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Does Inflexible Attention Undermine the Benefits of Cognitive Reappraisal? A Multi-method Study of Adolescents With Anxiety

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DOES INFLEXIBLE ATTENTION UNDERMINE THE BENEFITS OF COGNITIVE REAPPRAISAL? A MULTI-METHOD STUDY OF ADOLESCENTS WITH ANXIETY

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ABSTRACT

Several models suggest that anxious individuals suffer from deficits in emotion regulation. However, cognitive reappraisal has shown to effectively reduce anxiety. Deficits in attentional control have been theorized as a possible underlying mechanism of emotion regulation and may moderate the association between cognitive reappraisal and anxiety. Therefore, the present study examined the moderating role of attentional control on the effects of cognitive reappraisal on anxiety symptomology via multiple methodologies in a sample of adolescents. Community dwelling adolescents (N=51) completed measures of anxiety symptoms, the habitual use of cognitive reappraisal, an attention disengagement eye tracking task, and an 8-day Ecological Momentary Assessment (EMA) protocol that measured hourly peak and current ratings of nervousness. Multiple moderation models were fit to examine study hypotheses. Contrary to expectation, neither of the hypotheses were supported and cognitive reappraisal was found to be unrelated to self-reported anxiety symptoms and ratings of nervousness in daily life. However, slower disengagement from disgusted faces significantly predicted increased anxiety symptoms. Interestingly, slower disengagement from sad faces significantly predicted less change in peak to current nervousness. Results suggest that an attention disengagement task may be used as a preventative or screening measure for those who have subthreshold levels of anxiety.

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CHAPTER I

INTRODUCTION

Anxiety disorders are characterized by excessive anxiety and fear, accompanied by physical disturbances like muscular tension, vigilance, and cautious or avoidant behavior (American Psychiatric Association (APA), 2013). Anxiety is an emotion that is future-oriented and is associated with preparing for the possibility of negative upcoming events. Fear, on the other hand, is an emotional response to current or impending danger whether it be real or perceived (Barlow, 1988). Lang and Cuthbert (1984) suggested that fear and anxiety can be classified into three responses: subjective, physiological, and behavioral. They believed that subjective verbal reports of distress, anxiety, fear, dread, panic, worry, inability to concentrate, and insecurity are a primary response of anxiety. Behavioral responses like escape, hypervigilance, dysfunctional immobility, compulsive mannerisms, deficits in attention, performance, and control are all observable acts of anxiety and fear-avoidance. Lastly, physiological responses in the sympathetic nervous system like increased heart rate and blood-pressure, sweating, and generalized muscle tension are also associated with anxiety and fear.

Anxiety disorders are also the most common psychiatric disorders across the developmental span with a 7.3% point prevalence rate worldwide, meaning that one in 14 people around the world at any given moment have an anxiety disorder (Baxter et al, 2013). Anxiety disorders are particularly prevalent amongst youth, affecting approximately 32% of individuals under the age of 19 years (Merikangas et al., 2010). Many anxiety disorders tend to develop in childhood and may persist into adulthood if not treated (APA, 2013).

Anxiety disorders differ by the type of situations or objects that induce anxiety, fear, and avoidance (APA, 2013). Among them, specific phobias are the most common (19.3% prevalence amongst adolescents; Merikangas et al., 2010). Those with a specific phobia are typically immediately fearful, anxious or avoidant of certain objects or phobic situations in a way that is out of proportion with actual risk. Social anxiety disorder (SAD) is second most common anxiety disorder (9.1% prevalence amongst adolescents; Merikangas et al., 2010). People with social anxiety have a persistent, excessive fear of negative judgement in social situations (APA, 2013). Separation anxiety disorder (7.6% prevalence amongst adolescents; Merikangas et al., 2010) is the third most common anxiety disorder in adolescents and is characterized by a persistent fear that harm will come to their attachment figure or anxiety of events that could lead to separation from their attachment figure in a developmentally inappropriate way (APA, 2013).

Moreover, presence of anxiety disorders in youth increase the risk of suicide attempts (Foley et al., 2006), are associated with significant morbidity and

mortality (Wehry et al., 2015), and predict a range of psychiatric disorders later in life, including depression, substance use disorders, and other anxiety disorders (Pine et al., 1998).

Not only can anxiety disorders cause significant functional impairment, subthreshold symptoms of anxiety disorders have also been known to cause significant impairment in daily life. For example, Fehm et al. (2008), tested the effect of sub-syndrome levels of SAD symptoms on clinical and functional outcomes. The authors found that those who solely met two (subthreshold) and one (symptomatic) SAD criteria reported more clinical complaints, reduced satisfaction in different life domains like family, social relations, work situation, financial situation and they took more disability days than those who were not symptomatic for SAD (Fehm et al., 2008).

Balázs et al. (2013) also found that those with subthreshold anxiety evidenced higher levels of psychopathology and had an increased risk for functional impairment and suicidality compared to non-anxious adolescents. Mean scores of subthreshold anxious adolescents on the Strengths and Difficulties Questionnaire (SDQ) which was used to evaluate psychopathology were significantly higher than the mean scores of the non-anxious group. Also, when adjusting for age, gender and BDI-II score, the odds for those in the subthreshold anxious group having suicidal thoughts/ideations were 1.788 times greater than the odds for those in the non-anxious group, meaning those in the subthreshold anxious group were approximately 1.8 times more likely to endorse suicidal thoughts/ideations compared to those in the non-anxious group (Balázs et al.,

2013). In addition to subthreshold anxiety leading to increased risk for functional impairment, having subthreshold anxiety also significantly predicts the development of a full-blown anxiety disorder after a 2-year follow-up (Karsten et al., 2011).

Due to the functional impairment and the risk for suicidality and future psychopathology of both anxiety disorders and subthreshold levels of anxiety symptomology, it is important to identify risk factors of anxiety disorders and the mechanisms by which anxiety symptoms increase.

1.1 Emotion Regulation Deficits and Cognitive Reappraisal in Anxiety

Though common in most people, the emotional experience of fear and anxiety at extreme levels represent emotion dysregulation. Emotion dysregulation reflects the difficulty in regulating negative emotions and is a hallmark of the etiological model of childhood anxiety disorders (Southam-Gerow & Kendall, 2002). Emotion regulation is the process through which individuals modify their emotions, either consciously or nonconsciously, automatic or controlled, to appropriately respond to the environment by changing the magnitude or type of emotional experience (Gross, 1998). There are several different emotion regulation strategies that can be grouped into maladaptive responses and adaptive responses. Maladaptive responses maintain or exacerbate the affect's intensity and can make it last longer (Parrott, 1993). For example, such responses as rumination, suppression, and avoidance have been known to lead to the maintenance and exacerbation of internalizing disorders (Aldao et al., 2010).

On the other hand, adaptive responses lessen the affect's intensity or duration as appropriate to context so that it does not impair functioning in the short-term or long-term as it pertains to anxiety disorders. Adaptive responses also may up-regulate and maintain emotions and are critical to the development and maintenance of social wellbeing (Chervonsky & Hunt, 2019). One of several adaptive emotion regulation responses is cognitive reappraisal. Reappraisal involves reinterpreting a situation to alter its emotional impact (Gross, 1998; Aldao et al., 2010). Although there is a myriad of emotion regulation strategies that could be examined, the current study focuses only on cognitive reappraisal.

Several models suggest that anxious individuals suffer from greater negative emotional reactivity and deficits in emotion regulation (Hannesdottir & Ollendick, 2007; Mennin et al., 2007; Suveg & Zeman, 2004). Cognitive reappraisal in particular has been shown to effectively reduce anxiety when compared to suppression or acceptance strategies (Hofmann et al., 2009). De Witte and colleagues (2017) also discovered that cognitive reappraisal training improved self-reported emotion regulation and anxiety. Pupil dilation data from the study suggested that anxious youth required more cognitive resources for the upregulation of negative affect compared to the non-anxious control group (De Witte et al., 2017). Additionally, those with anxiety disorders have demonstrated less effectiveness in implementing cognitive reappraisal as an emotion regulation strategy and it has been theorized that this lack may be a possible maintenance mechanism for anxiety disorders (Kivity & Huppert, 2018). Similarly, research by Suveg and Zeman (2004) found that children with anxiety disorders have less

adaptive coping than children without anxiety disorders according to self-report measures. Therefore, acquiring or improving upon reappraisal skills may be beneficial in decreasing symptoms of anxiety (Schäfer et al, 2017). However, additional research by Kivity and Huppert (2016) found that although adults who are more anxious report less success in deploying the cognitive reappraisal strategy, they did not actually use cognitive reappraisal less than controls during a behavioral task (Kivity & Huppert, 2016). Relatedly, Carthy et al. (2010) ascertained that although anxious adolescents were less able to implement the instructed cognitive reappraisal, their subsequent reduction in self-reported negative affect was similar to the level of negative affect reduction observed in non-anxious adolescents. Yet, a study by Eastabrook and colleagues (2014) found that lower levels of cognitive reappraisal did not contribute to increased social anxiety symptoms in adolescent females. Research by Shapero et al. (2016) also found that cognitive reappraisal was not associated with emotional reactivity or biological recovery in regard to anxiety symptoms.

Due to these mixed findings, one could theorize that a potential third factor may undermine the positive effects of cognitive reappraisal and explain the discrepant results.

1.2 Attention Control Deficit and Anxiety

Attentional control refers to the ability to voluntarily attend to goal-relevant information and to inhibit distraction from goal-irrelevant information (Koster et al., 2011). Attention Control Theory (ACT) specifies three central executive functions involved in attention control: inhibition, shifting, and

updating (Eysenck et al., 2007). The general assumption of ACT is that the effects of anxiety on attentional processes are fundamental in understanding how anxiety affects one's performance. This assumption is based on the theory that when a person's goal is threatened, they experience anxiety. This threat to one's goal causes attention to be directed to detecting the source of the threat and in determining how to respond to the threat (Eysenck et al., 2007).

Support for this theory has come from research on attentional bias in which people with anxiety attend to threat-related stimuli more so than neutral stimuli. A study by Derryberry and Reed (2002) examined trait anxious participants to see whether they would have a bias toward threatening stimuli compared to neutral stimuli. Participants showed a quicker attentional bias favoring the threatening stimuli compared to a slower reaction to the neutral stimuli. The researchers also found that the anxiety-related threat bias was moderated by attentional control. Anxious participants with poor attentional control showed a threat bias, but those with better attentional control were able to shift away from the threatening location more easily. Derryberry and Reed's (2002) research suggests that skilled control of voluntary attention may allow those with anxiety to limit the impact of threatening information (Derryberry & Reed, 2002). Another study by Lonigan and Vasey (2009) found that effortful control moderated the relationship between negative affect, which is a strong risk factor for the development of anxiety disorders (Rapee, 2002), and attentional bias to threatening stimuli. Children with low levels of effortful control and high levels of negative affect showed an attentional bias to threatening stimuli

(Lonigan & Vasey, 2009). In addition, Cohen Kadosh and colleagues (2014) found that younger adolescents compared to older adolescents had more difficulties with attention control in the presence of valenced faces which suggests that there may be a developmental process associated with one's attentional control abilities (Cohen Kadosh et al., 2014). Furthermore, Susa and colleagues (2012) discovered that attentional control moderates the relation between attentional biases toward threatening facial expressions and anxiety in children. Reinholdt-Dunne et al., (2009) also ascertained that a combination of high anxiety and poor attention control was associated with greater cognitive interference when viewing emotional faces. Moreover, Grafton and colleagues (2016) found that attentional control moderated the association of social anxiety vulnerability and attentional avoidance of negative social information in socially anxious children and adolescents.

Another theory of attention control is a model based on cognitive neuroscience research by Posner and Peterson (1990). This model describes a posterior attentional system and an anterior attentional system. The posterior attentional system is reactive and orients attention from one location to another. The posterior system has three operations: attention first disengages from one location, secondly moves to a new location, and thirdly engages with a new location. The anterior system takes over when the new location or stimuli is engaged. This system is situated in the frontal region of the brain in the anterior cingulate cortex and acts as an executive system that carries out voluntary attentional functions. The anterior system can regulate or inhibit response

tendencies occurring in the posterior system, thereby voluntarily controlling attention. Therefore, the anterior system may reduce anxiety by allowing the person to disengage from threatening stimuli and engage attention to a source of safety (Posner & Peterson, 1990).

Posner and Peterson's model of attentional control is also the basis of the vigilance and maintenance hypotheses. The vigilance hypothesis asserts that individuals with anxiety disorders identify threat more easily and as a result, shift their attention towards threat more often, whereas the maintenance hypothesis suggests that those with anxiety have an impairment in disengaging attention away from threat (Weierich et al., 2008). These biases emerge after detecting the threat because threatening stimuli hold the attention of anxious individuals longer than non-anxious individuals (Armstrong & Olatunji, 2012). In support of the vigilance hypothesis, Mueller et al. (2012) found that anxious relative to healthy children exhibited enhanced orienting toward threat-related stimuli. Whereas Fox and colleagues (2001) found that the presence of threatening stimuli makes it more difficult for high state-anxious individuals to disengage their visual attention, supporting the maintenance hypothesis. Additionally, a neuroscience study by Bishop (2009) discovered that trait anxiety was associated with a deficit in attentional control, as indexed by a deficiency in the dorsolateral prefrontal cortex which is associated with switching attention. Pergamin-Hight and colleagues (2016) also ascertained that youth with SAD, compared to their non-anxious peers, showed poorer attention control, greater difficulty disengaging attention from threat stimuli, and tended to negatively interpret ambiguous social

situations. The researchers determined that each of the cognitive processes significantly contributed to SAD diagnosis, but there were no significant interactions between cognitive biases and attention control (Pergamin-Hight et al., 2016).

An additional theory of attention control is the attention disengagement hypothesis (Koster et al., 2011). This hypothesis suggests that attention disengagement deficits may be a possible underlying mechanism of emotion regulation responses in depressed individuals. Koster et al. (2011) posits that one's tendency to engage in certain maladaptive emotion regulation strategies lies in the difficulty to disengage attention from negative thoughts. Therefore, lack of attentional control found in those who use maladaptive strategies may undermine their ability to use adaptive strategies such as cognitive reappraisal to reevaluate their distressing situation. Due to the association between anxiety and negatively biased interpretations of threatening stimuli, improved cognitive reappraisal of these threatening scenarios may be one way to reduce these biases as well as reduce anxiety (Kivity & Huppert, 2018).

When examining the relationship between attentional control and cognitive reappraisal, van Reekum and colleagues (2007) found that attentional control accounted for a significant portion of the variance in neural activity when participants were instructed to decrease their negative affect. Bebko et al. (2011) also found that attentional deployment was associated with successful emotion regulation through cognitive reappraisal. However, Bebko and colleagues (2014) later discovered there was no causal relationship between attentional control and

cognitive reappraisal and determined that these strategies remain distinct. Although attentional control may not influence emotion regulation use, such as whether cognitive reappraisal is deployed, it still may play a crucial role in one's ability to reappraise successfully.

1.3 Attentional Control as Moderator

Although the literature has not examined attentional control as a moderator between cognitive reappraisal and anxiety in adolescents, attentional control has been found to moderate associations between attention and anxiety. Further, indirect evidence in support of the attention control moderation comes from the mixed findings on the effect of cognitive reappraisal on anxiety. Such discrepancies open the door for a possible third, moderating variable which may provide explanation for a potential underlying phenomenon.

In the mixed emotion regulation literature, some research has found that those with anxiety are less successful at cognitive reappraisal (De Witte et al., 2017; Kivity & Huppert, 2018) and that successful cognitive reappraisal can reduce anxiety (De Witte et al., 2017; Hofmann et al., 2009; Schäfer et al, 2017, Suveg & Zeman, 2004), yet, Carthy et al. (2010) found that although anxious adolescents were less able to implement instructed cognitive reappraisal, their subsequent reduction in self-reported negative affect was similar to the level of negative affect reduction observed in non-anxious adolescents. Moreover, a study by Eastabrook et al. (2014) found that lower levels of cognitive reappraisal did not contribute to increased social anxiety symptoms in adolescent females. Research by Shapero et al. (2016) also found that cognitive reappraisal was not

associated with emotional reactivity or biological recovery in regard to anxiety symptoms. However, Kivity and Huppert (2016) found that anxious adults reported less success in deploying the cognitive reappraisal strategy but did not actually use cognitive reappraisal less than controls when completing a behavioral task.

Due to these discordant findings in the emotion regulation literature, the question remains on whether there is a possible third variable impacting these findings in covert ways. The attention disengagement hypothesis suggests that attention disengagement deficits may be underlying emotion regulation deficits (Koster et al., 2011). Therefore, lack of attentional control found in those who have difficulty disengaging from negative stimuli may undermine one's ability to use adaptive strategies such as cognitive reappraisal to improve their distressing situation. To engage in the effortful task of cognitive reappraisal successfully, the ability to filter out distracting stimuli is required. In the literature, attentional control deficits have been linked to anxiety as both a bias toward threatening stimuli and a maintenance on threatening stimuli (Armstrong & Olatunji, 2012; Fox et al., 2001; Mueller et al., 2012; Pergamin-Hight et al., 2016; Weierich et al., 2008). Attentional control has also moderated the relationship between anxiety-related threat biases and anxiety (Derryberry & Reed, 2002), attentional biases toward threatening facial expressions and anxiety in children (Susa et al., 2012), and social anxiety vulnerability and attentional avoidance of negative social information in socially anxious children and adolescents (Grafton et al., 2016), which demonstrates its importance as a mechanism in anxiety disorders. Although

the literature suggests a strong inverse relationship between attentional control and anxiety in adults (Shi et al., 2019), research by Cohen Kadosh and colleagues (2014) shows that attentional control may have a developmental context unique to adolescents, especially as it pertains to threatening stimuli.

Using the attention disengagement hypothesis as a framework and utilizing what is known about the associations between cognitive reappraisal and anxiety as well as attentional control and anxiety, incorporating attentional control as a third, moderating variable may offer a potential explanation to the mixed findings of cognitive reappraisal success on anxiety symptomology in adolescents.

1.4 Limitations of Current Literature

Although there is some evidence to suggest that both cognitive reappraisal and attentional control may play a role in reducing the symptoms of anxiety disorders, to this author's knowledge there are no studies examining the interplay of attentional control, cognitive reappraisal, and anxiety together in adolescents. Another limitation of the current literature is that most studies looking at attentional control rely on behavioral measures (Derryberry & Reed, 2002) or through behavioral paradigms like the dot-probe task, Stroop task, and negative priming (Donaldson et al., 2007; Joorman, 2004), which are less precise than using eye-tracking methods to assess attention processes in near-real time (Isaacowitz et al., 2006). Also, while there is efficacy in using self-report measures for trait-level anxiety (Balázs et al., 2013; Ebesutani et al., 2012), these retrospective reports limit the ability to accurately understand behavior and

symptomology in a real-world setting (Shiffman et al., 2008). Utilizing ecological momentary assessment (EMA) methodology may better elucidate the association between state-level anxiety and cognitive reappraisal in real time by measuring the change in emotional states over time. Given the current limitations of the literature, further investigation is necessary to understand the role of attentional control in the relationship between cognitive reappraisal and anxiety symptomology.

CHAPTER II

THE CURRENT STUDY

The present study tested the moderating role of attentional control on the effects of cognitive reappraisal on anxiety symptomology cross-sectionally through self-report measures and in daily life in a sample of adolescents. The current study addresses the identified limitations by utilizing eye tracking and EMA methodologies rather than relying solely on self-report measures and behavioral paradigms to elucidate the near-real time effects.

Attentional control was indexed via covert attention disengagement away from disgusted faces, stimuli that have been employed in measuring attentional processes in anxiety (Amir, et al., 2005; Buckner et al., 2010; Xia et al., 2018). As some have demonstrated that slow attention disengagement from disgusted faces is associated with elevated anxiety levels (Buckner et al, 2010), slower disengagement from disgusted faces were viewed to represent poorer attentional control in this study.

Anxiety symptomology in daily life was indexed by current and peak levels of nervousness during an 8-day EMA period. Assessing peak affect ratings

have been noted to minimize retrospective bias in participants (Fredrickson, 2000).

Based on the extant literature, it was hypothesized that the lack of attentional control would dampen the effect of cognitive reappraisal on adolescents' anxiety symptoms and change in nervousness in daily life.

2.1 Hypotheses

Hypothesis 1. Slower disengagement from disgusted faces will attenuate the negative relationship between cognitive reappraisal and anxiety symptomology (see Appendix, Figure 1).

Hypothesis 2. Slower disengagement from disgusted faces will moderate the association between cognitive reappraisal and the change in levels of nervousness from peak to current in daily life (see Appendix, Figure 2).

CHAPTER III

METHODS

3.1 Participants

Participants were 51 community dwelling adolescents between the ages of 12-17 (M_{age} = 14.57, 57% female) of whom 45% were siblings. Families were recruited through ResearchMatch, Craigslist, local schools, the Cleveland Clinic Mood Disorder Program, and St. Vincent Charity Medical Center Intensive Outpatient program. Community dwelling participants were paid to compensate them for their time. Eligible families included those who completed a pre-screen survey online with measures of depression and anxiety symptoms, demographic information, and information on whether they and/or their child received prior treatment for emotional or behavioral disorders. Parents also provided contact information including their name and telephone number where they can be reached, should they meet study entry criteria. Interested parents were then contacted by a graduate research assistant who administered a semi-structured telephone screen of the parents' and adolescents' psychiatric histories using the M.I.N.I. Neuropsychiatric Interview's Depression, Dysthymia, and Hypomania modules and the Child Depression Screening survey.

3.2 Measures

3.2.1 General Measures

Demographics. Demographic information included participants' age, gender, and race.

Revised Children's Anxiety and Depression Scale-Short version (RCADS-25) anxiety subscale. The RCADS is a 25-item scale measuring child depression and anxiety symptoms. Items are scored on a 4-point Likert scale: 0="Never", 1="Sometimes", 2="Often", or 3="Always". The anxiety subscale comprises of 15 items which reflect a single "broad anxiety" dimension and has possible scores ranging from 0 to 45 (Ebesutani et al., 2012; Klaufus et al., 2020). An anxiety total score was computed and used for analyses. Coefficient omega hierarchical was .74 in a clinic-referred sample and .71 in a school-based sample. Coefficient omega hierarchical may be a more accurate estimate of the reliability for composite scores like the Anxiety Total score because it contains multiple group factors compared to coefficient alpha (Ebesutani et al., 2012; Reise et al., 2010). Internal consistency for the anxiety subscale was acceptable (α=.82; Klaufus et al., 2020). In this sample, the RCADS anxiety subscale (α = 0.86) also evidenced acceptable reliability (RCADS full scale, α = 0.91).

Emotion Regulation Questionnaire (ERQ) reappraisal subscale. The ERQ is a 10-item scale designed to assess individual differences in the habitual use of cognitive reappraisal and expressive suppression. Items are scored on a 7-point Likert scale with 1= "Strongly Disagree," 4= "Neutral," and 7= "Strongly Agree." The reappraisal subscale comprises of 6 items. A reappraisal total score

was computed and used for analyses. Reliability for the reappraisal subscale was acceptable (α=.79; Gross & John, 2003). In this sample, the ERQ reappraisal subscale (α = 0.76) also evidenced acceptable reliability.

3.2.2 Eye Tracking Measures

The stimuli for the attention disengagement task were neutral-valenced face pairs taken from the Karolinska Directed Emotional Faces (KDEF) database (Lundqvisk et al., 1998) and validated by Sanchez-Lopez and Vazquez (2013). KDEF frontal view pictures showed discrete expressions of happiness, sadness, and disgust for a total of 24 happy, 24 sad, and 24 disgust face stimuli with 12 men and 12 women for each emotion category along with their neutral expression which was based on a similar design from Sanchez et al. (2017) and Yaroslavsky et al. (2019). There were 72 trials (24 happy-neutral, 24 sad-neutral, and 24 disgust-neutral pairs) in the attention disengagement task, but only the disgust-neutral face pairs were analyzed for this study. The face pairs were shown on a 48 cm (width)×27 cm (height) widescreen computer monitor. Each image measured at 12 cm (width)×18 cm (height) and positioned at 450×614 (left image) and 1430×614 (right image) X- Y- coordinates, respectively, with 25 cm between the centers of the images.

Eye movements were recorded using the Tobii 3X-120 eye tracking system with a 120 Hz sampling rate. Data transformation and processing was conducted using E-Prime. Visual fixations were operationally defined as gaze resting within 0.5–1.0° visual angle for at least 100 ms (Manor & Gordon, 2003) in pre-determined areas of interest (AOIs). AOIs contained the entirety of the

facial stimuli for both the free-viewing and attention disengagement trials. The attention disengagement indices were considered the average time until the first fixation was initiated within the target image AOI, which for the disengagement trials were the neutral faces.

3.2.3 Ecological Momentary Assessment (EMA) Measures

Current and Peak Affect. Positive and negative affect were measured via items drawn from the Positive and Negative Affect Schedule (Watson et al., 1988). For this study, only current and peak levels of nervousness were analyzed. Assessing peak affect ratings have been noted to minimize retrospective bias in participants (Fredrickson, 2000). Participants were asked to rate their feelings of nervousness on a 5-point Likert scale at the time when they received the EMA prompt and while reflecting on the most nervous they felt in the past hour (Lennarz et al., 2019; Stone et al., 2019; Tan et al., 2012). Peak nervousness was defined as any rating of nervousness on the Likert scale during the peak time of distress within the preceding hour. Specifically, participants rated their level of nervousness when asked, "Rate how you were feeling when you felt the worst (most negative) during the past hour using the scale below." Current nervousness was defined as any rating of nervousness on the Likert scale at the time when the EMA prompt was received. A change score was calculated from the current and peak nervousness ratings.

3.3 Procedures

3.3.1 Experimental Protocol

Data used from this study was drawn from a larger project that examined the developmental precursors of depressive disorders through investigating potential physiological, behavioral, and attentional mechanisms in the laboratory and in daily life among adolescents at familial risk for depression. This larger project was carried out in two phases: Phase 1 involved an online and telephone pre-screen of parents' and adolescents' psychiatric histories, and Phase 2 involved data collection in the laboratory and in participants' daily lives via EMA. Only Phase 2 data was used in this study.

When participants came into lab, they were consented and privately completed self-report surveys to assess their levels of current anxiety symptoms (RCADS) and cognitive reappraisal (ERQ). Next, participants completed semi-structured clinical interviews to assess histories of psychiatric disorders, which was not used in the present study. Then, participants engaged in an experimental protocol that included, among other tasks, the attention disengagement task.

3.3.2 Eye Tracking Protocol

Participants were seated approximately 60 cm from the center of the computer monitor where they viewed 72 trials of neutral-valenced face pairs from the KDEF database (Lundqvisk et al., 1998). Before the attention disengagement task began, participants underwent a 5-point calibration procedure to ensure that the eye tracker was accurately recording eye movement positions on the computer screen.

The experimental design was similar to one used by Sanchez et al. (2013) and Yaroslavsky et al. (2019). A visual representation of the attention disengagement task procedure is presented in Figure 3. Each trial opened with a black screen for 500 ms, followed by a central fixation cross for another 500 ms. Then, a single, random digit (1–9) appeared where the fixation cross was and remained for 1,000 ms. Participants were instructed to say the displayed number aloud to orient their attention to the center of the screen before the face pairs were presented. Once the number on the screen disappeared, the face pairs immediately appeared on the screen for a 3,000 ms "free viewing" period. After the free viewing period, either an additional free-viewing period began one-third of the time, an attention engagement period began one-third of the time, or an attention disengagement period began one-third of the time. All three trial conditions were presented randomly.

In the attention engagement period, participants had to disengage gaze from the neutral face in order to engage gaze with the emotional-valenced face in the pair whereas in the attention disengagement period, participants had to disengage gaze from the emotional face in order to engage gaze with the neutral face in the pair. Only the neutral-disgust face pairs in the attention disengagement trials were analyzed for this study. For the disengagement trials, after the free-viewing period, participants' fixation on the emotional face (for at least 100 ms) triggered a rectangular or oval frame to appear around the neutral face, and participants indicated the shape of the frame by pressing one of two keys on a keyboard corresponding to a "rectangle" or "oval." For the engagement trials, the

opposite occurred. Participants completed two practice trials to ensure their understanding of task instructions. Both types of frames and valenced faces were equal in their presentation and their appearance in the left or right positions. Neutral and valenced faces were presented equally on the left and right side of the screen across trials. The mean tracking ratio was 81% and ranged from 41-96%. Five participants evidenced a tracking ratio that fell below the optimal 70% or greater levels. However, their data were retained and reported in our findings, as the exclusion of these participants did not impact our conclusions.

3.3.3 Ecological Momentary Assessment Protocol

Participants received five fixed EMA prompts a day for 8 days (Fridays, Saturdays, Sundays, and Mondays across continuous weeks) following the laboratory procedure on their cell phone or email between the hours of 9:00 a.m. and 9:00 p.m. to allow for the sampling of participants' affective states evenly across the morning, afternoon, and evening hours. This schedule was created with participant input and was sometimes modified when the participant was not able to use their cell phone or email during these hours. Participants were sent a reminder prompt 15 minutes after receiving the original text message within a scheduled sampling period and were allowed 30 minutes to answer the survey before the link expired. The EMA prompt led the participants to a survey on SurveyHub where they provided contextual information about where they were, who they were with, and reported current affect and peak affect in the past hour on a 5-point Likert scale ("very slightly/not at all", "a little", "moderately", "quite

a bit" & "extremely"). Overall, there were 1,144 observations and response rate to the EMA prompts was 68%.

3.4 Statistical Analyses

Descriptive statistics and bivariate associations among study variables were examined using SPSS v. 22. SPSS was also used to examine assumptions that underlie analytic approaches to test the study hypotheses. MPlus v. 8.1 (Muthén & Muthén, 1998-2017) software was used to test hypotheses 1 and 2 that involve both nested and missing data. Robust Full Information Maximum Likelihood was used to adjust for missing values on study variables that ranged from 2-12% of the sample, and that were missing completely at random (MCAR) due to mechanical issues with the eye tracker. Missingness on the attention variable was 12% while missingness on the self-report (only the cognitive reappraisal measure had missing data) measures were 2%. Familial effects were evident among anxiety symptoms and affective measures to which 13–34% of variability was attributed (ICC_{RCADS}= 0.34, $ICC_{EMA\text{-}nervousness}$ = .13). Disengagement from disgusted faces was transformed by taking the square root due to the high variability.

Multi-level modeling was employed for hypothesis 2 due to the nested nature of this data as reflected by EMA-based change in nervousness ratings from peak to current levels (level 1) within participants (level 2). Although familial effects were tested to accommodate potential dependencies among siblings from the same family in the EMA data, preliminary analyses showed that variance attributable to families was essentially zero. Therefore, the EMA data was fit

using a two-level model. A random intercept was included in the model to accommodate within-participant dependency in the EMA data (ICC= .13). Additionally, the continuous level 2 predictors and covariates (i.e., cognitive reappraisal, disengagement from disgusted faces, and disengagement from sad faces) were grand mean centered (Enders & Tofighi, 2007).

Power Analysis. A sensitivity analysis using the formula for design effects in two-stage samples was conducted (Snijders & Bosker, 2012). This formula indicated that 42 participants have a medium to large effect size (H1: f^2=.20, H2: r=.64-.69; Cohen, 1992).

CHAPTER IV

RESULTS

4.1 Descriptive Analyses

Cross-Sectional. Pearson correlations were performed to examine the relationship between cross-sectional self-report variables (see Table 1). Of the demographic characteristics, age approaches a level of significance in its relationship with anxiety symptoms (r=.22, p=.07); gender was unrelated to all study variables. Cognitive reappraisal was significantly correlated with disengagement from disgusted faces (r=.40, p<.001) but contrary to expectation, was unrelated to self-reported anxiety symptomology. The relationship between self-reported anxiety and disengagement from disgusted faces (r=.18, p=.07) approached significance. All other variables in the model were unrelated.

EMA. In support of their validity, self-reported anxiety symptoms significantly predicted peak ratings of nervousness in daily life (γ=.03, p=.03) and evidenced a trend association with current nervousness levels (γ=.03, p=.06). However, self-reported anxiety symptoms were not related to change from peak to current nervousness ratings in daily life.

4.2 Hypothesis Testing

4.2.1 Hypothesis 1:

Does slower disengagement from disgusted faces moderate the negative relationship between cognitive reappraisal and anxiety symptomology?

To test this hypothesis, anxiety symptoms were regressed on disengagement from disgusted faces, cognitive reappraisal, and the two-way interaction between disengagement from disgusted faces and cognitive reappraisal (see Table 2).

Independent of the effects of disengagement from sad faces, slower disengagement from disgusted faces significantly predicted increased anxiety symptoms (B=1.38, p=.002). However, cognitive reappraisal was not related to anxiety symptoms. In contrast to expectation, the association between cognitive reappraisal and anxiety symptoms also did not vary as a function of disengagement from disgusted faces.

4.2.2 Hypothesis 2:

Does slower disengagement from disgusted faces moderate the association between cognitive reappraisal and the change in levels of nervousness from peak to current in daily life?

To test this hypothesis, change in peak to current nervousness in daily life was regressed on disengagement from disgusted faces, cognitive reappraisal, and the two-way interaction between disengagement from disgusted faces and cognitive reappraisal (see Table 3).

In contrast to expectation, neither cognitive reappraisal nor disengagement from disgusted faces were related to the change in peak to current nervousness in daily life, independent of the effects of disengagement from sad faces. This null effect was also observed in the hypothesized moderation: the association between cognitive reappraisal and change in nervousness in daily life did not vary as a function of disengagement from disgusted faces. However, slower disengagement from sad faces significantly predicted less change in nervousness from peak to current (γ=-.27, p=.02).

CHAPTER V

DISCUSSION

The current study aimed to test the moderating role of attentional control on the effects of cognitive reappraisal on anxiety symptomology via multiple methodologies in a sample of adolescents. Anxiety disorders are very prevalent amongst youth (Merikangas et al., 2010) and may persist into adulthood if not treated (APA, 2013). Even subthreshold symptoms of anxiety disorders have been known to cause significant impairment on daily life. Several models suggest that anxious individuals suffer from deficits in emotion regulation (Hannesdottir & Ollendick, 2007; Mennin et al., 2007; Suveg & Zeman, 2004). The adaptive emotion regulation strategy of cognitive reappraisal has been shown to effectively reduce anxiety (Hofmann et al., 2009; De Witte et al., 2017), but there has been some mixed findings in the literature regarding the nature and the strength of the relationship between cognitive reappraisal and anxiety as well (Eastabrook et al., 2014; Shapero et al., 2016). Due to these mixed findings, one could postulate that a potential third factor may undermine the positive effects of cognitive reappraisal and explain the discrepant results. Deficits in attentional control have been theorized as a possible underlying mechanism of emotion regulation (Koster et

al., 2011) and may moderate the association between cognitive reappraisal and anxiety. Therefore, two hypotheses were examined to test whether the lack of attentional control would dampen the effective use of cognitive reappraisal on adolescents' anxiety symptoms. Specifically, it was hypothesized that slow disengagement from disgusted faces would attenuate the relationship between cognitive reappraisal and anxiety symptoms (Hypothesis 1) as well as change in nervousness levels in daily life (Hypothesis 2).

In contrast to expectation, neither of the two hypotheses were supported. However, lower-order ties emerged between the variables of interest across cognitive reappraisal which was unrelated to anxiety symptoms and change in nervousness in daily life. These null results add to the mixed findings in the emotion regulation literature on the relationship between cognitive reappraisal and anxiety symptomology in adolescents. While some research has found that adolescents with anxiety symptoms are less successful at cognitive reappraisal (De Witte et al., 2017) and that successful cognitive reappraisal can reduce anxiety (De Witte et al., 2017; Schäfer et al, 2017, Suveg & Zeman, 2004), other studies found that cognitive reappraisal was not associated with emotional reactivity or biological recovery related to anxiety symptoms (Shapero et al., 2016) and that lower levels of cognitive reappraisal did not contribute to increased social anxiety symptoms in adolescent females (Eastabrook et al., 2014). The current study did not find any relationship between cognitive reappraisal and self-reported anxiety or change in nervousness from peak to current in daily life and thus is consistent with the research conducted by Eastabrook and colleagues

(2014) and Shapero and colleagues (2014) who also found similarly null results. These findings are also discordant with the literature showing an association between social anxiety in adults and less reported cognitive reappraisal in daily life (Blalock et al, 2016). These results also show that self-report measures may not transfer to daily life as suggested by Robinson and Clore (2002).

Furthermore, the effects of cognitive reappraisal on nervousness in daily life may be contextual. Haines and colleagues (2016) discovered that adults with higher well-being (which included measures of general anxiety as well as social anxiety among several other measures) used cognitive reappraisal more in situations where they perceived they had less controllability and used cognitive reappraisal less in situations where they perceived they had higher controllability. The researchers did not find an association between greater well-being and greater mean use of cognitive reappraisal, however (Haines et al., 2016). Therefore, the adaptiveness of cognitive reappraisal may depend on situational factors in real-life not accounted for in the present study.

However, independent of the effects of disengagement from sad faces, the main effect of slower disengagement from disgusted faces significantly predicted elevation in self-reported anxiety symptoms. This finding is consistent with research done by Fox and colleagues (2001) who found that the presence of threatening stimuli makes it more difficult for high state-anxious individuals to disengage their visual attention. This also supports the findings from Pergamin-Hight et al. (2016) who found that youth with SAD, compared to their non-anxious peers, showed a greater difficulty disengaging attention from threatening

stimuli. Relatedly, Attention Bias Modification Treatment (ABMT) is an intervention that targets a threat-specific bias in attention underlying anxiety disorders. There is already a large body of research showing the benefits of ABMT compared to a control treatment in reducing anxiety (see Hakamata et al., 2010 and Linetzky et al., 2015 for a meta-analytic review) which bolsters the notion that enhancing attention flexibility could improve the negative affective outcomes observed in anxiety disorders.

Interestingly, disengagement from disgusted faces was unrelated to the change in peak to current nervousness in daily life. Though unexpected given the strong relationship between disengagement from threatening stimuli and anxiety found in the literature (Fox et al., 2001; Pergamin-Hight et al., 2016), these null findings reflect a methodological obstacle that was encountered in the study and is discussed below.

Additionally, in Hypothesis 1 disengagement from sad faces was not associated with increased self-reported anxiety which shows that disgusted faces are uniquely linked to anxiety disorders rather than just negatively valenced faces. This finding lends support to research from Amir and colleagues (2005) who ascertained that individuals with social anxiety rated disgusted faces as more negative than angry faces because disgusted faces convey social rejection (Amir et al., 2005). As disengagement times from sad and disgusted faces share common variance that may reflect a general attention switching ability (Yaroslavsky et al., 2019), controlling for disengagement from sad faces enables the examination of unique covariance between disengagement from disgusted faces and anxiety.

Therefore, the significant relationship between slow disengagement from disgusted faces and elevated anxiety symptoms is disambiguated from a general attention switching ability.

Interestingly, slower disengagement from sad faces significantly predicted less change in peak to current nervousness in daily life. This could mean that those who were slower to disengage from sad faces were less able to decrease their level of nervousness from peak to current, or it is conceivable that those who were slower to disengage from sad faces reported peak nervousness levels that endured over time.

Why may significant findings emerge for disengagement from sad faces in daily life rather than self-report outcomes? It may be that the nervousness in daily life measure reflects more general negative affect rather than anxiety which could explain why there was an association between disengagement from sad faces and nervousness in daily life (Yaroslavsky et al., 2019) and not with disengagement from disgusted faces and nervousness in daily life.

As mentioned, the results failed to show a significant moderation of the association between cognitive reappraisal and anxiety-related outcomes by disengagement from disgusted faces. If conceptually linked, why may an anxiety-relevant index of attentional control fail to show the expected moderation effects? It may be that attention control is not as relevant to the association between cognitive reappraisal and anxiety as is effort. Attentional control is only one facet of a broader effortful control construct. Effortful control reflects the ability to employ executive control processes to allow one to override reactive tendencies

and replace the reactive responses to responses better adapted to long term goals (Lonigan & Vasey, 2009). In a neuroimaging study, Campbell-Sills et al. (2011) found that anxious individuals showed greater activation of the brain regions associated with effortful and automatic control of emotions during down-regulation of negative emotions compared to non-anxious individuals. These anxious participants required greater engagement of the brain regions associated with effortful control to successfully reappraise and reduce their negative emotions (Campbell-Sills et al., 2011). There may also be other variables not presently measured that could better explain the relationship between cognitive reappraisal and anxiety.

In addition, methodological factors may have occluded the ability to test the hypothesized moderation using EMA data. Specifically, only a limited number of participants rated nervousness at moderate to high levels. Nervousness even at its peak (highest level of nervousness in the past hour) was low with the average level of nervousness at the time of the prompt (current) being 1.27 on a 5-point Likert scale and the average peak rating of nervousness being 1.44. The amount of change in nervousness from peak to current which was used in the analysis was even less with the average change scoring being .17; less than one point on the Likert scale. This small amount of change means that levels of nervousness either did not significantly improve over time or the levels were so low to begin with that it did not necessitate a change.

5.1 Limitations and Recommendations for Future Research

Results of the present study should be interpreted while considering several limitations. First, participants were not from a clinical sample and therefore, many did not have a diagnosed anxiety disorder. The non-clinical sample may have been a factor in the limited number of daily endorsed nervousness ratings used in the EMA analysis. Therefore, future research may benefit from recruiting higher concentrations of individuals with clinical levels of anxiety to ascertain whether it strengthens these relationships in a clinical sample.

Second, cognitive reappraisal in this sample was only examined via a cross-sectional self-report measure. Kivity and Huppert (2016) found that anxious adults reported less success in deploying cognitive reappraisal but did not actually use cognitive reappraisal less than controls when completing a behavioral task. Having a behavioral measure may have given a clearer picture of the emotion regulation strategies participants are truly employing rather than the frequently used self-report measures to identify whether participants are using cognitive reappraisal more than they believe. A behavioral task may prove to be a stronger measure of cognitive reappraisal. Further, as emotion regulation outcomes are contextual, it is feasible that the results would have changed if EMA-based measures of cognitive reappraisal were employed.

Third, by design the EMA schedule accommodated adolescents' school schedules and collected data only on two of the five post school-day periods each week. Given the sampling schedule, it is likely that this study undersampled key

anxiety-related moments that that likely occurred within the school environment. Future research may benefit from collecting data within the school context.

Fourth, as emotion regulation has a maturational course that affects its outcomes (McRae et al., 2012), it is feasible that findings would have changed if age was added as second moderator to the cognitive reappraisal-anxiety relationship. McRae and colleagues (2012) examined older children, adolescents, and young adults and discovered a strong linear increase in cognitive reappraisal ability with age and a linear age-related increase in the activation of a brain region associated with cognitive reappraisal in adults. Further, as cognitive reappraisal may take a variety of forms that were not assessed in this study (e.g., positive reappraisal and negative reappraisal), it is feasible that the null findings noted in this work may apply to some but not other forms of the above constructs, which may also follow distinct maturational trajectories. Relatedly, research conducted by Cohen Kadosh et al. (2014) found that younger adolescents compared to older adolescents had more difficulties with attention control in the presence of valenced faces (Cohen Kadosh et al., 2014). Therefore, future research should examine a larger sample of adolescents and adults to further tease out the developmental nature of attentional control and how it impacts the ability to reappraise one's emotions.

5.2 Strengths and Clinical Implications

The strengths of the current study are reflected in its novelty and design. This study is the first to examine the moderating role of attentional control on cognitive reappraisal and anxiety in adolescents. Additionally, these relationships

were examined across both self-report and daily life measures, which provided unique information on the associations and helps inform future research.

While the hypothesized moderation effects were not supported via self-report or in daily life settings, the lower order findings are clinically relevant because they illustrate an important link between attentional control, anxiety, and nervousness in daily life and how it can lead to poor outcomes. The finding that slower disengagement from disgusted faces predicted self-reported anxiety symptomology suggests that an attention disengagement task has the potential to be used as a preventative or screening measure for those who have subthreshold levels of anxiety. Strengthening one's attention flexibility has shown to be clinically relevant in the literature (Hakamata et al., 2010; Linetzky et al., 2015) and has the potential improve the negative affective outcomes observed in anxiety disorders. Alternately, given the null finding between cognitive reappraisal and anxiety symptomology, clinicians may be better served to not focus on cognitive reappraisal in therapy for anxiety disorders, especially given the developmental considerations needed when working with adolescents (McRae et al., 2012). Therefore, it is important to assess the age of the youth and their subsequent cognitive reappraisal abilities before directing all clinical efforts to implementing cognitive reappraisal strategies in a therapy setting. In sum, the lower order findings have important clinical implications that may help inform recommendations for treatment and screening efforts.

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APPENDIX A: Tables

Table 1. *Descriptive Statistics and Correlations Among Demographic, Anxiety, Cognitive Reappraisal, and Eye-Tracking Measures.*

Variable	*n*	*M*	*SD*	1.	2.	3.	4.	5.	6.
1. Age	51/ 51	14.57/ 14.57	1.76/ 1.78	---	.04	.22	-.08	.09	.29*
2. Gender	51/ 51	1.53/ 1.53	.50/ (.50)	.04	---	.22	.10	.07	-.26†
3. Anxiety	51/ 51	10.22/ 10.22	6.91/ 6.98	.22†	.22	---	-.18	.16	.01
4. Cog.Reapp	51/ 50	26.64/ 26.64	6.27/ 6.34	-.07	.10	-.18	---	.38**	.04
5. Disg.Dis	51/ 46	244.14/ 244.73	2404.34/ 2405.37	.12	.07	.18†	.40***	---	.07
6. Sad.Dis	51/ 46	251.06/ 250.98	9443.65/ 9443.67	.32**	-.26†	.01	.07	.14	---

Note. Numbers to the right part of the slash and in the upper part of the triangle are the unadjusted values. Anxiety= Revised Children's Anxiety and Depression Scale-Short version anxiety subscale; Cog.Reapp= Emotion Regulation Questionnaire reappraisal subscale; Disg.Dis = Disengagement from disgusted faces; Sad.Dis= Disengagement from sad faces.
***p<.001, **p<.01, *p<.05, †p<.10.

Table 2. *Cognitive Reappraisal Effect on Self-Reported Anxiety Symptoms via Disengagement from Disgusted Faces.*

	DV: Anxiety					
	Main Effect			Interaction		
Variables	*B*	*SE*	Test Statistic	*B*	*SE*	Test Statistic
Cog.Reapp	-.33	.26	-1.29, *p*=.20	-.34	.25	-1.38, *p*=.17
Disg.Dis	1.38	.45	3.09, *p*=.002	1.40	.43	3.26, *p*=.001
Sad.Dis	-.13	.31	-.43, *p*=.67	-.14	.30	-.46, *p*=.65
Cog.Reapp*Disg.Dis	---	---	---	-.03	.10	-.26, *p*=.80

Note. Anxiety= Revised Children's Anxiety and Depression Scale-Short version anxiety subscale; Cog.Reapp= Emotion Regulation Questionnaire reappraisal subscale; Disg.Dis = Disengagement from disgusted faces; Sad.Dis= Disengagement from sad faces.

Table 3. *Cognitive Reappraisal Effect on Change in Peak to Current Nervousness in Daily Life via Disengagement from Disgusted Faces.*

	DV: Δ Nerv					
	Main Effect			Interaction		
Variables	*γ*	*SE*	Test Statistic	*γ*	*SE*	Test Statistic
Cog.Reapp	.07	.11	.66, *p*=.51	.004	.01	.84, *p*=.40
Disg.Dis	.16	.14	1.19, *p*=.24	.02	.02	.91, *p*=.36
Sad.Dis	-.27	.11	-2.40, *p*=.02	-.03	.02	-1.68, *p*=.09
Cog.Reapp*Disg.Dis	---	---	---	.003	.003	1.05, *p*=.29

Note. Δ Nerv= Change in peak to current nervousness in daily life; Cog.Reapp= Emotion Regulation Questionnaire reappraisal subscale; Disg.Dis = Disengagement from disgusted faces; Sad.Dis= Disengagement from sad faces.

APPENDIX B: Figures

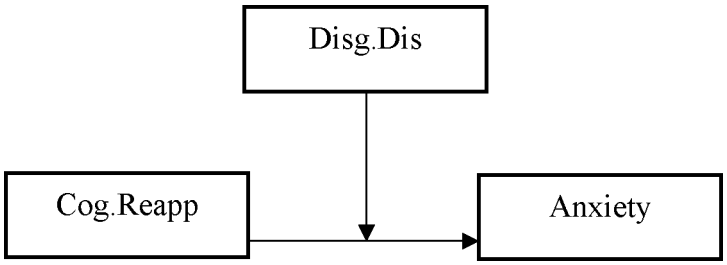

Figure 1. Anxiety= Revised Children's Anxiety and Depression Scale- Short version anxiety subscale; Cog.Reapp= Emotion Regulation Questionnaire reappraisal subscale; Disg.Dis = Disengagement from disgusted faces.

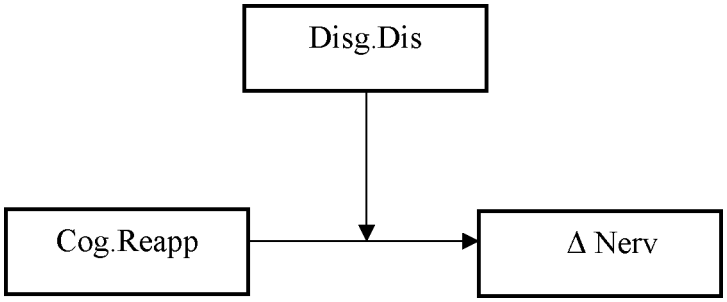

Figure 2. Cog.Reapp= Emotion Regulation Questionnaire reappraisal subscale; Disg.Dis = Disengagement from disgusted faces; Δ Nerv= Change in peak to current nervousness in daily life.

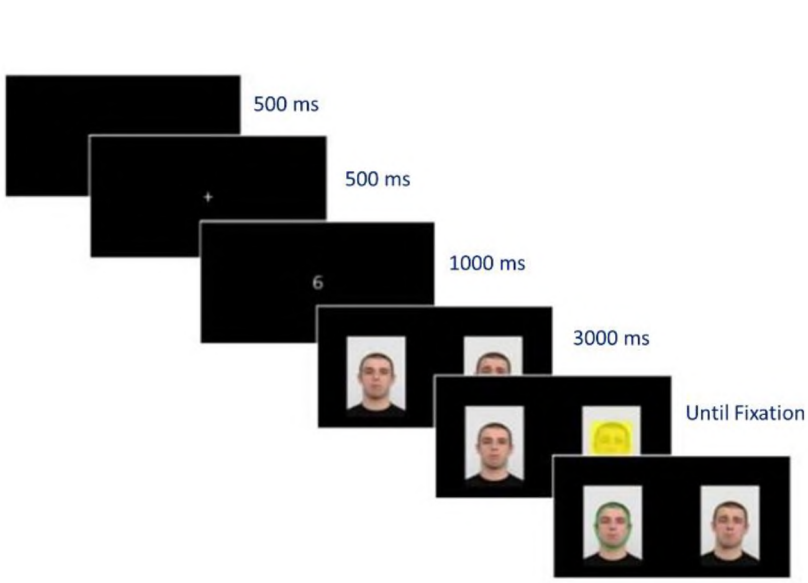

Figure 3. Schematic outline of the attention disengagement task procedure.