted subsequent PTSD symptom severity, independent from early symptom development (Marshall, Miles, & Stewart, 2010), (for a review on AS and PTSD, see Elwood, Hahn, Olatunji, & Williams, 2009).

Information processing theories

Cognitive theories on PTSD

Several theoretical models on cognitive processing in PTSD have been proposed in the past three decades (e.g., Ehlers & Clark, 2000, Resick & Schnicke, 1993; Brewin, Dalgleish, & Joseph, 1996). One of the most influential is emotional processing theory (EFT, Dancu & Foa, 1992). According to this theory, patients with PTSD develop pathological fear networks related to the traumatic event(s). When one trigger activates this network, a pattern of fear reactions is enrolled. Moreover, it is hypothesized that in PTSD a large set of stimuli can activate the complete fear network (i.e., lead to all PTSD symptoms), and this leaves an individual extremely vulnerable to outside stimuli (Foa, Steketee, & Rothbaum, 1989).
Exposure therapy was hypothesized to weaken the associations in the network in the absence of expected outcomes (i.e., the traumatic events); a process of unlearning. More recent evidence suggests an inhibiting role of new pathways formed through therapy, preventing the range of stimulus-driven fear reactions (McNally, 2007). Consequently, as Bardeen & Orcutt (2011) suggest, although emotional processing theory has contributed largely to the understanding of PTSD by accounting for the bottom-up, reflexive processing, more elaborated models are necessary that incorporate top-down threat processing.

Recent models for anxiety: dual process model for anxiety and attention control theory

Ouimet, Gawronski, and Dozois (2009) propose a dual process model to account for both associative, automatic information processing in anxiety and more rule-based, strategic cognitive functioning. Instead of focusing on a specific form or stage of information processing (e.g., attentional vigilance or avoidance or cognitive biases), the model integrates these phenomena into either an automatic or a strategic system. Individual differences in central executive functioning are proposed to function as a vulnerability factor; e.g., limited attentional control can influence the rule-based system. Instead of inhibiting activated threat associations, an individual is more likely to act on these associations in a fear-driven way (both behaviorally and cognitively). A focus on enhancement of executive functioning is suggested as a useful strategy for improving therapy in anxiety disorders.
Attentional control theory (ACT; Eysenck, Santos, Derakshan, & Calvo, 2007) was designed to explain the effect of anxiety specifically on attentional control, not on all cognitive performance. The underlying central assumption is that the effect of anxiety on attentional processes is crucial in understanding impaired cognitive performance (efficiency). Attentional control comprises attentional focus, which renders an individual capable of inhibiting distractions by task-irrelevant stimuli, and attentional shifting. Shifting is the ability to flexibly switch attention between and within tasks (Derakshan & Eysenck, 2009).

Anxious individuals then tend to be distracted by task-irrelevant emotional information more easily (i.e., demonstrate AB). Anxiety is also considered to affect the attentional inhibition function, while inhibition of task-irrelevant distraction is crucial to remain focused and/or ''correct'' AB. In this way, anxiety disrupts the balance between two ways of information processing. Bottom-up processing (i.e. AB) is increased while top-down processing is decreased. In an individual facing threatening stimuli, this leads to debilitating effects; inhibition of the attentional bias is disrupted while reflexive attentional processing is enhanced.
Although ACT is set up as a conceptual framework to understand different levels of information processing, it is not clear on how these two processes interact. For example, is high ability to control attention thought to buffer against the development of AB? Empirical research into the relationships between the two systems may further clarify this interaction.

Process focused therapies

Inspired both by theoretical as well as experimental evidence, novel therapies have recently been developed with a focus on cognitive processing, both on the automatic and strategic aspects. In this thesis, we investigate the effectiveness of two of these new treatments in patients with PTSD.

Attentional bias modification

Several studies have investigated the role of attention training in clinical samples. In a randomized controlled trial (RCT), Schmidt and colleagues (2009) assigned 36 patients with general social phobia (GSP) to ABM or a control condition. At post-treatment, 72% of the participants in the ABM condition no longer met diagnostic criteria for GSP, compared with 11% of participants in the control group. These results were maintained at four-month follow up (Schmidt et al., 2009). In another RCT (Amir et al., 2009a), 44 GSP patients were randomly assigned to ABM or a placebo condition. Interviewer ratings of Social Avoidance showed a remarkable decline after treatment, and treatment gains were maintained during a follow up period. Importantly, change in symptoms in the training condition was related to change in AB.
Amir and colleagues (2009b) also examined the effects of ABM in patients with generalized anxiety disorder (GAD). In this study, fifty percent of participants in the training condition were classified as responders, compared with 13% of the participants in the placebo condition.
In summary: there are reasons to expect that ABM can reduce AB and that ABM can influence clinical symptoms. Three clinical studies with 8 or more sessions of ABM

claim a reduction of social or general anxiety symptoms. Since AB is also observed in PTSD (see above), we aimed to investigate the effects of ABM in PTSD in a large RCT.

Mindfulness-based cognitive therapy

In 1995, when mindfulness interventions were first introduced as psychological treatments, they were referred to as ''attentional control training'' (Teasdale, Segal, & Williams, 1995). Later on, mindfulness-based cognitive therapy (MBCT) (Segal, Williams, & Teasdale, 2002) was developed; a manualized 8-week treatment program firmly based in cognitive theory of depression. The model assumes that recovered depressed patients differ from never-depressed people in that when the former group experiences dysphoria, depressogenic thinking patterns are more likely to be activated, which may ultimately lead to relapse (Teasdale et al., 1995). In MBCT, patients learn techniques to turn attention towards potential difficulties instead of avoiding, combined with an attitude of acceptance. Thus, MBCT aims at reducing relapse risk by increasing awareness of negative thinking patterns and by promoting the disengagement from ruminative thinking, which is also a core problem in PTSD. In this way, MBCT might also be a promising treatment for PTSD, since the focus of treatment is specifically on enhancing attentional control combined with decreasing maladaptive metacognitive patterns through acceptance.
Two meta-analyses concluded that MBCT is an effective treatment for patients with recurrent depression (Piet & Hougaard, 2011; Fjorback, Arendt, Ørnbøl, Fink, & Walach, 2011). However, MBCT seems beneficial for patients with two prior episodes, but not in patients with three or more prior episodes of depression. Ma and Teasdale (2004) investigated the role of adverse childhood experiences in an attempt to explain this difference in effect. Patients with three or more episodes were found to be more characterized by adverse childhood experiences (abuse and/or indifference) compared to patients with two episodes. Supposedly, the autonomous cognitive and affective ruminative processes that are often experienced in this population are disrupted by mindfulness techniques (Ma & Teasdale, 2004).
Kabat-Zinn and colleagues (1992) also found that mindfulness-based stress reduction (MBSR, on which MBCT is based) has significant positive effects on symptoms of anxiety disorders (GAD and panic disorder, PD), both at post-treatment and at 3-month follow up. In addition, a recent meta-analysis (Chiesa & Serreti, 2011) concluded that treatment augmented with MBCT has a beneficial effect on symptoms of PD, GAD and bipolar disorder in remission.

Research aims

The present project is concerned with the testing and implementation of two novel treatments that have recently been developed in the field of anxiety disorders and depression, respectively.
ABM is the translation of experimental psychological findings in anxiety disorders into a treatment program. The central question of this study is: is ABM more effective than the control condition in changing AB and alleviating PTSD symptoms in patients with PTSD? In a RCT, participants will be asked to follow 8 sessions of ABM (training or control/placebo condition). In a following case series we examined a personalized version of ABM, based on the same hypotheses.
The relationship between AB and AC will be investigated in the same patient group, to examine whether the earlier mentioned relations between these two types of information processing can be replicated in a clinical sample.
We will examine the associations between the different potential working mechanisms (mindfulness skills and metacognitions) and PTSD symptoms in a cross-sectional study with PTSD patients. Next, we will investigate an adapted version of the MBCT protocol of Segal and colleagues (2002) in a pilot study with PTSD patients.. Our focus is to explore the feasibility, safety and the effect of MBCT on symptoms of PTSD.

Outline of this thesis

In Chapter 2, results of a large RCT for ABM in PTSD are reported Chapter 3 is concerned with the association between AB and AC in PTSD patients. Chapter 4 is the report of a case series in male veterans with PTSD, in which we tested individualized ABM. The next chapter concerns a cross-sectional study on the relation between mindfulness skills, reactivity and PTSD symptoms. Chapter 6 describes a pilot study (case series) on the effect of MBCT in patients with PTSD. The last chapter contains a summary and general discussion of the main findings, clinical implications and directions for future research.

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