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Cognitive bias modification-attention: training at home with multiple sessions

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Abstract

Anxiety disorders are the most frequently occurring psychiatric disorder in the United States (Beard, 2011). One type of treatment, Cognitive Bias Modification for Attention (CBM-A), has been shown to be an effective alternative for those who do not benifit other popular treatments (Ballinger, 2004). People with high levels of anxiety have a higher attention bias towards threatening information in the environment and CBM-A training works to reduce that attention bias towards threat, and in turn, reduce anxiety (Bar-Haim, 2010; Browning, Holmes, & Harmer, 2010; Hakamata, Y., Lissek, S., Bar-Haim, Y., Britton, J. C., Fox, N. A., Leibenluft, E., & ... Pine, D. S., 2010; Yiend & Mackintosh, 2004). However, it is unclear if CBM-A training is effective when completed outside of the controlled lab environment. The aim of this study was to further explore the possibilities of using multiple sessions of CBM-A in the home setting as a method of reducing attentional bias and trait anxiety. Participants consisted of 43 undergraduate psychology students at Eastern Washington University. Participants completed 6 daily sessions of CBM-A at home (or an equivalent control task), and their levels of anxiety were measured pre and post training in an on-campus lab setting. The results show a reduction in trait anxiety for those who received CBM-A training, but no indication of a change in attentional bias for either the control or experimental group regardless of the number of training sessions completed. Though the current study does lend some support to the idea that CBM-A training in the home environment may be helpful for reducing anxiety, further work is needed to explore how CBM-A training in the home can impact attention bias and what impeding its effectiveness as well as what tasks are appropriate for measuring an attention bias.

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We have all experienced anxiety symptoms such as muscle tension, sweating, or stomach discomfort. This anxiety is designed to aid us to cope with a threat and is a normal reaction to a stressful situation. However, anxiety becomes problematic when it overwhelms us, impacts our ability to function in daily life, is experienced in the absence of real threat, or does not dissipate in the absence of the threat. As a whole, anxiety disorders are the most frequently occurring psychiatric disorder in the United States. (Beard, 2011). There is a continuing need for improvement to current available treatments for anxiety disorders, which will be described further later, and a number of people for whom current treatments are not available or not effective for one reason or another (Arch & Craske, 2009). For those who have access to available treatments such as Selective Serotonin Reuptake Inhibitors (SSRI's) or Cognitive Behavioral Therapy (CBT), some may have concern about the treatment or find it is too demanding. (Arch & Craske, 2009; Pine, Helfinstein, Bar-Haim, Nelson, & Fox, 2009). Also, not all those who complete treatment achieve remission with treatments such as CBT (Ballinger, 2004). Is there an alternative at home treatment that could fill in the gap in traditional treatment success and accessibility for those who suffer from anxiety? One potential alternative is Cognitive Bias Modification for Attention (CBM-A). This treatment works by targeting the automatic attentional biases towards threatening information associated with high anxiety. These attentional biases can be quickly and easily modified with CBM-A training making it ideal for use in the home setting.

Anxiety and the Stress Response

In order to know how to treat anxiety disorders, one must first understand the impact of anxiety on our bodies and brains and what elevates normal anxiety to unmanageable levels. If sensory information is perceived as threatening, our amygdala (where our emotional memories, including fear memories, are stored) signals an alarm, setting in motion physiological responses. Triggering the stress response system activates the hypothalamic-pituitary-adrenal (HPA) axis, which leads to physiological and neuroendocrinological changes in our bodies (Dandeneau, Baldwin, Baccus, Sakellaropoulo, & Pruessner, 2007). Our limbic system (part of our midbrain involved in survival) begins a process that enables us to react to the perceived threat Stress hormones, such as epinephrine/norepinephrine, are released to mobilize our bodies to react. We become hypervigilant, our heart rate increases, we experience a rush of energy, and our bodies are otherwise primed to react instinctually to protect ourselves. If protection is no longer necessary, or when we have adequate/excess amounts of hormones such as cortisol, a negative feedback loop is triggered which reduces the output of regulatory hormones and brings our mind and body back to normal (Rothschild, 2000).

When Does Stress/Anxiety Lead to an Anxiety Disorder?

Although we have learned a great deal about how the body and brain react to threats, we do not fully understand why some people develop anxiety disorders and others do not. While the threat response is necessary for our survival, for some people, it can be problematic by becoming too easily triggered or in other ways dysfunctional. These individuals seem much more hypervigilant, much more likely to perceive stimuli as threatening, and have more difficulty getting their bodies and brains to return to the state

they were before their threat system was activated (Dickerson & Kemeny, 2004). Some believe a vicious cycle takes place where the perceptions of threat lead to a stress response, which then reinforces the individual to be more vigilant to future threat (Mikulincer, Shaver, & Pereg, 2003; Beard, 2011). Compton (2003) theorized that hypervigilance is produced by the limbic system becoming sensitized to threat and that hypervigilance is evident across a range of stimuli, including visual images and threat-relevant words (Bradley, Mogg, Falla, & Hamilton, 1998; Ellenbogen, Schwartzman, Stewart, & Walker, 2006; MacLeod, Mathews, & Tata, 1986).

Individuals who are hypervigilant will have a higher expectation of threat and will therefore be constantly scanning the environment watching for any indication of danger and will be more likely to interpret ambiguous stimuli as threatening (Beard, 2011). In some instances, this occurs in reaction to particular situations or to precise triggers such as with specific or social phobia. For instance, if an individual is especially hypervigilant toward social threat, they may be much more likely to notice a group of people who are standing together whispering or laughing and to perceive them to be whispering or laughing at them. Having their attention particularly sensitive to social threat and thus identifying more instances of perceived threat may then reinforce their perceptions of themselves or other people and increase their isolating behavior. In other instances, the response is generalized on a larger scale such as with generalized anxiety disorder or post-traumatic stress disorder. This leads such individuals to have a constant awareness and suspicion of even ambiguous sensory information and the sights, smells, and sounds they take in are more likely to lead to the perception of threat even where none exists.

When the threat system becomes sensitized, individuals tend to have a strong attention bias (Dandeneau, et al., 2007). They will become hypervigilant and pay attention to the information in the environment which is perceived as threatening while ignoring the information which does not trigger their threat system. For example, if an individual who has social phobia were to give a speech, they would be more likely to focus their attention on those in the audience who are frowning while not attend to those in the audience who are smiling. This perception of threat would lead to increased anxiety and again to increased sensitivity to threat, thus creating a vicious cycle. These attentional biases are believed to both create a vulnerability for disorders and to maintain such disorders (Beck, 1976, 2008; Eysenck, 1992, 1997; MacLeod & Mathews, 2005; Rapee & Heimberg, 1997). The more we perceive things in our environment as threatening, the more we attune to that threatening information and the more that information supports are perceptions and beliefs about the world. This cycle can lead to the development of anxiety disorders. Subsequently, individuals with these disorders continue to take in information which enforces the perception of threat and thus, maintains the anxiety disorder (Beard, 2011).

Current Treatments

Most who seek treatment try to manage their anxiety through psychopharmacological methods and/or psychotherapy techniques. One way to reduce anxiety quickly is to directly target the neurological dysfunction related to anxiety through the use of psychiatric medications (e.g., SSRIs). SSRIs are the most commonly used medication for the treatment of serotonin deficiencies, a deficiency often experienced by those who suffer from anxiety. SSRIs work by blocking the reuptake of serotonin after synapse

between neurons has occurred. This increased concentration of serotonin allows for an increased absorption of serotonin, thus improving communication between neurons in the brain. SSRIs have been shown to be effective in reducing anxiety (Gould, Otto, Pollack, &Yap, 1997); however, the effects only last as long as the medication continues and there are potential side effects such as low sex drive, uncomfortable withdrawal symptoms, the triggering of a manic episode for individuals with bipolar disorder, and an increased risk of suicide in younger patients. Additionally, it can take between 4 to 6 weeks for the effects of SSRIs to reach maximum efficacy (Schiffman, 2011).

For those who wish to manage their anxiety therapeutically rather than through medications, CBT has been shown to be the most effective evidence-based treatment (Baldwin, Buis, & Mayers, 2001). CBT works to reduce anxiety by changing the thoughts and behaviors that lead to increased anxiety through client education about fear and anxiety, self-monitoring of symptoms, teaching relaxation and coping techniques, and exposure to feared stimuli in order to break the link that has been established between the stressor and anxious response. These techniques have been shown to be effective in reducing anxiety (Wells, 2000; Williams & Kuyken, 2012); however, these approaches rely on verbal dialogue and explicit instruction to change cognition. For example, with cognitive restructuring, clients will examine their beliefs to determine if they do hold up to reality. This requires the individual to examine all the evidence, determine its validity, and to try to work towards identifying previously ignored evidence that refutes their beliefs. These cognitive beliefs are often rooted deeply and a therapist must continually walk the client through this process of examining and challenging their cognitions in order to produce noticeable change. Because attentional biases towards

threat are often automatic in nature, they are not always under volitional control. Thus, they may be more efficiently and directly modified via repeated experiential practice on tasks that require rapid processing (Beard, 2011) such as what is used with CBT-A. Research suggests it may be possible to interrupt the threat response cycle by modifying the stage of initial attention to threat and recent findings have indicated that these attention biases are subject to experimental modification (Dandeneau, et al., 2007).

While both SSRI's and CBT have shown efficacy with anxiety disorders, neither CBT nor pharmacotherapy helps all individuals, and some of those who are helped remain somewhat symptomatic; the limitations of these therapies are also compounded by refusal to seek out treatment and high dropout rates for those who do begin treatment (Foa, Franklin, & Moser, 2002). While CBT is effective in reducing anxiety, it involves in-depth instruction and practice in changing the way the individual thinks and behaves. On the other hand, CBM-A involves little instruction or practice and focuses on working to reduce the automatic attentional biases associated with anxiety rather than the interpretative aspects. Due to the simplicity involved in training with CBM-A it can be made available to clients in their homes which could reach those who are not seeking out or completing treatment in the therapeutic setting.

Cognitive Bias Modification for Attention

Cognitive bias modification for attention (CBM-A) is a treatment that has been shown to impact attentional biases through rapid processing tasks. CBM-A works by having an individual repeatedly tune their attention to non-threatening stimuli while ignoring threatening stimuli. For example, a modification task may have individuals quickly

identify the smiling face in a panel of frowning faces. Doing such a task repeatedly helps to break an individual's inclination to attend to the threatening information (the frowning faces). This effect has been shown to cross over to other threatening information so that individual will not only be less likely to tune their attention to frowning faces in the future but also to other threatening information such as negative words (Dandeneau & Baldwin, 2004). There has been much research with results that provide credence for the effectiveness of CBM-A both on changing our attentional bias to threat and for decreasing vulnerability and maintenance of anxiety (Bar-Haim, 2010; Browning et al., 2010; Hakamata et al., 2010; Yiend & Mackintosh, 2004). Past research has shown a link between experimentally manipulated processing biases and emotional vulnerability. Inducing attentional bias towards threatening information increases vulnerability to anxiety (MacLeod, Rutherford, Campbell, Ebsworthy, & Holker, 2002), while reducing these attentional biases decreases vulnerability to anxiety.

Studies have demonstrated that CBM-A reduces attentional biases and anxiety even after only one session (Hakamata et al., 2010). Multisession CBM-A treatments have shown preliminary efficacy when applied to social and generalized anxiety disorders. For instance, after seven daily sessions of CBM-A training participants in one study demonstrated a decrease in attentional bias and some reduction in self-reported anxiety symptoms compared to a control group (LI, Tan, Qian, & Liu, 2008). In another study, after five weekly sessions of CBM-A training with high worriers there was a significant reduction in attention bias and reduced self-reported anxiety and depression scores (Hazen , Vasey, & Schmidt, 2009). A meta-analysis reviewing 12 Randomized Control Trials (RCTs) in 467 participants found a statistically significant medium effect of CBM-

A training on reducing anxiety compared to control groups (Hakamata et al., 2010). Many studies have examined the effect of CBM-A training on anxiety following a stressor both simulated in lab setting and naturally occurring. These studies have found a reduction in attentional bias (as measured by a dot probe task) and in state anxiety (as measured by a number of inventories) following CBM-A training (Dandeneau, et al., 2007; See, J., MacLeod, C., & Bridle, R., 2009; MacLeod et al., 2002; Eldar, S., Ricon, T., & Bar-Haim, Y., 2008).

When evaluating only the effect sizes of RCT's conducted in clinical settings (as opposed to an at home setting), the effect on anxiety reduction was comparable to those observed for cognitive behavioral therapy and medications such as SSRI's (Hakamata et al., 2010). There was also a large positive correlation between effect sizes on attention bias change scores and on anxiety change scores suggesting CBM-A reduces anxiety through by reducing attentional bias. The results also showed a greater impact on trait anxiety (a person's general level of anxiety) with results indicating greater reductions in trait anxiety levels than state (a participants currently rated anxiety level). This gives hope that CBM-A may be able to reduce a person's enduring anxiety by creating buffers for future stress and thus perhaps decrease anxiety levels in those with anxiety disorders or general high anxiety (Hakamata et al., 2010).

Barriers to Treating Anxiety Disorders and a Potential Solution

One current barrier to treating those with anxiety disorders is lack of accessibility to treatment. Only about one third of those who suffer from anxiety seek out or manage to access treatment (Amir & Taylor, 2013). Perhaps the barrier is financial or perhaps it is

the very anxiety plaguing the patient that is keeping them from being able to seek help or complete therapy. Regardless, one way to address this barrier is to bring the treatment to the patient. This can be done with training that can be completed online or via phone or other device the patient can access at home. Because CBM-A does not require much instruction, it is ideal for such a purpose. Research has begun to investigate CBM-A's effectiveness in such settings (Carlbring et al., 2012). CBM-A training at home could be downloaded as an app on multiple devices and appear in a game type format. Those with such apps already available, such as Mind Habits, allow participants to create their own profile where they can sign in and complete the training, monitor their progress, and learn about how the app works through their interactive web site ("MindHabbits", 2008). This particular site is advertised for the purpose of improving self-esteem and attention bias. One of the apps available through the site is a task called the find-the-smile app. The find-the-smile app has been used in a number of studies which evaluated its effectiveness for reducing attentional bias and anxiety (Dandeneau & Baldwin, 2004; Dandeneau, et al., 2007; and Dandeneau & Baldwin, 2009).

Past research using CBM-A Training

Dandeneau and Baldwin (2004) explored how the find-the-smile app could be used to reduce attentional bias. They first used the find-the-smile task to suggest that low self-esteem participants who performed the repetitive task would later show reduced attentional bias toward rejection words. Participants were instructed to examine a four by four matrix panel of sixteen faces and locate the one smiling face out of the fifteen frowning faces. Using a touch-screen panel, they were instructed to choose the smiling face as quickly as possible for a total of 112 training trials. This app works by training

participants to inhibit their attention to rejection stimuli as they focus attention on the positive stimuli, which in turn, reduces their attentional bias towards rejection. Participants in the control condition completed the find-the-flower which is identical to the find-the-smile condition except instead of searching for a smile amongst frowning faces, the participant must search for the five-petaled flower amongst the seven-petaled flowers.

Directly following CBM-A training, a Rejection Stroop Task was used to measure participant's level of attention bias for rejection versus acceptance words (Dandeneau & Baldwin, 2004). Thirty-six stimulus words were divided into three categories; 12 rejection words (such as unwanted and neglected), 12 acceptance words (such as welcomed, wanted, and liked), and 12 non-interpersonal words of mixed valence (meaning mixed rejection, acceptance, and non-interpersonal words such as spoon, pain, and happy). On each of the trials, a target word was randomly presented in one of four colors (red, blue, green or yellow), and the same color was never presented on two consecutive trials. The 144 trials were presented in four blocks of 36 trials. Participants were instructed to look directly at the word presented on the screen and to name the ink color of the word as quickly as possible. It was expected that those with greater attentional bias towards rejection words would take longer to name the ink colors compared to acceptance words. In line with this hypothesis, those with low self-esteem were found to have greater attentional bias and more interference from rejection words then acceptance words. Participants with low self-esteem who completed CBM-A training (find-the-smile app) had a reduction in attentional bias and had less interference from rejection words compared to those who completed the find-the-flower app.

(Dandeneau & Baldwin, 2004). Thus, the results of this study suggested it is possible to measure a person's attention bias and to modify their attention bias through CBM-A training.

Dandeneau et al. (2007) also sought to test whether the use of attentional training tasks, such as the find-the-smile app, could reduce the experience of stressful situations in the real word by directing attention away from rejection-related information. Past research has found that individuals who consistently experience anxiety in stressful situations tend to anticipate failure and negative evaluation, which in turn, become significant threats to their self-esteem (Schlenker & Leary, 1982). In Experiment 3a, Dandeneau et al. (2007) found that students who were trained on the find-the-smile app one week prior to their final exam reported significantly lower levels of stress about the exam on the morning of the exam and immediately following the exam, and marginally higher levels of self-esteem following the exam, compared to participants in the find-the-flower app. However, training on the find-the-smile app did not lead to differences in stress that was not exam related, meaning it reduced that students stress about the exam but not overall feelings of stress. Experiment 3b examined the psychological, behavioral, and neuroendocrinological impact of attentional modification among telemarketers to determine whether the training task could positively influence their experience of social stress in the workplace. Dandeneau et al. (2007) found that participants who completed one session and112 trials of the find-the-smile app experienced a significant increase in self-esteem, decrease in self-reported stress, lower levels of cortisol release, greater self-confidence, and improved sales performance, compared with those in the control condition. Thus, Dandeneau et al. (2007) demonstrated that the find-the-smile app can

significantly reduce attention bias and that these findings can be extended into more ecologically valid domains. Further work by Dandeneau and Baldwin (2009) suggested that training on the find-the-smile app reduced people's hypervigilance for social rejection, which helped promote positive self-regulation of emotions and behaviors, buffering against rejection and academic failure.

Overall, research suggests that the find-the-smile app can be a successful method of CBM-A training (Dandeneau & Baldwin, 2004; 2009; Dandeneau, et al., 2007). CBM-A appears to be effective in not only reducing attentional bias, but also in reducing participants stress in the short term in real life situations such as the threats posed by job stress or by a test. However, questions still remain such as whether using such treatments in a home type setting will yield similar results, particularly on stress in the long term which would benefit those with anxiety disorders (Dandeneau, et al., 2007).

CBM-A in a simulated home setting.

While it is possible to deliver CBM-A training at home using online programs, and patients appreciate the convenience of an at home treatment, the results are mixed as to whether these programs are effective (Beard, Weisberg, Perry, Schofield, & Amir, 2010). In an attempt to understand what is causing CBM-A training to fail to yield consistently positive results in a home setting, Booth, Mackintosh, Mobini, Ozton, and Nunn (2014) examined the potential impact of the distractions more likely to occur in a home environment versus a typical treatment setting. Instead of testing this premise in a home environment, they chose to experimentally create the conditions they believed constituted the differences between a home and lab setting by manipulating the working memory (WM) load of participants (Booth et al., 2014). It was theorized that there are various

factors in a home environment competing for attention, (such as other people, pets, or the television). Thus, participants were tested in both a high WM load condition (created to reflect training in a home setting) and low WM load condition (created to reflect training in a lab setting). (Browning et al., 2010; Koster, Baert, Bockstaele, & De Raedt, 2010).

Booth et al. (2014) hypothesized that those completing training with a high working memory load would not benefit from CBM-A training because there attention is divided between multiple tasks. Therefore, attentional resources that would normally be devoted to CBM-A training are devoted to other tasks. In this study, participants came in once a week for three weeks. First, they completed pretest measures including a measure for attention bias which was assessed using a dot-probe task. The dot probe task consisted of 72 trials, each beginning with a fixation cross being presented in the middle of the screen. Next two cue words, one neutral (such as feature) and one threatening (such as failure), were presented one on the top and one on the bottom of the screen. The threat cue's position on the screen was randomized. These were followed by the probe (< or >), which appeared in one of the locations previously occupied by the cue words. Participants were instructed to press z if the probe pointed left and m if the probe pointed right as quickly and accurately as possible. The probe followed the threat or neutral cue with equal probability. An attentional bias is apparent when the participants respond more quickly following a threatening word as opposed to a neutral word, suggesting their attention was already devoted to the negative information. If attentional biases towards threatening stimuli are reduced, there is no longer a difference in reaction times between threatening and neutral words.

Following this, participants received one training session with a high WM load and one with a low WM load (Booth et al., 2014). Training sessions also utilized a dot probe task except each training session consisted of 144 trials and the dot probe was used as CBM training by having the probe always appeared in the neutral cue's position for the CBM-A group while there was no contingency between cue and target position for the placebo group. Attention bias was measured after each training session and the order of the WM load conditions varied per participant. During the high WM load portion, participants were presented with six random digits (from one to nine) before training and asked to remember them throughout the task. This made it difficult for them to tune their attention to the CBM-A task because their attention was partially focused on recalling those digits. For the low WM load portion, participants were asked to remember only one digit. At the end of the dot probe training, participants were presented with one digit and asked to recall if it had appeared earlier (which occurred 50% of the time). Results demonstrated that there was a reduction in attentional bias following training in the low WM load condition but not after participants completed the high WM load condition. Booth et al. (2014) concluded that this supports the idea that CBM-A training may not be effective when completed in a home environment due to the influence of everyday worries and distractions which detract from attention to the CBM-A task.

However, Booth et al. (2014)'s study is based on a single training session in each WM load condition and the study does acknowledge that it may be possible that a high WM load only slows down CBM-A's effectiveness rather than preventing it entirely (Booth et al., 2014). It is therefore possible that those who complete CBM-A training in a home setting will show changes in attentional bias in time, but these results may not be

evident until multiple training sessions are completed. Therefore, perhaps multiple sessions of CBM-A is needed in order to see a reduction in anxiety and attentional bias.

The Present Study

The purpose of the present study was to test the proposition that CBM-A training may be effective in a home setting after multiple training sessions using an internet-delivered app. The find-the-smile task which is currently available in app form and was developed by Dandeneau and Baldwin (2004) was used. It was hypothesized that the find-the-smile app would reduce attentional bias towards negative or threat in home settings after multiple trainings while the control find-the-flower condition would not reduce the attentional bias towards threat.

This study also investigated whether CBM-A training in a home setting would decrease both short term state anxiety and long term trait anxiety. Past research has provided support that CBM-A training in a home setting can decrease state anxiety but only when measuring anxiety before and after a particular life stressor such as a big exam (MacLeod et al., 2002; Dandeneau et al., 2007). While there is a lack of research examining CBM-A's impact on trait anxiety in the home setting, past research done in the lab setting has supported CBM-A trainings ability to decrease trait anxiety (Hakamata et al., 2010). Therefore, this study hypothesized that CBM-A training would show a decrease in participants' trait anxiety using the State-Trait Anxiety Inventory (STAI form Y-1) (Spielberger, Gorsuch, Lushene, Vagg, & Jacob, 1968).

Method

Participants

Fifty-six participants were recruited from undergraduate psychology courses at Eastern Washington University who were seeking course credits for study involvement. They were recruited through the psychology departments study recruitment site called SONA. Participants were told that the study was researching whether a CBM-A app could lead to reductions in cognitive bias and anxiety when training takes place in the home setting. However, they were not told whether they were placed in the experimental or control condition or even that there were multiple conditions in the study. There were 29 participants in the experimental condition (find-the-smile app) and 27 in the control condition (find-the-flower app). Of the 56, 13 were excluded (7 experimental and 6 control group participants); 3 were excluded due to not completing any training sessions at home and 10 were excluded due to not completing a portion of the study (either by failing to attend the second lab portion or to complete the final anxiety measure).

Thus, 43 participants were included in the analyses. Twenty-three were females and 20 were males, with an average age was 21.63. The majority of participants were Caucasian (31), with others being Hispanic (5), Asian/Pacific Islander (3), American Indian (2), Black (1), and one that was a mix of Asian, American Indian, and Caucasian.

Apparatus/Materials

CBM-A training tasks. The find-the-smile, PsychMeUp app made available through the mind habits website, ("MindHabbits", 2008) was used as at-home training for

the experimental training task. Independent raters in Dandenueau and Baldwin's (2004) study confirmed that the smiling pictures were perceived as significantly more accepting and the frowning pictures were significantly more rejecting than a neutral point on a 7-point scale. The grayscale stimuli were presented as a 4 X 4 square matrix and appeared in the middle of the screen wherein there was 1 smiling face and 15 frowning faces. Participants were instructed to select the smiling face as quickly as possible. Each of the 16 accepting faces were randomly presented each time in a different square in the matrix. Participants completed 112 trials and each training session was expected to take under 15 minutes to complete. In the control condition, the stimuli consisted of black and white drawings of five and seven-petaled flowers. The procedure was identical to that of the experimental condition except the instructions asked that the participant identify the five-petaled flower as quickly as possible in the matrix of seven-petaled flowers (see appendix A for examples of these apps).

Dot probe. A dot probe task is currently the most commonly used measure for attention bias (Beard, 2011). The dot probe is used to determine each individual's level of attentional bias. Each trial began with a fixation cross, presented centrally for 1,000 ms. Next, two cue words, one neutral (such as feature), and one threatening (such as failure), were presented at the top and bottom of the screen for 750 ms. The threat cues position was randomized in its appearance on the bottom or top of the screen. These were followed by the probe (< or >), which appeared in one of the locations previously occupied by the cue words (see appendix B for an example). Participants were instructed to press z if the probe pointed left and m if the probe pointed right, as quickly and accurately as possible. As soon as they made a selection the next trial began. The probe

followed either the threat or neutral cue with equal probability. Seventy-two trials were presented in each dot probe test. A participant's task was to identify the probe as quickly and accurately as possible by pressing a corresponding button. Biased attention toward threat was inferred from faster reaction times when identify probes replacing threat stimuli compared with neutral stimuli. That is, participants would be faster to press z following a < probe that had appeared in the same place as the word failure as opposed to a probe that appeared in the same place as the word feature. If participants do not have an attentional bias towards threat, then there would be no difference in reaction times between threatening and neutral words.

State-Trait Anxiety Inventory. The STAI form Y-1 (Spielberger, Gorsuch, Lushene, Vagg, & Jacob, 1968) consists of a series of items which seek to measure state and trait anxiety and will be used to measure pre and post anxiety levels. There are an equal number of items assessing each type of anxiety. All items are rated on a four-point scale. State anxiety refers to the more temporary or short term stress while trait anxiety is the more enduring anxiety resulting from a stressor. For state anxiety, items include statements such as "I am tense"; "I am worried"; "I feel calm" and the four-point scale including 1) not at all, 2) somewhat, 3) Moderately so, and 4) Very much so. Trait items include statements such as "I am a steady person"; "I worry too much about unimportant matters" and the four-point scale include 1) Almost never, 2) Sometimes, 3) Often, and 4) Almost always. (See Appendix C for a copy of the STAI) Higher scores indicate greater anxiety. Item scores are added to obtain a total and scoring should be reversed for anxiety-absent items. The range of scores is 20-80 with clinically significant scores varying depending on the clinical sample (Julian, 2011).

Procedure

Ethical approval was obtained from the universities Institutional Review Board (IRB) and informed consent was obtained from all participants with a debriefing given at study completion.

Participants were randomly assigned to either the control (find- the-flower) or experimental (find-the-smile training) groups. During the initial lab session, participants were given the STAI to measure anxiety symptoms, followed by a dot probe task to determine current level of attentional bias. Upon completion, participants were asked to complete 6 once daily at-home sessions of CBM-A training. The CBM-A training was made available online through a Canvas webpage and participants were only able to complete training between 6 am and 11pm. Reminders were sent out daily through Canvas. After six days of CBM-A training participants were asked to return to a second lab session where the STAI survey and dot probe task were again administered. For example, if participants completed initial assessments on a Wednesday, they then completed their first CBM-A training on Thursday and their last on Tuesday, then reported back for final assessment on Wednesday. Participants were then debriefed and credit was provided.

Design

The current study employed a mixed 2 (Training condition: find-the-smile task, find-the-flower task) by 2(Attention bias/Anxiety: Pre-training, Post-training) factorial design with training condition manipulated between subjects and attention bias measured within

subjects. Participant's attention bias and anxiety were measured both before and after training.

Results

Though participants were asked to complete 6 at home sessions, not all participants completed the full number sessions. Of the 43 participants, 1 completed 1 at-home session, 3 completed 2 at-home sessions, 2 completed 3 at home sessions, 3 completed 4 at home sessions, 10 completed 5 at home sessions, and 24 completed all 6 at home sessions. Participants who did not complete any at home sessions were removed from the data set with a total of three removed for this purpose (two from the experimental group and one from the control group). Though most participants completed 5 or 6 at-home sessions, it is important to see whether the number of at-home sessions was related to changes in anxiety scores from lab session 1 to lab session 2. If there is a relationship between the number of at-home sessions and anxiety changes, then this would suggest separate analyses should be done for participants who completed a majority of the at home session (5 or 6 sessions) and participants who completed fewer sessions. I calculated the correlations between the change in anxiety scores and the number of at-home sessions completed. A positive correlation would indicate a relationship between these two variables; that is, participants who completed more at-home sessions had a greater decrease in anxiety scores at lab session 2 while participants with fewer at-home sessions exhibited little change in anxiety scores. For the experimental condition, there was not a reliable relationship between the number of at-home sessions and changes in trait anxiety, r (20) = -.01, p = .95, or state anxiety, r (20) =

.34, p = .13. Similarly, the control condition did not exhibit a reliable relationship between the number of at-home sessions and changes in anxiety scores for either trait anxiety, r (19) = -.05, p = .84, or state anxiety, r (19) = .37, p = .10. Because the number of at-home sessions did not appear to differentially impact changes in anxiety scores, all participants who completed at least 1 at-home session were included in the following analyses.

In the results detailed below, this study first explored changes in anxiety scores followed by changes in reaction times on the dot probe task. The alpha level was set at .05 for all analyses reported.

Trait and State Anxiety

Trait Anxiety. Trait anxiety scores were analyzed in a 2(Group: experimental group, control group) by 2(Lab Session: session 1, session 2) mixed factorial ANOVA with group manipulated between-subjects and session manipulated within-subjects. Results for model assumptions of normality, homogeneity of covariance, and linearity were satisfactory.

There was not a statistically significant between-subjects main effect for group for trait anxiety, F (1, 41) = .03, p = .86. Average trait anxiety scores did not differ between participants in the experimental and control groups (see Figure 1). There was also not a statistically significant within-subjects main effect for session, F (1, 41) = 1.48, p = .23. Trait anxiety scores were not significantly different from session 1 to session 2. However, the interaction between Group and Session was statistically significant, F (1,

41) = 5.34, p =.03. There was not a significant different in anxiety levels between participants in the experimental and control conditions during lab session 1, t (41) = .81, p = .42, or lab session 2, t (41) = -.36, p =.72. Participants in the experimental condition displayed a significant decrease in trait anxiety from session 1 (M = 40.96, SD = 11.97) to session 2 (M = 38.05, SD = 13.01), t (21) = 3.17, p < .01. However, trait anxiety did not differ from session 1 (M = 38.48, SD = 7.47) to session 2 (M = 39.38, SD = 10.92), t (21) = -.65, p = .52 for participants in the control condition.

State Anxiety. State anxiety scores were analyzed in a 2(Group: experimental group, control group) by 2(Session: session 1, session 2) mixed factorial ANOVA with group manipulated between-subjects and session manipulated within-subjects. Results for model assumptions of normality, homogeneity of covariance, and linearity were satisfactory.

There was not a statistically significant between-subjects main effect of group, F (1, 41) = .038, p = .85 (see Figure 1). Average state anxiety scores did not differ between participants in the experimental condition and control condition. There was not a statistically significant within-subjects main effect of session, F (1, 41) = .549, p = .46. State anxiety scores did not reliably differ between session 1 and session 2. Lastly, there was not a statistically significant interaction between Group and Session, F (1, 41) = .271, p = .61. Participants who completed CBM-A training did not have any significant changes in state anxiety levels and did not differ significantly to those in the control condition.

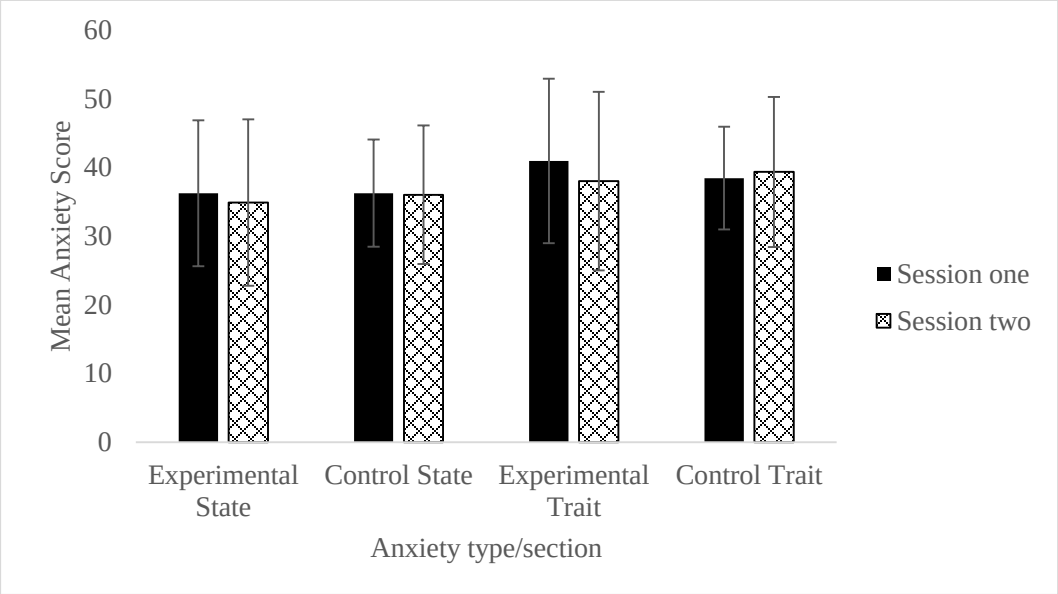

Figure 1. Anxiety levels for state and trait anxiety during lab session 1 and lab session 2. Error bars represent the standard deviation.

Dot probe Task.

Reaction times (measured in milliseconds) were analyzed for the experimental and control conditions in two separate 2(Lab Session: session 1, session 2) by 2 (Word Type: threat, neutral) repeated measures ANOVAs. An attentional bias would be apparent if reaction times for threat words were faster than reaction times for neutral words.

Experimental Condition. For those in the experimental condition, there was not a statistically significant main effect of Session, F (1, 21) = .41, p = .53 (see Table 1). There was not a statistically significant main effect for Word Type,

F (1, 21) = .21, p = .65. Lastly, there was not a significant interaction between Session and Word Type, F (1, 21) = 2.63, p = .12. Therefore, there were no significant

reaction time differences between threat and neutral words either before or after completing the CBM-A training. This indicates that participants did not exhibit an attentional bias pre or post training.

Table 1
Mean reaction time data measured in milliseconds

	Control		Experimental	
	Mean	SD	Mean	SD
Threat Words Time 1	516.39	203.5	482.98	100.5
Neutral Words Time 1	523.77	216.08	476.28	83.48
Threat Words Time 2	459.61	69.18	468.36	80.95
Neutral Words Time 2	454.67	71.83	472.38	86.4

Table notes: A significantly faster reaction time towards threat would indicate a bias towards threat.

Control Condition. For those in the control group there was not a statistically significant main effect of Session, F (1, 20) = 3.52, p = .08 (see Table 1). There was not a statistically significant main effect of Word Type, F (1, 20) =.173, p = .68. However, there was a statistically significant interaction, F (1, 20) = 4.67, p = .04. For threat words, there was not a reliable decrease in reaction time from session 1 (M = 516.39, SD = 203.50) to session 2 (M = 459.61, SD = 69.18), t (20) = 1.74, p = .10. For neutral words, there was a marginal decrease in reaction times from session 1 (M = 523.77, SD = 216.08) to session 2 (M = 454.67, SD = 71.83), t (20) = 1.99, p = .06. However, there was not a significant difference in reaction times between threat and neutral words during lab session 1, t (21) = 1.25, p = .23, or lab session 2, t (21) = -1.27, p = .22. There was no significant differences between reaction times for threat vs non-threat words, thus, an attentional bias was not apparent before or after the at-home training.

It is important to note that this interaction should be interpreted with caution. During session 1, a single participant displayed reaction times much higher than the rest of the participants (an average of 1407.32 ms compared to an average of 475.38 ms for all other participants). When this participant was removed from the analyses, the interaction was no longer significant.

Discussion

Past research has raised questions as to the efficacy of using CBM-A training in a home setting for the treatment of anxiety. CBM-A training requires participants to consciously focus their attention on non-threatening stimuli to override their predisposition to focus on threatening stimuli. One type of CBM-A training, the find-the-smile task, requires participants to find the smiling face among frowning faces and can be administered at-home without the direct supervision of a trained professional. However, distractions in the home environment may impair attention that should be devoted to the CBM-A training and thus, prevent CBM-A from being effective in reducing attentional bias and decreasing anxiety. While one study found participants failed to benefit from one training session of CBM-A under such conditions, they posed the possibility that the distractions present were not completely inhibiting CBM-A from being effective, but rather slowing down its effectiveness (Booth et al., 2014). Therefore, the current study explored whether home CBM-A training was more effective when participants completed daily sessions for five to six days. Participant's levels of anxiety and reaction times on a dot probe task were assessed both pre and post training. It was hypothesized that those in the experimental condition (who received the CBM-A training) would show a decrease in

attention bias (as measured by the dot probe task) as well as a decrease in trait anxiety levels post training, but that state anxiety would remain unchanged. For participants in the control group, changes on anxiety measures or the dot probe task were not expected.

In line with the hypotheses, the results of the current study did not yield significant changes in state anxiety for either the experimental or control groups. While some studies have found support for CBM-A trainings ability to decrease state anxiety, this is most often found to occur when measuring anxiety levels before and after a particular life stressor, for example, after a test or significant stress associated with a job (Dandeneau, et al., 2007). Because the current study did not include a life stressor or measure for the occurrence of natural life stressor, we did not anticipate a reduction in state anxiety.

However, participants in the experimental group who received CBM-A training did show a decrease in trait anxiety from session 1 to session 2, while participants in the control condition did not exhibit any changes. Previous research in the lab setting supports CBM-A training in its ability to reduce trait anxiety and asserts this change is prompted by CBM-A's ability to decrease a person's attentional bias towards threat (Hakamata et al., 2010). The current study found that participants who received CBM-A training did report a reduction in trait anxiety post training while those who did not receive the CBM-A training did not report a significant change in anxiety. It is important to note that these results should be interpreted with caution. Though trait anxiety significantly decreased from session 1 to session 2 for participants in the experimental group, their scores were not significantly different than participants in the control group during session 2.

It was hypothesized that there would be a reduction in attentional bias towards the threat from time one to time two for those in the experimental condition. Researchers theorize that decreases in trait anxiety following CBM-A training can be attributed at a decrease in attentional bias (Hakamata et al., 2010). However, participants in the current study (in both the experimental and control groups) did not exhibit an attentional bias pre or post training. Although participants in this study displayed significant pre- to posttreatment changes in their trait anxiety, this change was not significantly associated with changes in their attentional bias towards threat which is the premise behind the efficacy of CMB-A training.

Overall, the goal of the current study was to determine if multiple at-home sessions CBM-A training would lead to decreases in anxiety and attentional bias compared to a condition where participants were not receiving training. Previous research suggests that the distracting nature of a home environment may detract from the effectiveness of CBM-A (Booth et al., 2014). The results of the current study are mixed with regards to the efficacy of CBM-A in the home. The data in this study supports the studies hypothesis that those who received multiple sessions of CBM-A training in the home setting would show a significant reduction in their self-reported trait anxiety compared to those who did not receive the training. However, attentional biases towards threat were not apparent before or after CBM-A training. Therefore, this study cannot conclusively support that CBM-A training in the home setting with multiple sessions has the ability to decrease attentional bias and anxiety. Further, because there were not significant differences in anxiety reduction for those who completed the majority of at-home sessions compared to those who completed at least one session, our results do not

suggest increasing the number of sessions increases the effectiveness of at-home CBM-A training.

Limitations

There were several limitations that may have influenced the results of the current study. First, the population used for this study was non-clinical for anxiety. Previous research has more often failed to find significant results in testing the effectiveness of CBM-A training in non-clinical versus clinical samples (Hakamata et al., 2010). For instance, in a meta-analysis examining the impact of CBM-A training among both clinical and nonclinical samples compared to the impact of CBT and SSRIs among clinical and nonclinical samples, CBT and SSRIs produced greater reductions in anxiety than CBM-A training. However, when the same comparison is made with clinical populations alone, CBM-A is comparable to CBT and SSRIs at reducing anxiety (Hakamata et al., 2010). This may indicate that those with non-clinical levels of anxiety may not benefit from CBM-A training as much as those with clinical levels of anxiety, which may have impacted the results of the current study. The initial reaction time data on the dot probe task did not indicate a cognitive bias towards threat for those in either the experimental or control condition at the start of the study. If a clinical sample had been used, the likelihood of starting with a cognitive bias would have been far greater. In addition to using a non-clinical sample, the study was further limited by the use of undergraduate university students. There could be confounding factors associated with this specialized population that impact the study and decrease the generalizability of the results to other groups. For example, the results could be impacted by the participants' previous knowledge about anxiety and treatment for anxiety disorders, by their potential

desire to please the researchers (thus exaggerating benefits reported for treatments), or by other unknown differences in this population that are not seen in clinical populations.

Another limitation in this study is the low participation rate. The lack of result in support of the studies hypotheses could have been impacted by the low number of participants analyzed. With few participants in each condition, the results of one participant can potentially have a large impact on the overall results. This point is illustrated in our study with the one participant whose initial reaction time, which was abnormally high, caused the overall data to show significant results. However, when this individual's data was not included, the results were not significant. A larger sample would help to decrease the ability of one or a few participants having a large impact on overall results and perhaps capture a larger range of anxiety levels in a non-clinical population.

Most studies have used a variation of the dot probe task to both train and measure attention bias. However, there is not a consistent method for administering the dot probe task and there are other measures and training tools used to assess attention bias. This study chose to utilize the dot probe task to measure attention bias and the find the smile visual search task to as our training tool due to past criticism claiming that while those who use the same method (dot probe task for training and measurement) provide a manipulation check, using different methods would help to ensure results can be generalized (Beard, 2011). However, choosing to use two methods to assess and measure attention bias in our study could be a limitation since we were unable to provide a manipulation check. Perhaps using the same method or using other options to assess the attention bias would have picked up on differences which our study failed to detect.

Future Directions

Though the current study did not fully support the effectiveness of at-home CBM-A to decrease anxiety levels, the results of this study lead to interesting questions that will require further exploration. The lack of a correlation between the number of training sessions and changes in anxiety was unexpected and is a potentially valuable direction for future research. If these results, or lack of results, are not due to the design or methodology particular to this study and future research is able to replicate these finding, then, this leads to a need for a more in-depth examination of the effectiveness of CBM-A training.

It may be necessary to identify what specifically is impeding CBM-A trainings' effectiveness in the home setting, since there is much support in the lab setting. CBM-A training at home may be a viable option for the treatment for anxiety, although, there are still many factors which could be impacting the treatments effectiveness. Is it the distractions present in the home setting that are disrupting CBM-A's effectiveness? If so, are these distractions impeding CBM-A's effectiveness or slowing it down? If not distractions, then could there be another reason CBM-A has been supported in the lab setting but not at home? As discussed in the limitations, it may be helpful for future studies to use clinical samples. This increases the likelihood of participants having an initial attention bias and leads to greater ability for any results found to have clinical significance.

If not found to be sufficient for the treatment of anxiety on its own, CBM-A training at home may be beneficial when combined with other treatments. For example, there is a need to further investigate the use of CBM-A training in combination with that

of CBM-I (cognitive bias modification for interpretation) (Brosan et al., 2011). While CBM-A training works by targeting one's automatic tendency to give threatening stimuli our attention, CBM-I works to change our interpretation of the information we attune to. While the CBM-A training utilized by this study worked to retrain what the participant automatically attunes to, with CBM-I training, the focus would be on changing how the participant is interpreting what their attention is attuned to. Therefore, for this study's app, the participants would work to change how they perceive the frowning faces with the goal of working to reduce the occurrence of interpreting ambiguous cues as negative or threatening. This would occur by reducing the cognitive bias towards threat, thus, making the individual less inclined to tune their attention towards threats or potential threats in the environment. CBM-I training has been studied both in the lab and at home settings and has shown some support in its impact on reducing state and trait anxiety, however, it is also lacking in research with clinical samples for anxiety (Beard, 2011). Research has provided some support that combining CBM-A with CBM-I may significantly increase the benefit they would have on their own (Brosan et al., 2011); however, this research has focused on training in the lab setting. Thus, more research is necessary to determine if the efficacy of CBM-A in the home can be enhanced when paired with CBM-I (Brosan et al., 2011).

Additionally, it may be important to investigate the effectiveness of CBM-A training at home in combination with other current treatments for anxiety disorders such as CBT (cognitive behavior therapy). CBM-A's focus on the automatic tendency to attune towards threat is not addressed in CBT and this could amplify CBTs benefit in the treatment of anxiety. Thus, CBM-A training could target the individuals' automatic

tendency to focus their attention towards the threat (which leads to a maintenance of anxiety), while CBT could target the distorted interpretations and memories associated with those threat cues in our environments through cognitive restructuring and behavioral experiments. CBT can also focus on easing anxiety by training in relaxation techniques and work on gradual exposure to threat in order to promote fear extinction. While a therapist is using CBT in sessions, CBM-A training could be an easy addition in the form of homework assignments. CBM-A in the home could work well with CBT and potentially prove more effective than each on their own.

Conclusion

While using CBM-A training in combination with current treatment for anxiety could prove to further benefit those with anxiety disorders, having CBM-A as a standalone, at home, treatment could potentially address some of the barriers found with current treatments particularly for those who do not have access to traditional counseling for their anxiety disorders. Therefore, CBM-A should be evaluated for its value on its own in the home setting as well as in combination with other treatments for anxiety. The results of this study were not conclusive as to the efficacy of using CBM-A training at home; however, they do highlight the need for a more in-depth examination of the use of CBM-A training outside of a laboratory setting.

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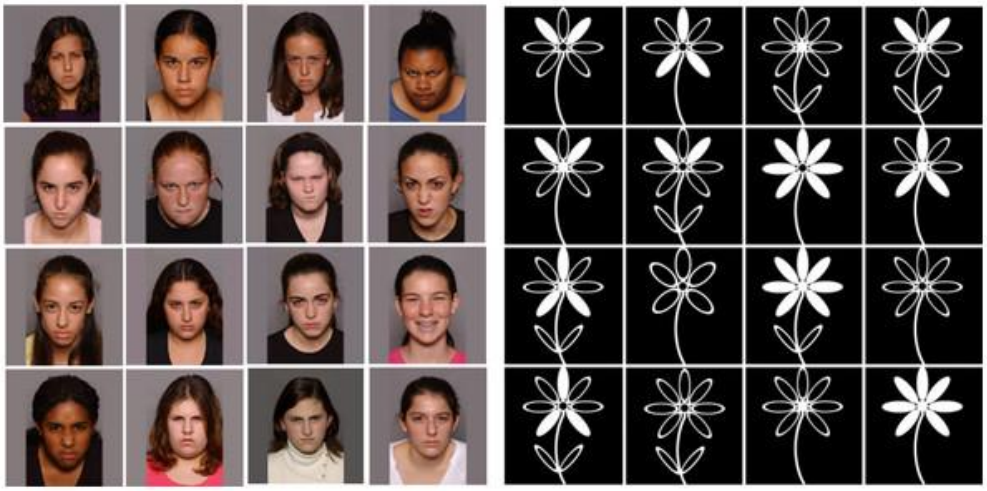
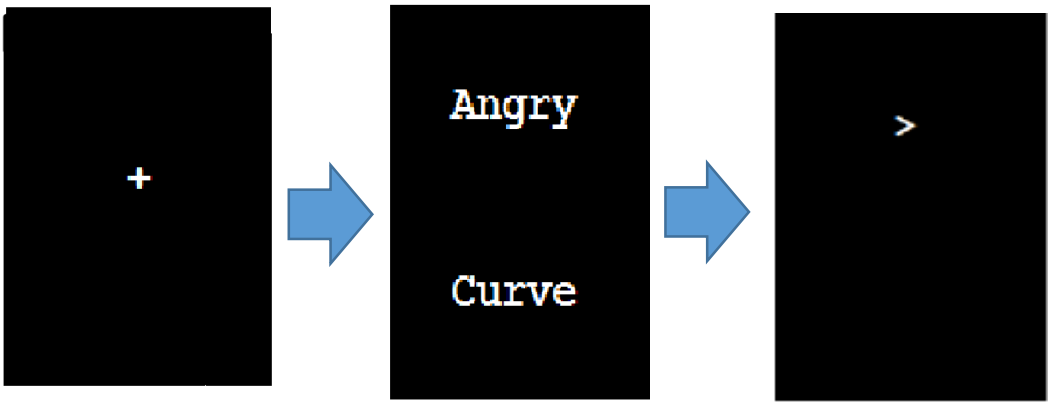
APPENDIX A: Find the Smile CBM-A Training App/Find the Flower Control App



APPENDIX B: Dot Probe Example


+
Angry
Curve
>

APPENDIX C: Anxiety Questionnaire – STAI

MIND GARDEN
Palo Alto, California

SELF-EVALUATION QUESTIONNAIRE

STAI Form Y-1

Please provide the following information:

Name_____ Date_____ S_____

Age_____ Gender (*Circle*) **M** **F** T_____

DIRECTIONS:

A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you feel *right* now, that is, *at this moment*. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe your present feelings best.

	NOT AT ALL	SOMEWHAT	MODERATELY SO	VERY MUCH SO
1. I feel calm	1	2	3	4
2. I feel secure	1	2	3	4
3. I am tense	1	2	3	4
4. I feel strained	1	2	3	4
5. I feel at ease	1	2	3	4
6. I feel upset	1	2	3	4
7. I am presently worrying over possible misfortunes	1	2	3	4
8. I feel satisfied	1	2	3	4
9. I feel frightened	1	2	3	4
10. I feel comfortable	1	2	3	4
11. I feel self-confident	1	2	3	4
12. I feel nervous	1	2	3	4
13. I am jittery	1	2	3	4
14. I feel indecisive	1	2	3	4
15. I am relaxed	1	2	3	4
16. I feel content	1	2	3	4
17. I am worried	1	2	3	4
18. I feel confused	1	2	3	4
19. I feel steady	1	2	3	4
20. I feel pleasant	1	2	3	4

 STAIP-AD Test Form Y

SELF-EVALUATION QUESTIONNAIRE

STAI Form Y-2

Name_____ Date_____

DIRECTIONS

A number of statements which people have used to describe themselves are given below. Read each statement and then circle the appropriate number to the right of the statement to indicate how you *generally* feel. There are no right or wrong answers. Do not spend too much time on any one statement but give the answer which seems to describe how you generally feel.

	ALMOST NEVER	SOMETIMES	OFTEN	ALMOST ALWAYS
21. I feel pleasant	1	2	3	4
22. I feel nervous and restless	1	2	3	4
23. I feel satisfied with myself	1	2	3	4
24. I wish I could be as happy as others seem to be	1	2	3	4
25. I feel like a failure	1	2	3	4
26. I feel rested	1	2	3	4
27. I am "calm, cool, and collected"	1	2	3	4
28. I feel that difficulties are piling up so that I cannot overcome them	1	2	3	4
29. I worry too much over something that really doesn't matter	1	2	3	4
30. I am happy	1	2	3	4
31. I have disturbing thoughts	1	2	3	4
32. I lack self-confidence	1	2	3	4
33. I feel secure	1	2	3	4
34. I make decisions easily	1	2	3	4
35. I feel inadequate	1	2	3	4
36. I am content	1	2	3	4
37. Some unimportant thought runs through my mind and bothers me	1	2	3	4
38. I take disappointments so keenly that I can't put them out of my mind	1	2	3	4
39. I am a steady person	1	2	3	4
40. I get in a state of tension or turmoil as I think over my recent concerns and interests	1	2	3	4

 STAIP-AD Test Form Y

VITA

Author: Priscilla Fauth

Undergraduate Schools Attended:

Wor-Wic Community College (WWCC)

Salisbury University (SU)Graduate Schools Attended:

Eastern Washington University

Degrees Awarded:

Associates Degree, 2007, Wor-Wic Community College

Bachelor of Science, 2009, Salisbury University

Honors and Awards:

Caregiver of the Year (2012) – Home Instead Sr Care Spokane office

Certificate of National Service – For service in AmeriCorps, 2009

Special Congressional Recognition – For AmeriCorps service, 2009

Governor's Volunteer Service Certificate – For AmeriCorps service, 2009

The President's Volunteer Service Award - For AmeriCorps service, 2009

Magna Cum Laude graduate, WWCC and SU 2007 and 2009

Deans list, WWCC and SU 2007 - 2009

Honor student, WWCC, 2005 - 2007

Member of Phi Theta Kappa – National Honors Society, WWCC 2006 -2007

Professional Experience:

Licensed Home Care Aide, Home Instead Sr Care, Denton County, Texas and Spokane, Washington, 2011- Present

Counseling Intern, Lutheran Community Services, Spokane, Washington, 2015 – 2016

Behavioral/Therepeutic/Day Care Aide, Dove Pointe:Children's Department, Salisbury, Maryland, 2008 – 2011

Program Coordinator, I.P.P.S (Involved Parents Productive Students) Mentoring Program, Salisbury, Maryland, 2010 – 2011

Part time AmeriCorps volunteer at I.P.P.S Mentoring Program, ShoreCorps PALS, Spokane, Maryland, 2009 - 2010