INVESTIGATING EMOTIONAL FACIAL RECOGNITION IN TRAIT ANXIOUS INDIVIDUALS: AN EYE-TRACKING STUDY

by

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Abstract

The current study examined the relationship between the recognition of the six basic emotions as a function of trait anxiety. Previous research has led to conflicting findings; one study reported increased accuracy for expressions of fear, and another finding no differences as a function of trait anxiety. As suggested by previous literature, the current study included eye movement measures to further investigate the processing of emotional expressions in anxious individuals. The current study also utilized four intensities of emotional expressions, a new addition to anxiety literature, as well as incorporated a measure of emotional dysregulation. The task consisted of a free viewing recognition task of expressions of the six basic emotions. Results from the current study revealed no accuracy or viewing time differences as a function of trait anxiety, however, a robust relationship was found between level of trait anxiety and emotional dysregulation. Clinical implications and future directions are discussed.

Keywords: Emotion; Trait anxiety; Facial expression; Recognition; Regulation

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Investigating emotional facial recognition in trait anxious individuals: An eye-tracking study

Anxiety is currently one of the most common mental health disorders; in fact, a recent study proposed the global prevalence to be 10.6% of individuals who have experienced anxiety within the past year and stating that 16.6% of individuals will experience an anxiety disorder at some point over the course of their lives (Somers, Goldner, Waraich, & Hsu, 2006). Recent research has attempted to explain how individuals with high and low trait anxiety attend to emotional stimuli and process emotional facial expressions as a way to explain the maintenance of the symptoms of anxiety. Regrettably, there have been inconsistent findings in previous research, with one study reporting that individuals with high trait anxiety were better able to identify the emotional facial expression of fear in comparison to those with low anxiety (Surcinelli, Codispoti, Montebarocci, Rossi & Baldaro, 2006), whereas a similar study reported no such differences (Cooper, Rowe, & Penton-Voak, 2008). The current study will build on the previous research to elucidate the differences between high and low trait anxious individuals in their processing of expressions of the six basic emotions.

Emotions

Emotions have been found to play a significant role in every component of our lives as they are present in all areas of human relationships (Ekman, 2003). The basic definition of emotions has been disputed over many decades in both research and academics (Kleinginna & Kleinginna, 1981) and there has yet to be a concrete, universally accepted definition (Cabanac, 2002). However, a number of experimenters support that emotions are mental experiences in response to an internal or external event, and those experiences provoke feelings of pleasure and/or displeasure, produce physiological changes, have motor (face and body) expressions, result in action tendencies, and cognitive processes (Cabanac, 2002; Kleinginna & Kleinginna,

1981; Scherer, 2005).

In order to further describe emotions, Scherer (2005) believed that explaining the many components of emotions was integral for the understanding of how they are felt, henceforth named: the component process theory. The component process theory suggests that emotions are created as a result from changes in the body's internal subsystems (Scherer, 2005). The first proposed component is the evaluation of the stimuli, this assessment of the stimuli occurs prior to the emotion and is predominantly enforced by the central nervous system (CNS) in order to receive information from the stimuli and process it (Scherer, 2005). Another suggested component is the bodily symptoms, meaning how the body reacts and what it does in order to regulate itself (Scherer, 2005). Some examples of reactions to emotions are an increase in blood pressure and an increase in heart rate. In order to reduce these bodily symptoms, it has been suggested that the body utilizes the central nervous system (CNS), neuro-endocrine system (NES) and the autonomic nervous system (ANS) in order to equilibrate the body (Scherer, 2005). After the body reacts to the stimuli, it has been suggested that the immediate reaction from the body is to plan for action, for instance, when a fearful stimulus appears, the body would experience a fight-or-flight response in order to deal with the emotional stimuli (Scherer, 2005). It has been suggested that emotional facial expressions are an important component of emotions as it communicates an individual's emotion nonverbally (Scherer, 2005). Finally, Scherer claims the importance of the emotional experience, or the internal feeling or state an individual experiences in regards to the emotional stimuli (Scherer, 2005). In sum, theorists like Scherer view emotion as a concept that consists of multiple components.

Within emotional theories, Paul Ekman, Wallace Friesen and Phoebe Ellsworth are some researchers that proposed that there are six basic emotions: anger, disgust, fear, happiness,

sadness, and surprise (Ekman, Friesen, & Ellsworth, 1972). Other theorists and researchers examining emotions have proposed other basic emotions that sometime consist of seven emotions or more (e.g., Izard, 1982; Plutchik, 1994). Ekman defined a basic emotion as something that is inborn as it has the ability to provide humans with the ability to complete a variety of what Ekman defines as fundamental life-tasks. In addition, Ekman claims that basic emotions are different from other emotions as they have been shown to be universal, expressed not only in humans but in animals as well, have unique physiological reactions, often have a rapid onset and do not have a long duration, and they cannot be changed or manipulated by the individual (Ekman, 1992). Although there are many constituents of emotions, the current thesis will be primarily focused on examining the processing of emotional facial expressions, specifically with the recognition of emotional faces.

Emotional Faces

The ability to accurately recognize emotional facial expressions in others has been suggested to be advantageous, as it allows one to unconsciously and nonverbally understand the intentions and feelings of others, and then can respond accordingly (Calvo & Lundqvist, 2008; Darwin, 1872; Ekman, 2003). The focus of recent research on emotional faces has examined individuals' ability to recognize emotional facial expressions as a way to gain a greater understanding of the differential processing of them. Research has further examined this through the addition of tracking participants' eye movements during the emotional facial recognition task. Specifically, it has been consistently demonstrated in research that individuals typically have greater accuracy and viewing times for expressions of happiness in comparison to expressions of fear (Beaudry, Roy-Charland, Perron, Cormier & Tapp, 2014; Calvo & Lundqvist, 2008; Calvo & Nummenmaa, 2008).

Beaudry et al. (2014) examined the emotional facial recognition of the six basic emotions (anger, disgust, fear, happiness, sadness and surprise). The authors also recorded participants eye movements in order to obtain greater depth of knowledge of the participants' use of eyes/brow and mouth areas when distinguishing between emotions (Beaudry et al., 2014). The study also examined how participants recognized different intensities of emotional facial expressions (20%, 30%, 50% and 100%). The purpose of including different intensities of emotions was to diminish a ceiling effect in the identification of some emotional facial expressions, specifically for happiness as it is often found to have near perfect accuracy (Beaudry et al., 2014). The results demonstrated that, consistent with previous literature, the expression of happiness was the most accurately recognized and the expression of fear was the least accurately recognized (Beaudry et al., 2014). Results from proportion of time analyses found that the mouth area was more important for the identification of happiness and the eyes/brow area was more important in the recognition of sadness (Beaudry et al., 2014). It was observed that for every emotion, the participants fixated on the eyes/brow areas for more time than the mouth area (Beaudry et al., 2014).

Due to the previous study's findings from a sample that was not screened for psychopathology, it has been considered if the same complexity would be present in individuals experiencing mental health disorders, or if differences would be found. As previous research suggests that individuals with mental health disorders show alterations in the structure of their brains, and that its function and neurochemistry may effect emotional processing (National Institutes of Health, 2007). Specifically, the Diagnostic and Statistical Manual of Mental Disorders suggests that the important emotion associated with anxiety disorders is fear (American Psychiatric Association, 2013). Some research has proposed that individuals with

higher levels of anxiety demonstrate differential processing of the emotional facial expression of fear during an emotional facial recognition task (Surcinelli et al., 2006). In addition, it has been theorized that individuals with greater levels of anxiety may have greater accuracy for the expression of fear as they may attribute the expression of fear as being more threatening or negative than non-anxious individuals (Mogg & Bradley, 1998). The purpose of the current study was to examine if individuals with greater levels of trait anxiety demonstrate a similar pattern of emotional facial recognition and processing as Beaudry et al. (2014). Specifically, do individuals with greater levels trait anxiety display similar patterns for accuracy, viewing time, and proportions of time as in the general population? Or if differences would be found as a result of the participants' anxiety, supporting previous literature examining facial recognition in individuals with greater levels of trait anxiety.

Emotion Regulation

Emotional regulation, defined by Gratz and Roemer (2004) is described as 1) emotional awareness and understanding, 2) emotional acceptance, 3) the ability to control impulses and pursue desired outcomes when experiencing strong emotions, and 4) uses situationally appropriate emotion regulation strategies to modulate emotional responses. It has been proposed that the absence of any or all of the characteristics may indicate that the individual has difficulties in emotional regulation, or sometimes referred to as emotional dysregulation (Gratz & Roemer, 2004). Therefore, in order to assess this type of emotional experience, Gratz & Roemer created the Difficulties in Emotion Regulation Scale (DERS) to assess emotion dysregulation more meticulously than previous measures.

Emotional dysregulation has been found to be related to numerous mental health disorders, such as major depressive disorder (Gross & Levenson, 1997; Rude & McCarthy,

2003) and panic disorder (Baker, Holloway, Thomas, Thomas, & Owens, 2004). Research by Gross and Levenson (1997) thoroughly examined the mental health disorders found in the Diagnostic and Statistical Manual of Mental Disorders – Fourth Edition, their results suggested that over 50% of Axis I disorders and 100% of Axis II disorders implicated at least one area of emotion regulation difficulties. The results obtained from the study by Gross and Levenson (1997) began a conversation regarding the impact of emotion dysregulation from a mental health perspective.

It has been suggested that the maintenance of anxiety symptoms may be related to the difficulty in regulating one's own emotions, with particular emphasis on the emotion of fear (Barlow, 1988). Individuals who experience greater levels of anxiety have been reported as displaying maladaptive emotion regulation strategies such as ignoring or suppressing the emotion and that this may also play a role in the maintenance of anxiety symptoms (Gross & Levenson, 1997). Certainly in research, one of the most examined maladaptive emotion regulation strategies is emotional suppression, or sometimes described as avoiding one's emotional experiences (Gross & John, 2003).

It has been proposed that individuals who have greater levels of anxiety often experience excessive and persistent negative emotions, which has been found to be related to ineffective emotion regulation (Campbell-Sills, Barlow, Brown & Hofmann, 2006). This excessive negative emotionality found in individuals with anxiety may be connected to emotional dysregulation as research suggests that individuals are often more likely to use emotional suppression if the emotion they are experiencing feels negative or aversive (Amstadter, 2008). Currently, research investigating the role of emotional dysregulation in nonclinical university samples is lacking. The importance of the current study is to further the examination between nonclinical trait

anxiety and emotional dysregulation, therefore, potentially finding differences for emotional dysregulation in comparison to those with clinically diagnosed anxiety disorders. Results examining emotional dysregulation and trait anxiety in nonclinical university samples will be able to inform educational institutions and community mental health resources in their endeavours to reduce symptoms of mental health.

Anxiety

Anxiety Disorders are a group of mental heath disorders that are defined by feelings of fear and anxiety and described as causing worry and apprehension over things that have happened previously, or events that may happen in the future (American Psychiatric Association, 2013). Anxiety disorders is an umbrella term for numerous different mental health disorders that fall under the classification of anxiety. Some of the most common anxiety disorders include Generalized Anxiety Disorder, Specific Phobia, Social Anxiety Disorder, and Panic Disorder (American Psychiatric Association, 2013).

The Diagnostic and Statistical Manual of Mental Disorders – Fifth Edition defines anxiety disorders as a group of dysfunction consisting of feelings of fear and anxiety (American Psychiatric Association, 2013). The DSM-5 defines fear as the individual's emotional reaction to a real or a perceived danger, and in response to the fear, the body's reaction is to escape from the conflict, activating one's fight or flight automatic response (American Psychiatric Association, 2013). In comparison, anxiety is described as an individual's anticipation of a potential upcoming threat (American Psychiatric Association, 2013). The bodily felt sense is tense and tight during these periods of anxiety, which is in contrast to the heightened heart rate that is characteristic of fear (American Psychiatric Association, 2013).

State and Trait Anxiety. Within anxiety theories, Charles Spielberger proposed two

categories of anxiety: state and trait (Endler & Kocovski, 2001). State anxiety is commonly described as feelings of trepidation and uneasiness by perceiving a situation to be threatening (Spielberger et al., 1983). State anxiety is considered a temporary feeling in response to an individual's current environment, whereas, trait anxiety is more representative of an individual's personality, which is comprised of a predisposition to generally identify situations as threatening (Spielberger et al., 1983).

Emotional Facial Recognition and Trait Anxiety

It has been proposed that individuals with higher levels of trait anxiety may attend more to threatening or negative stimuli than to positive or neutral stimuli (Eysenck, 1997). Thus, it could be anticipated that they would also attend more to negative or threatening emotional facial expressions than to happier or neutral expressions as observing another individual in a negative state may increase feelings of discomfort within themselves. In a study conducted by Surcinelli and colleagues, a nonclinical sample of participants were recruited in order to examine the differences in the recognition of emotional faces as a function of trait anxiety (Surcinelli et al., 2006). Participants were instructed to complete the State-Trait Anxiety Inventory, a self-report measure that examines an individual's experience with anxiety and evaluates their level of state and trait anxiety (Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, 1983). The researchers categorized the participants into two groups: high trait anxiety (individuals who scored above the 75th percentile on the State-Trait Anxiety Inventory trait scale) and low trait anxiety (participants who scored below the 25th percentile on the trait scale). The materials for the study consisted of 42 emotional faces from the Pictures of Facial Affect with equal presentations of the six basic emotions: anger, disgust, fear, happiness, sadness, surprise as well as a neutral expression (Ekman & Friesen, 1976). Each emotional face was presented on the screen for 10 seconds, and

afterward the image disappeared and the participants had unlimited time to label the expression by pressing a button on a keyboard associated to one of the seven emotions: anger, disgust, fear, happiness, sadness, surprise, and neutral) (Surcinelli et al., 2006).

The results from the experimental session revealed a significant difference for the recognition of the emotional facial expression of fear as a function of trait anxiety (Surcinelli et al., 2006). In effect, the results demonstrated that the high trait anxious group had significantly greater accuracy levels for fear in comparison to the low trait anxiety group (Surcinelli et al., 2006). An explanation for the results obtained were that perhaps as anxious individuals are more personally familiar with feelings of threat and danger, and that these feelings are closely associated to the emotion of fear, that individuals with higher trait anxiety may in fact recognize the expression of fear as a precursor for feelings of threat and danger (Surcinelli et al., 2006).

However, Cooper and colleagues (2008) believed there to be two main limitations from the Surcinelli and colleagues study. First, they believed that the study was not accurately measuring emotional facial recognition as participants were forced to examine the image for 10 seconds regardless, which may have effected their decision process. Specifically, as the stimuli was presented on the screen for 10 seconds, it was suggested that similar accuracy could have been achieved with a significantly shorter duration time or that longer presentation allowed reprocessing impacting accuracy levels (Cooper et al., 2008). According to the authors, the duration time may have had an impact on the results as it may have been possible that high trait anxious group could have attended more to the threatening stimuli than the low trait anxious group, possibly accounting for their superior accuracy (Cooper et al., 2008). According to Cooper et al. (2008), another limitation from the Surcinelli et al (2006) study was that response time was not recorded, only accuracy. The concern with not measuring response time is that

there was no method to analyze if the high trait anxiety group were also able to respond faster to the emotional facial expression of fear (Cooper et al., 2008), which would further give support to the attentional bias towards expressions of fear if accuracy was significantly faster for the high trait anxiety group.

In order to address the previous limitations, Cooper and colleagues conducted a similar study, using the same categorization strategy as Surcinelli et al. (2006). The differences between the two studies were found in the procedure as they presented their images (same database as previous study) on the screen until the participant identified the image on a keyboard or after four seconds had elapsed, whichever occurred first (Cooper et al., 2008). The results obtained demonstrated that happiness was the most accurately recognized emotion with the exception of surprise (Cooper et al., 2008). Remarkably, there was no significant interaction between emotional facial recognition as a function of trait anxiety, therefore, the results from Surcinelli et al. (2006) were not supported.

Due to the differing results from the Surcinelli et al. (2006) and the Cooper et al. (2008) study, future examinations are necessary to clarify the relationship between the recognition of emotional facial expressions in individuals with high and low trait anxiety. It was proposed by Cooper and colleagues that further research should include eye movement measures in order to assess where the participants are looking in order to possibly provide further explanations for any differences between groups (Cooper et al., 2008). The importance of the addition of eye movement measures was to further examine if participants with greater levels of trait anxiety would display different proportion of time patterns in the eyes/brow and mouth areas than the low trait anxiety group, which is a recent addition to current anxiety literature.

Current Study

The purpose of the current study was to examine the recognition of the six basic emotions (anger, disgust, fear, happiness, sadness, surprise) as a function of trait anxiety (low and high). The goal of the present study was to clarify the differences found between the research conducted by Surcinelli et al. (2006) and Cooper et al. (2008) through the addition of eye-tracking measures. A non-clinical sample of university students participated in an experimental session involving viewing and identifying expressions of the six basic emotions. A different stimuli database was incorporated into the current study which included four intensities of emotional faces in order to provide additional insight into the role of lower levels of intensity in comparison to the full intensity emotional expressions (Beaudry et al., 2014). The importance of the inclusion of different intensities of emotional facial expressions is that in everyday life, it is typically uncommon to see full intensity expressions of emotions, thus increasing the ecological validity for the current study's findings.

As suggested by Cooper et al. (2008), the current study measured the participants' eye movements in order to provide additional information with regards to which areas on the face participants gaze, which could be used to rationalize their accuracy for the recognition of emotional faces. In addition, the results from the current study will be used to corroborate the findings from Beaudry et al. (2014) regarding the order of emotional facial recognition. The present study examined the participants' accuracy, viewing time, as well as their eye movements in response to the experimental session. The current study also incorporated the Difficulties in Emotion Regulation Scale as a measure to assess participants' level of emotional dysregulation, and the Positive and Negative Affect Schedule, as it has been consistently used in research examining levels of anxiety in individuals (Surcinelli et al., 2006; Cooper et al., 2008; Quigley et al., 2012). In addition, it is also a great tool for assessing if participants' affective states changed

as a result from the experimental session, as participants were given the PANAS before and after the recognition task.

Hypotheses

The present study hopes to clarify inconsistencies in previous research involving emotional facial recognition in individuals with high levels of trait anxiety. Hypothesis 1: it was hypothesized that the participants who reported as having high trait anxiety would either demonstrate greater accuracy and faster viewing times for the identification of the emotional facial expression of fear than any other emotion (Surcinelli et al., 2006), or there would be no differences between emotional facial recognition as a function of trait anxiety (Cooper et al., 2008). Hypothesis 2: it was anticipated that the participant's accuracy for the recognition of emotional faces would correlate with difficulties in emotional regulation, as the relationship between emotional dysregulation and anxiety has been suggested in previous literature. Hypothesis 3: it was hypothesized that the results from the current study will be consistent with findings from Beaudry et al. (2014), insofar as the role of the eyes/brow and mouth area on the recognition of the six basic emotions.

Chapter Two: Methodology

Participants

A total of 114 individuals participated in the research study, however, 21 were removed for either incomplete measures or the degree of eye-tracking calibration was less than favourable. Therefore, 93 individuals (83 females, 10 males; *M* = 21.58 years, *SD* = 6.26) were maintained in the current research study. All participants were recruited from Laurentian University undergraduate psychology courses, with some professors offering extra course credit in appreciation for their participation. Previous research examining the effects of anxiety (Surcinelli et al., 2006; Cooper et al., 2008) have categorized their participants with having low or high trait anxiety if their scores on the State-Trait Anxiety Inventory were below the 25th percentile or above the 75th percentile, while removing participants who fell in the middle. However, after examining the percentiles of the State-Trait Anxiety Inventory, it was anticipated that the discrepancy between the 25th and 75th percentile would not have been as distinct than if participants were sorted into quartiles or thirds; thus, the present study sorted participant's total trait anxiety score in ascending order and separated them into thirds. The lower third became the low trait anxiety group (*M* = 24.26 years, *SD* = 9.72), and the upper third became the high trait anxiety group (*M* = 20.74 years, *SD* = 3.20).

Materials

Stimuli. The stimuli used in the present study were images that were obtained from the Japanese and Caucasian Facial Expressions of Emotion (JACFEE) database (Matsumoto & Ekman, 1989). The stimuli from the JACFEE database included images of the six basic emotions: anger, disgust, fear, happiness, sadness, and surprise (Matsumoto & Ekman, 1989). The current study used the Caucasian faces, consisting of the 6 basic emotions, presented twice

for each gender. In addition, the images, used by Beaudry et al. (2014) modified using the Morpheus 7.0 program in order to achieve four levels of intensities for each emotion: 20%, 30%, 50% and 100% were used in the current study. At the end of the experimental session, the participants viewed a total of 96 images. Examples of the stimuli used can be found in Figure 1.

Figure 1. Examples of emotional stimuli used in the current study.

Measures. The participants were asked to complete four measures: a Demographic Questionnaire, the State Trait Anxiety Inventory (STAI), the Difficulties in Emotional Recognition Scale (DERS) and the Positive and Negative Affect Schedule (PANAS).

Demographic Questionnaire. The Demographic Questionnaire asked participants their gender, age, primary language, ethnic/racial background and lastly, any mental health diagnoses, and if so, what was the diagnosis.

State-Trait Anxiety Inventory. The State-Trait Anxiety Inventory (STAI) is a 40-question self-report measure developed by Charles Spielberger (Spielberger et al., 1983). The inventory is a reliable measure of an individual's experience with anxiety, having been used in research approximately ten times more than the well-known Beck Anxiety Inventory (Spielberger et al., 1983).

The State-Trait Anxiety Inventory consists of two scales; there are twenty individual questions that specifically relate to the state anxiety scale (1-20), and another twenty that correspond to the trait anxiety scale (21-40). State anxiety is defined by anxious feelings resulting from a specific situation, whereas trait anxiety is defined as a predisposition to classify situations as threatening or dangerous (Spielberger et al., 1983). For instance, "I feel at ease" and "I feel upset" are examples of questions relating to the state anxiety scale, and "I am a steady person" and "I lack self-confidence" are examples of questions that correspond to the trait anxiety scale (Spielberger et al., 1983). For the state scale, participants were asked how they *currently feel* in response to each question; a score of 1 represented that they *did not agree* with the statement at all, 2 represents that they *somewhat* felt that way, 3 represents that they *moderately* felt that way, and 4 represents that they *very much* felt that way (Spielberger et al., 1983). For the trait scale, participants were asked how they *generally feel*; a score of 1

represented that they *almost never* felt that way, 2 represents that they *sometimes* felt that way, 3 represents that they *often* felt that way, and 4 represents that they *almost always* felt that way (Spielberger et al., 1983).

Difficulties in Emotion Regulation Scale. The Difficulties in Emotion Regulation Scale (DERS) is a brief, 36-item self-report questionnaire designed to assess difficulties in emotional regulation (Gratz & Roemer, 2004). The measure was developed in order to assess multiple difficulties in regard to emotional regulation through the 6 subscales: 1) acceptance of emotions (i.e., "when I'm upset, I feel guilty for feeling that way"), 2) ability to engage in goal directed behavior (i.e., "when I'm upset, I have difficulty getting work done"), 3) impulse control difficulties (i.e., "when I'm upset, I have difficulty controlling my behaviours"), 4) degree of emotional awareness (i.e., "I am attentive to my feelings"), 5) their access to emotion regulation strategies (i.e., "when I'm upset, it takes me a long time to feel better"), 6) and their level of emotional clarity (i.e., "I have no idea how I am feeling") (Gratz & Roemer, 2004).

Participants were asked to indicate how often each question applies to them on a scale of 1 to 5. A rating of 1 indicates the participant *almost never* felt that way, 2 means that the participant *sometimes* felt that way, 3 represents the feeling that way *about half of the time*, 4 means that individuals believe that they felt that way *most of the time*, and a score of 5 is indicative of the participant having the feeling that way *almost always* (Gratz & Roemer, 2004).

Positive and Negative Affect Schedule. The Positive and Negative Affect Schedule (PANAS) is a measure designed to assess an individual's positive and negative affective states (Watson, Clark, & Tellegen, 1988). The measure consists of 20 words that describe different emotions and feelings (Watson et al., 1988). As the measure assesses both positive and negative affect, it should be mentioned that 10 of the 20 items relate to assessing positive affective states:

active, alert, attentive, determined, enthusiastic, excited, inspired, interested, proud and strong (Watson et al., 1988). The remaining 10 words assess an individual's negative affective states: afraid, ashamed, distressed, guilty, hostile, irritable, jittery, nervous, scared and upset (Watson et al., 1988). The participants were instructed to carefully read each item and indicate how they currently felt about each item. The 5 possible responses from 1-5 were: *very slightly* or *not at all*, *a little*, *moderately*, *quite a bit*, and *extremely*. Responses for the measure range from 10-50; a high score on the positive affect scale represents a high level of positive affect, whereas a low score on the negative affect scale represents a low level of negative affect (Watson et al., 1988).

Eye Movement Recording

The participants' eye movements were recorded through the use of the SR Research Ltd. EyeLink II system. The apparatus has a high accuracy (<0.5°) and a high sampling rate (500 Hz). The participants observed the visual stimuli on a 21-inch VIEW-Sonic CRT monitor. The Eye Link II apparatus includes two small cameras (SR 520 monocular lens) that are mounted on to a padded headband. For the study, only the eye with the best calibration was tracked. The cameras are fixed below the participants' eyes and are used to measure the position of the eyes on the display screen in two millisecond intervals. In addition, the headband includes an infrared sensor that tracks the participants' point of gaze by tracking their precise head movements during the experimental session.

Procedure

The participants were all tested individually for one experimental session lasting approximately 60 minutes. Upon completing the Consent Form, participants were given a Demographic Questionnaire, and the Positive and Negative Affect Schedule (PANAS) to complete. Afterward, the participants were seated approximately 60 cm from the computer

monitor to view the stimuli. The researcher then calibrated and validated the Eye Link II apparatus in order to achieve highly accurate results from each participant.

The participants were presented with only one image at a time, and the participants controlled the duration of the stimulus presentation. When they were finished, they would press the left mouse button and a white screen would appear. Participants were asked to identify the emotion from a list of ten emotions: anger, contempt, disgust, fear, guilt, happiness, interest, sadness, shame and surprise. In addition, the participants were given an "other" option in order to classify the image as representing an emotion that was not presented in the list. Previous research incorporated *contempt, guilt, interest, and shame* as well as provided another option in order to reduce forcing their decision to one of the 6 basic emotions (Beaudry et al., 2014; Russell, 1993). Once the participant made their decision, the experimental session would continue and a new picture was presented. After the completion of the experimental session, the participants were asked to complete the Positive and Negative Affect Schedule once more, and were also asked to complete the State-Trait Anxiety Inventory (STAI), the Difficulties in Emotion Regulation Scale (DERS) in a counterbalanced order. Upon completion, participants were debriefed and explained the purpose of the study.

Data Analysis

In the present study, the first independent variable was the participants' level of trait anxiety based on their score on the State-Trait Anxiety Inventory. Participants were sorted the total trait anxiety score in ascending order and then separated the participants into thirds. The lower third became the low trait anxiety group, and the upper third became the high trait anxiety group. The second independent variable was the emotional faces, which consisted of anger, disgust, fear, happiness, sadness and surprise. The Japanese and Caucasian Facial Expressions of

Emotion (JACFEE) database was used as the emotional facial stimuli, used in previous literature (Beaudry et al., 2014). Similar to Beaudry et al. (2014), four intensities of expression were used (20%, 30%, 50%, 100%).

The dependent variables measured in the present study were participants' accuracy, viewing times, proportions of time for the eyes/brow and mouth area, scores on the Difficulties in Emotional Regulation Scale, and on the Positive and Negative Affect Schedule. For both the DERS calculations, appropriate items were reversed-scored and then were added together for create the six subscales and the total score.

Participants' accuracy for each emotion (anger, disgust, happiness, fear, surprise and sadness) was calculated by dividing the number of correct responses by the total number of occurrences of the stimuli. Participants' viewing times were recorded using the variable trial dwell time from the beginning of the image presentation to when the participant clicked the mouse button. For proportion of time, the time spent viewing each area (eyes/brow and mouth) was divided by the total viewing time of the image. Level of trait anxiety was grouped into high and low using the aforementioned categorization strategy for accuracy, viewing time, and proportion of time, but was used as a continuous variable for correlations, thus affecting the number of subjects in each analysis. For all analyses an alpha level of .05 was used, unless otherwise indicated.

Chapter Three: Results

First, results supported that the two groups (high anxiety: M = 58.77, SD = 5.65; low anxiety: M = 34.45, SD = 6.05) were significantly different in their anxiety levels, $F(1,60) = 267.19$, $p < .01$, $\eta^2_p = .82$.

Accuracy

A 2 (anxiety: high, low) x 6 (emotion: anger, disgust, fear, happiness, sadness, surprise) x 4 (intensity: 20%, 30%, 50%, 100%) mixed-design ANOVA was computed for accuracy at the recognition task. Results revealed a significant main effect for emotion (see Figure 2), $F(5,300)= 65.68$, $p < .01$, $\eta^2_p = .52$, a significant main effect for intensity, $F(3,180)= 710.35$, $p < .01$, $\eta^2_p = .92$, but no significant main effect was found for anxiety, $F(1,60)= .24$, $p = .62$, $\eta^2_p = .004$. A significant interaction between emotion and intensity was found, $F(15,900)= 13.71$, $p < .01$, $\eta^2_p = .19$, however, no significant interaction was found between emotion and anxiety, $F(5,300)= 1.07$, $p = .38$, $\eta^2_p = .02$, intensity and anxiety, $F(3,180)= .39$, $p = .76$, $\eta^2_p = .007$, or emotion, intensity and anxiety, $F(15,900)= .76$, $p = .73$, $\eta^2_p = .01$.

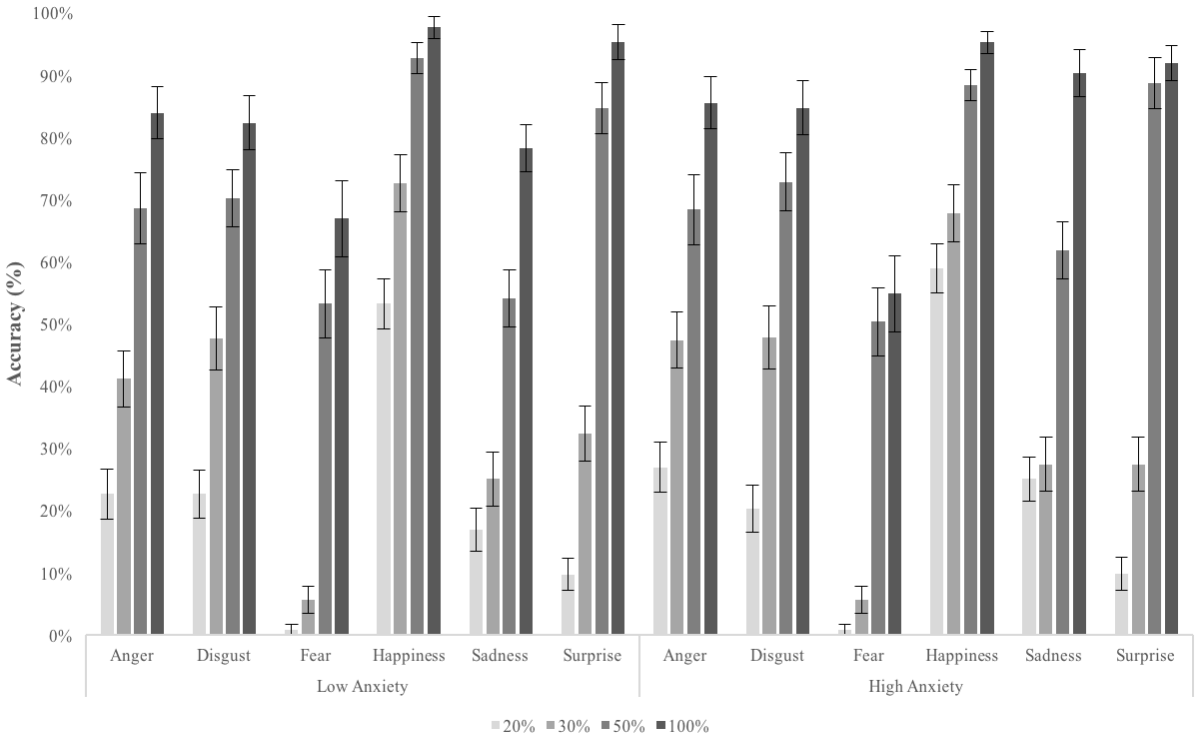

Figure 2. Mean accuracies (%) for the identification of the six basic emotions.

For the interaction between emotion and intensity, simple main effects tests were computed using a Dunn's corrections ($p < .015$). For expressions of anger, disgust, fear, happiness, sadness, and surprise respectively, results revealed a significant effect of intensity, $F(3,180)= 114.85$, $p < .01$, $\eta^2_p = .66$; $F(3,180)= 91.73$, $p < .01$, $\eta^2_p = .61$; $F(3,180)= 122.86$, $p < .01$, $\eta^2_p = .67$; $F(3,180)= 87.10$, $p < .01$, $\eta^2_p = .59$; $F(3,180)= 143.84$, $p < .01$, $\eta^2_p = .71$; $F(3,180)= 365.13$, $p < .01$, $\eta^2_p = .86$. Post hoc tests (LSD) for anger, disgust, fear, happiness, and surprise all found that all intensities were significantly different from one another, and that accuracy increased for all emotions as intensities increased from 20% to 100%. Post hoc tests (LSD) also found that participants' accuracy increased as intensities increased, however, the 20% and 30% intensities were not significantly different from each other.

For 20% 30%, 50%, and 100% respectively, significant effects for emotion were found, $F(5,300)= 68.80$, $p < .01$, $\eta^2_p = .53$; $F(5,300)= 53.28$, $p < .01$, $\eta^2_p = .47$; $F(5,300)= 22.88$, $p < .01$, $\eta^2_p = .28$; $F(5,300)= 18.59$, $p < .01$, $\eta^2_p = .24$. For 20%, post hoc tests (LSD) revealed that happiness had significantly greater accuracy than all with the other emotions with the exception of surprise, and fear had the lowest accuracy. Anger, disgust, and sadness did not different significantly. For 30%, post hoc tests (LSD) found that again, happiness had significantly greatest accuracy and fear has the lowest, anger and disgust did not differ significantly and had less accuracy than happiness. Also, sadness and surprise did not differ significantly, having lower accuracy than anger and disgust but more than fear. For 50%, post hoc tests (LSD) revealed that happiness had the greatest accuracy than all with the exception of surprise, and fear had the lowest accuracy than all with the exception of sadness. Anger and disgust did not differ significantly, having lower accuracy than happiness and surprise but greater accuracy than fear and sadness. For 100%, post hoc tests (LSD) found that happiness had the greatest accuracy than

all with the exception of surprise and that fear was significantly different from all emotions, having the lowest accuracy at 100%. Anger, disgust, and sadness were found to not be significantly different from each other.

Viewing Time

Analyses were conducted using a 2 (anxiety: high, low) x 6 (emotion: anger, disgust, fear, happiness, sadness, surprise) x 4 (intensity: 20%, 30%, 50%, 100%) mixed-design ANOVA on viewing time. Results revealed a significant main effect for emotion (see Figure 3), $F(5,300)= 7.40$, $p < .01$, $\eta^2_p = .11$, a significant main effect for intensity, $F(3,180)= 59.43$, $p < .01$, $\eta^2_p = .50$, but no significant main effect was found for anxiety, $F(1,60)= .18$, $p = .68$, $\eta^2_p = .003$. A significant interaction between emotion and intensity was found, $F(15,900)= 5.06$, $p < .01$, $\eta^2_p = .08$, however, no significant interaction was found between emotion and anxiety, $F(5,300)= 1.40$, $p = .23$, $\eta^2_p = .02$, intensity and anxiety, $F(3,180)= .56$, p = .64, $\eta^2_p = .009$, or emotion, intensity and anxiety, $F(15,900)= 1.50$, $p = .09$, $\eta^2_p = .02$.

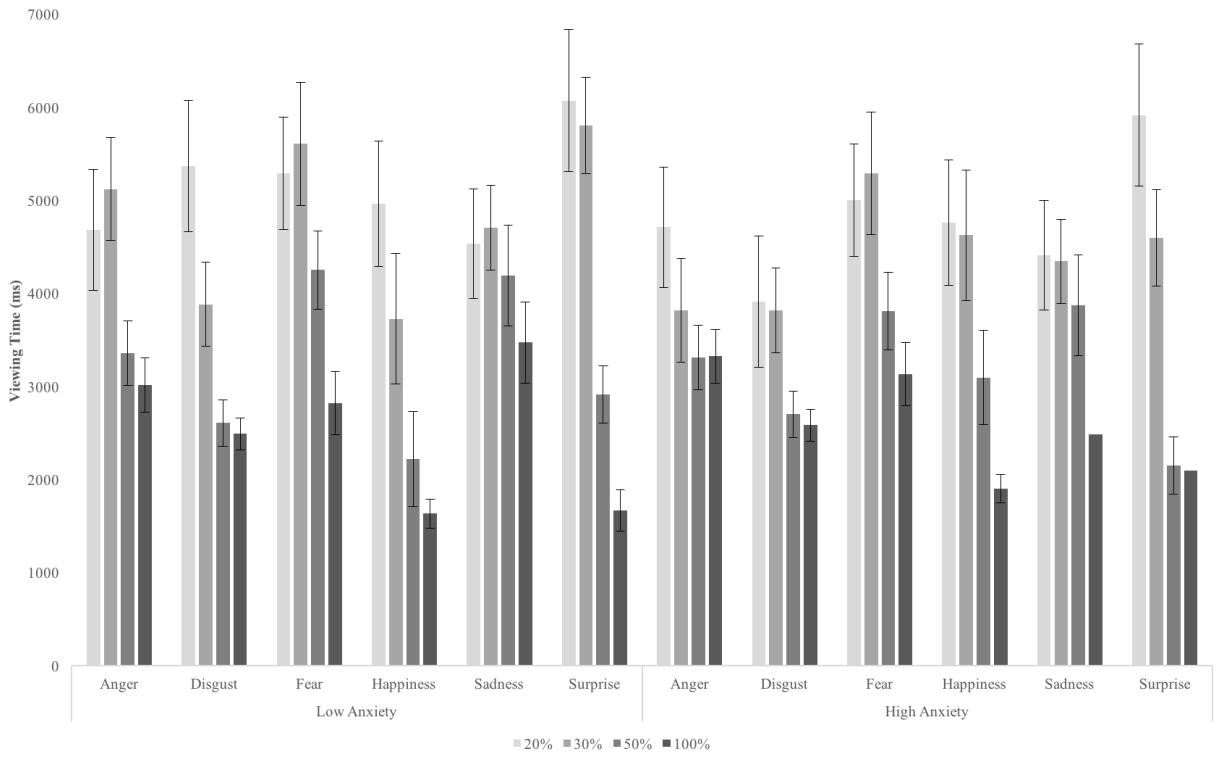

Figure 3. Mean viewing time (ms) for for the identification of the six basic emotions.

For the interaction between emotion and intensity, simple main effects tests were computed using a Dunn's corrections ($p < .015$). For the expressions of anger and disgust respectively, results revealed a significant effect of intensity, $F(3,180)= 8.46$, $p < .01$, $\eta^2_p = .12$; $F(3,180)= 16.47$, $p < .01$, $\eta^2_p = .22$. Post hoc tests (LSD) found that for both anger and disgust, 20% had significantly greater viewing times than 30%, and 50% was not significantly different from 100%, with 50% and 100% having significantly shorter viewing times. For fear, happiness, and surprise respectively, results revealed a significant effect of intensity, $F(3,180)= 19.50$, $p < .01$, $\eta^2_p = .25$; $F(3,180)= 22.16$, $p < .01$, $\eta^2_p = .27$; $F(3,180)= 48.08$, $p < .01$, $\eta^2_p = .45$. Post hoc tests (LSD) revealed for fear, happiness, and surprise, that 20% and 30% had significantly greater viewing times than 50% and 100%. Sadness had a significant effect of intensity, $F(3,180)= 7.94$, $p < .01$, $\eta^2_p = .12$. Post hoc tests (LSD) found that 20%, 30% and 50% did not significantly differ, and 100% was significantly different from all and had the shortest viewing time.

For 20%, a significant effect of intensity was found between emotions, $F(5,300)= 2.78$, $p = .02$, $\eta^2_p = .04$. Post hoc tests (LSD) revealed that surprise had greater viewing times than all other emotions. For 30%, a significant effect of emotion was found, $F(5,300)= 4.46$, $p < .01$, $\eta^2_p = .07$. Post hoc tests (LSD) revealed that fear had significantly longer viewing times in comparison to all other emotions, with the exception of surprise. Anger had significantly longer viewing time than disgust and disgust had significantly shorter viewing time than surprise. For 50%, a significant effect of emotion was found, $F(5,300)= 10.76$, $p < .01$, $\eta^2_p = .15$. Post hoc tests (LSD) found that fear and sadness were not significantly different, with greatest viewing times in comparison to all other emotions. Disgust, happiness, and surprise did not differ significantly and had the shortest times. For 100%, a significant effect of emotion was found,

$F(5,300)= 13.96$, $p < .01$, $\eta^2_p = .19$. Post hoc tests (LSD) found that happiness had significantly shorter viewing times than all emotions, with the exception of surprise. Anger, fear, and sadness had longer viewing times than happiness and surprise, and were not significantly different from one another. Disgust had longer viewing times than happiness and surprise and significantly shorter viewing times than anger, fear, and sadness.

Proportion of Time

For proportion of time, analyses were conducted using a 2 (anxiety: high, low) x 2 (zone: eyebrow, mouth) x 6 (emotion: anger, disgust, fear, happiness, sadness, surprise) x 4 (intensity: 20%, 30%, 50%, 100%) mixed-design ANOVA. The results revealed a significant main effect for zone, $F(1,60)= 202.99$, $p < .01$, $\eta^2_p = .77$, a significant main effect for emotion, $F(5,300)= 12.00$, $p < .01$, $\eta^2_p = .17$, a significant interaction for zone and anxiety, $F(1,60)= 10.48$, $p < .01$, $\eta^2_p = .15$, a significant interaction for zone and emotion (see Table 1), $F(5,300)= 17.55$, $p < .01$, $\eta^2_p = .23$, a significant interaction for zone and intensity, $F(3,180)= 15.30$, $p < .01$, $\eta^2_p = .20$, a significant interaction for emotion and intensity, $F(15,900)= 3.28$, $p < .01$, $\eta^2_p = .05$, and a significant interaction for zone, emotion, and intensity, $F(15,900)= 5.10$, $p < .01$, $\eta^2_p = .02$.

There was no significant main effect found for anxiety, $F(1,60)= 1.76$, $p = .19$, $\eta^2_p = .03$, no significant main effect for intensity, $F(3,180)= 1.77$, $p = .16$, $\eta^2_p = .03$, no significant interaction for emotion and anxiety, $F(5,300)= 1.10$, $p = .36$, $\eta^2_p = .02$, no significant interaction for intensity and anxiety, $F(3,180)= 1.69$, $p = .17$, $\eta^2_p = .03$, no significant interaction for zone, emotion and anxiety, $F(5,300)= .80$, $p = .55$, $\eta^2_p = .01$, no significant interaction for zone, intensity and anxiety, $F(3,180)= .96$, $p = .41$, $\eta^2_p = .02$, no significant interaction for emotion, intensity and anxiety, $F(15,900)= 1.38$, $p = .15$, $\eta^2_p = .02$, and no significant interaction for zone, emotion, intensity and anxiety, $F(15,900)= .94$, $p = .52$, $\eta^2_p = .02$.

		Emotions																							
		Anger				*Disgust*				*Fear*				*Happiness*				*Sadness*				*Surprise*			
Anxiety	*Zone*	*20%*	*30%*	*50%*	*100 %*	*20%*	*30%*	*50%*	*100 %*	*20%*	*30%*	*50%*	*100 %*	*20%*	*30%*	*50%*	*100 %*	*20%*	*30%*	*50%*	*100 %*	*20%*	*30%*	*50%*	*100 %*
Low	Eyes/ brow	.49 (.03)	.50 (.03)	.49 (.03)	.49 (.03)	.47 (.03)	.45 (.03)	.52 (.03)	.47 (.03)	.50 (.03)	.50 (.03)	.48 (.03)	.54 (.03)	.47 (.03)	.47 (.03)	.50 (.03)	.54 (.03)	.50 (.03)	.49 (.03)	.49 (.03)	.52 (.03)	.48 (.03)	.41 (.03)	.52 (.03)	.57 (.03)
	Mouth	.20 (.02)	.20 (.02)	.21 (.02)	.21 (.02)	.22 (.02)	.23 (.02)	.21 (.02)	.20 (.02)	.20 (.02)	.23 (.02)	.22 (.02)	.18 (.02)	.26 (.02)	.29 (.02)	.30 (.02)	.25 (.02)	.21 (.02)	.21 (.02)	.18 (.02)	.19 (.02)	.24 (.02)	.29 (.02)	.25 (.02)	.24 (.02)
High	Eyes/ brow	.60 (.03)	.63 (.03)	.64 (.03)	.56 (.03)	.60 (.03)	.59 (.03)	.60 (.03)	.56 (.03)	.59 (.03)	.58 (.03)	.62 (.03)	.62 (.03)	.57 (.03)	.53 (.03)	.59 (.03)	.62 (.03)	.60 (.03)	.62 (.03)	.56 (.03)	.63 (.03)	.60 (.03)	.53 (.03)	.61 (.03)	.60 (.03)
	Mouth	.15 (.02)	.15 (.02)	.14 (.02)	.14 (.02)	.14 (.02)	.15 (.02)	.13 (.02)	.15 (.02)	.16 (.02)	.17 (.02)	.17 (.02)	.16 (.02)	.21 (.02)	.23 (.02)	.22 (.02)	.16 (.02)	.16 (.02)	.15 (.02)	.12 (.02)	.13 (.02)	.18 (.02)	.22 (.02)	.20 (.02)	.17 (.02)

Table 1. Means and standard deviations (in brackets) for proportions of time as a function of emotion, zone, intensity, and anxiety.

For the interaction between zone and anxiety, simple main effects tests were computed using a Dunn's corrections ($p < .038$). For both low trait anxiety and high trait anxiety respectively, results revealed greater proportions of time in the eyes/brow zone than the mouth zone, $F(1,30)= 71.63$, $p < .01$, $\eta^2_p = .71$; $F(1,30)= 134.20$, $p < .01$, $\eta^2_p = .82$. For the eyes/brow zone, results revealed that the high trait anxiety group had greater proportions of time than the low trait anxiety group, $F(1,60)= 8.72$, $p < .01$, $\eta^2_p = .13$. For the mouth zone, results revealed that the low trait anxiety group had greater proportions of time than the high trait anxiety group, $F(1,60)= 7.53$, $p < .01$, $\eta^2_p = .11$.

For the interaction between zone and emotion, simple main effects tests were computed using a Dunn's corrections ($p < .019$). For anger, disgust, fear, happiness, sadness, and surprise respectively, results revealed greater proportions of time for the eyes/brow zone than for the mouth zone, $F(1,61)= 207.61$, $p < .001$, $\eta^2_p = .77$; $F(1,61)= 149.47$, $p < .01$, $\eta^2_p = .71$; $F(1,61)= 183.86$, $p < .01$, $\eta^2_p = .75$; $F(1,61)= 113.44$, $p < .01$, $\eta^2_p = .65$; $F(1,61)= 192.07$, $p < .01$, $\eta^2_p = .76$; $F(1,61)= 142.47$, $p < .01$, $\eta^2_p = .70$. For the eyes/brow zone, there were no significant differences between any emotions, $F(5,305)= 2.24$, $p = .05$, $\eta^2_p = .04$. For the mouth zone, there was a significant difference found for emotion, $F(5,305)= 37.14$, $p < .01$, $\eta^2_p = .38$. Post hoc tests (LSD) found that surprise had greatest proportions of time for the mouth zone, with the exception of happiness. Anger, disgust, and sadness were not significantly different from each other, with the least proportions of time in the mouth, and fear had significantly greater proportions of time in the mouth than sadness.

For the interaction between zone and intensity, simple main effects tests were computed using a Dunn's corrections ($p < .025$). For 20%, 30%, 50%, and 100% respectively, more time was spent in the eyes/brow area than in the mouth area, $F(1,61)= 171.93$, $p < .01$, $\eta^2_p = .74$;

$F(1,61)= 132.81$, $p < .01$, $\eta^2_p = .69$; $F(1,61)= 172.79$, $p < .01$, $\eta^2_p = .74$; $F(1,61)= 198.86$, $p < .01$, $\eta^2_p = .77$. For the eyes/brow zone, there was a significant effect of intensity, $F(3,183)= 9.72$, $p < .01$, $\eta^2_p = .14$. Post hoc tests (LSD) revealed that 20% and 30% had significantly fewer proportions of time than 50% and 100%. Also, 50% and 100% had significantly greater proportions of time than 20% and 30%. For the mouth zone, there was a significant effect of intensity, $F(3,183)= 9.45$, $p < .01$, $\eta^2_p = .14$. Post hoc tests (LSD) found that all intensities were significantly different from all with the exception, however 20% and 50% were not significantly different. 30% had greatest proportions of time than all other intensities and 100% had significantly fewer proportions of time than all.

For the interaction between emotion and intensity, simple main effects tests were computed using a Dunn's corrections ($p < .015$). For 20% and 30% respectively, no significant differences were found for emotion, $F(5,305)= 1.42$, $p = .22$, $\eta^2_p = .02$; $F(5,305)= 1.04$, $p = .40$, $\eta^2_p = .02$. For 50%, a significant differences were found for emotion, $F(5,305)= 14.56$, $p < .01$, $\eta^2_p = .19$. Post hoc tests (LSD) happiness had greatest proportions of time with the exception of surprise, and sadness had significantly lower proportions of time than all. Anger, disgust, and fear did not differ significantly, but had greater proportions of time than sadness. For 100%, a significant differences were found for emotion, $F(5,305)= 7.44$, $p < .01$, $\eta^2_p = .11$. Post hoc tests (LSD) found that anger, disgust, and sadness had significantly lower proportions of time, and fear, happiness, and surprise had significantly greater proportions of time. For anger, disgust, and fear respectively, there were no significant differences found for intensity, $F(3,183)= 1.55$, $p = .20$, $\eta^2_p = .03$; $F(3,183)= 1.40$, $p = .24$, $\eta^2_p = .02$; $F(3,183)= .78$, $p = .50$, $\eta^2_p = .01$. Happiness was found to have a significant difference for intensity, $F(3,183)= 3.72$, $p = .013$, $\eta^2_p = .06$. Post hoc tests (LSD) revealed that 50% and 100% had greater proportions of time than 20% and 30%. A

significant difference was found for the intensities of sadness, $F(3,183)= 4.95$, $p < .01$, $\eta^2_p = .08$. Post hoc tests (LSD) revealed that the 50% intensity had significantly fewer proportions of time than all other intensities. Surprise was also observed to have a significant difference for intensity, $F(3,183)= 5.34$, $p < .01$, $\eta^2_p = .08$. Post hoc tests (LSD) revealed that 20% and 30% had significantly fewer portions of time than 50% and 100%.

Correlations

Correlations were computed using all 93 participants' trait anxiety scores with their accuracy for the six basic emotions (anger, disgust, fear, happiness, sadness, surprise), all of the analyses were found to be not significant, with the exception of sadness, $r(92) = .22$, $p = .03$. In addition, correlations for participants' trait anxiety scores and their accuracy for all 4 intensities of emotion (20%, 30%, 50%, 100%) were calculated, with none of the analyses found to be significant.

Self-Report Results

The participants' trait anxiety scores were correlated with their total score on the Difficulties in Emotional Regulation Scale, the analysis was significant $r(92) = .73$, $p < .01$ (see Figure 4). More precisely, when the score on the Difficulties in Emotional Regulation increased, the level of trait anxiety also increased. In addition, all of the 6 subtests of the DERS were found to be significantly correlated to the trait anxiety scores. Subscale 5: limited access to emotion regulation strategies was found to be the strongest subscale correlated with total trait anxiety scores, $r(92) = .68$, $p < .01$, and subscale 2: difficulties engaging in goal-directed behaviours was found to be the weakest subscale correlated with total trait anxiety scores, $r(92) = .32$, $p < .01$.

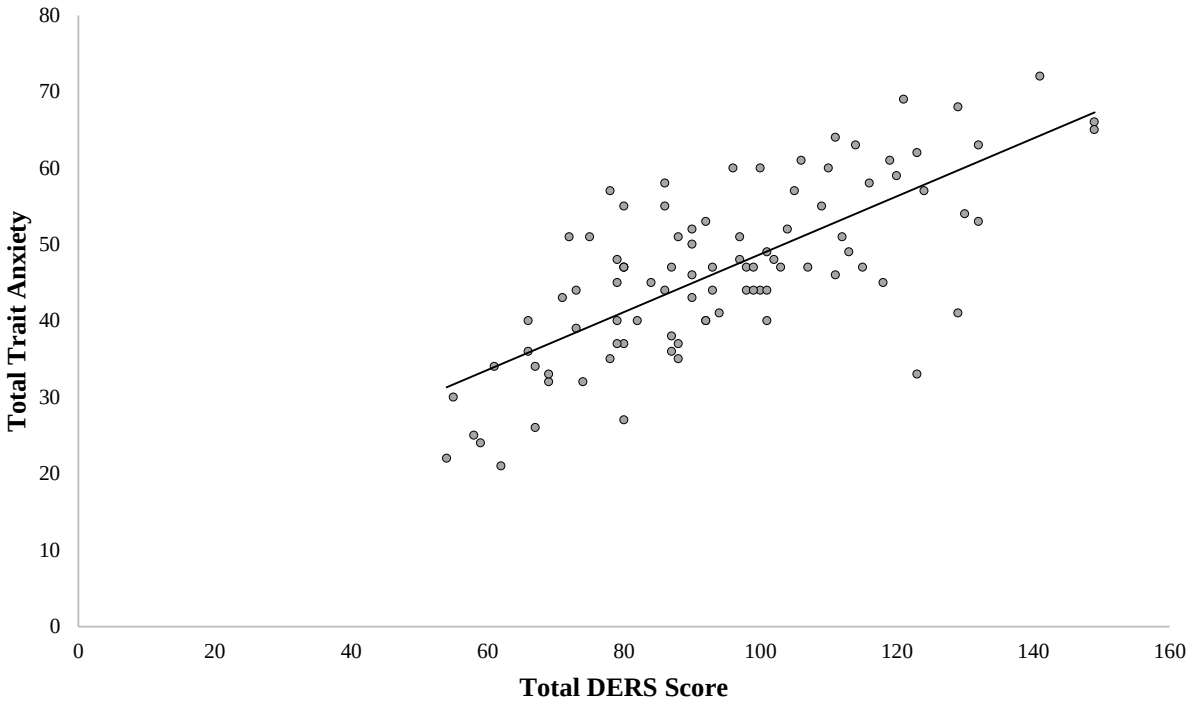

Figure 4. Correlation between total trait anxiety and total score on DERS.

Correlations for the participants' total score on the Difficulties in Emotional Regulation Scale (DERS) were examined with their accuracy for all six basic emotions (anger, disgust, fear, happiness, sadness, surprise), again, there was found to be a significant weak positive relationship for the accuracy of sadness, $r(92) = .20$, $p = .05$ (see Figure 5), all other expressions were not found to be significant. Correlations were also run with only the upper (high anxiety group) and lower (low anxiety group) thirds to examine the relationship between total DERS scores and accuracy of the six basic emotions. Again, there was a significant weak positive relationship found for the accuracy of sadness, $r(61) = .31$, $p = .02$, and again, all other expressions were not found to be significant.

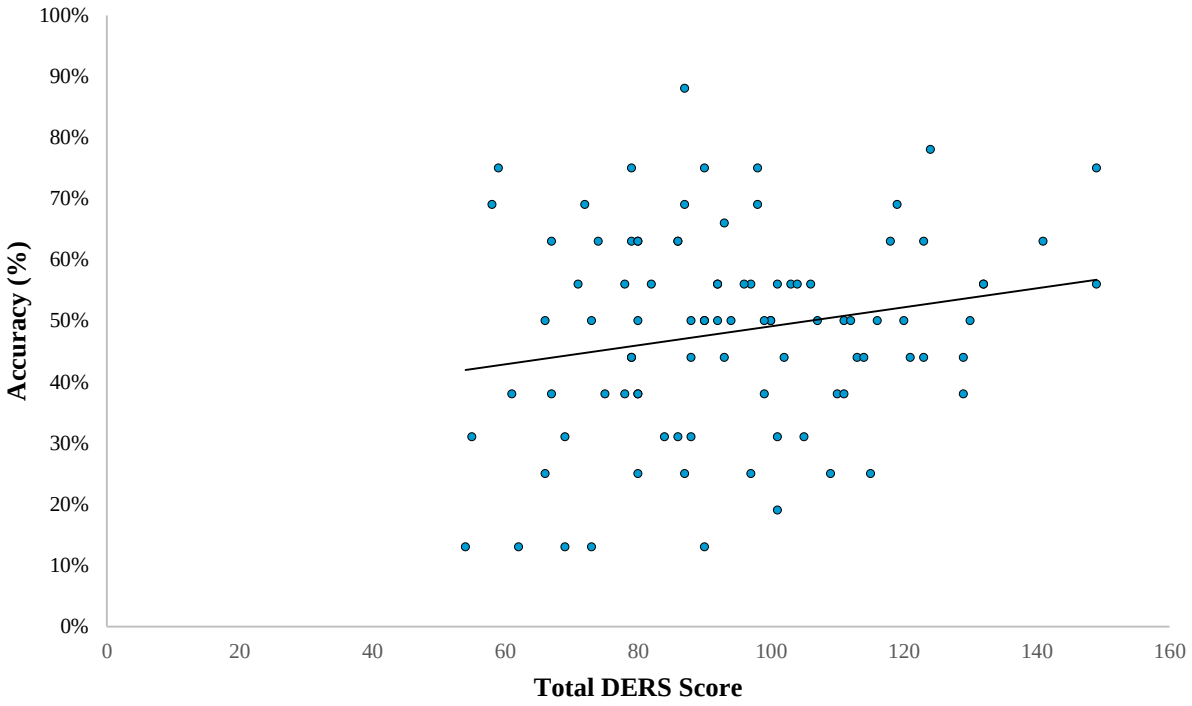

Figure 5. Correlation between total accuracy for sadness and total score on DERS.

Analyses for participants' scores on the Positive and Negative Affect Schedule were computed using a 2 (pre-test, post-test) x 2 (high anxiety, low anxiety) mixed-design ANOVA. Results revealed a significant difference for the negative affect word guilty, $F(1,59) = 4.97$, $p = .03$, $\eta^2_p = .07$. The results show that the low anxiety group reported as having greater feelings of guilt before the eye tracking intervention ($M = 1.06$, $SD = .25$) than after the eye tracking intervention ($M = 1.00$, $SD = .00$). The high anxiety group demonstrated the opposite effect; before the eye tracking intervention, they demonstrated a lower guilt score ($M = 1.10$, $SD = .31$), whereas after the eye tracking procedure, they demonstrated a significant increase ($M = 1.27$, $SD = .64$). Results also demonstrated a significant difference for the negative affect word afraid, $F(1,59) = 3.99$, $p = .05$, $\eta^2_p = .06$. Results show that the low anxiety group reported lower afraid scores before the eye tracking intervention ($M = 1.13$, $SD = .43$) and after the eye tracking procedure, there was a marginal increase ($M = 1.19$, $SD = .60$). The high anxiety group demonstrated the opposite effect, before the eye tracking intervention, they demonstrated a higher afraid score ($M = 1.67$, $SD = .55$), whereas after the eye tracking procedure, they demonstrated a significant decrease ($M = 1.47$, $SD = .68$). There were no other significant differences for any other negative affective words and there were no significant positive affective words found.

Chapter Four: Discussion

The current study has observed inconsistencies found in previous research and deepened the examination in order to explain for the differences found between high and low trait anxious individuals in their processing of expressions of the six basic emotions. For each of the six basic emotions (anger, disgust, fear, happiness, sadness, surprise), a new addition to the literature examining emotional facial expressions and anxiety is the inclusion of four intensities (20%, 30%, 50%, 100%) of each emotional face presented equally to all participants. The present study built on previous research examining the recognition of emotional faces in individuals with high levels of trait anxiety by examining accuracy, reaction time, eye movement data as well as self-report measures examining anxiety and emotional regulation.

First, it is important to mention that the two trait anxiety groups (high, low) were significantly different from each other. The categorization strategy for the current study was done through a rule-of-thirds method, meaning that the total 93 participants were sorted in ascending order by their total trait anxiety scores. They were then split into thirds, with the lowest third becoming the low trait anxiety group and the highest third becoming the high trait anxiety group; the individuals in the middle third were removed from the the analyses (except for correlation analyses). The categorization strategy utilized in the current study was different than what is often found in research on emotional facial recognition in nonclinical anxious populations (Cooper et al., 2008; Surcinelli et al., 2006). Most research utilizes the upper 75th and lower 25th percentile of the State-Trait Anxiety Inventory as cut-offs for their high and low trait anxiety group, however, the current study chose to use upper and lower thirds, as it was expected that there would be more variability between the high and low trait anxiety groups (Spielberger et al., 1983). The purpose of increasing the variability between the high and low

trait anxiety groups was to ensure that the two groups were significantly different from each other, as well as to maximize the applicability of the results to individuals with very low and very high anxiety, as previous research has suggested this to be a limitation.

Accuracy

It was hypothesized that the high trait group would demonstrate greater accuracy for the identification of the emotional facial expression of fear than any other emotion. The anticipated result was hypothesized from research conducted by Surcinelli et al. (2006) as they found that the high trait anxiety group had significantly greater accuracy for fear than any other emotion. However, as suggested by Cooper et al. (2008), Surcinelli and colleagues presented their stimuli for 10 seconds for expressions of each emotional face. It was proposed that the extended stimulus presentation time may have led the high trait anxiety group to attend more to the threatening stimuli than the low trait anxious group, possibly accounting for their superior accuracy (Cooper et al., 2008).

The results from the current study more closely supported results found by Cooper et al. (2008). Results revealed no differences in accuracy between individuals with high trait anxiety and those with low trait anxiety. An argument that could be made regarding the differing results found between Surcinelli et al. (2006) and the current study could be that the high trait anxiety groups may have had differing trait anxiety scores, therefore, influencing the accuracy results from the current study. Upon further examination, it appears as though the current study's high trait anxiety group (M = 58.77, SD = 5.65) was in fact, quite similar to the high trait anxiety group found by Surcinelli et al. (2006) (M = 57.10, SD = 8.50), thus it is unlikely that the scores from the high trait anxiety groups were responsible for the differences in accuracy. The results

suggest that the hypothesized greater accuracy for fear may not be applicable to all nonclinical undergraduate students, whereas it may still be related to clinically diagnosed individuals.

In addition, Cooper et al. found that expressions of happiness were recognized more accurately than all other emotional facial expressions with the exception of surprise. Their results also revealed that anger, disgust, fear, and sadness did not significantly differ from one another. The current study found that happiness had significantly greater accuracy in comparison to all other basic emotions, and fear had significantly lowest accuracy in comparison to all other emotions. It was also found that anger, disgust, and sadness were not significantly different from each other. The results from the current study are in line with those stated by Cooper et al. (2008), however, one of the discrepancies between the two involves the difference in the accuracy of surprise and the lower accuracy rate for happiness. An explanation for the differences could be explained that since the current study examined 4 intensities of emotional facial expressions (20%, 30%, 50%, 100%), and that Cooper et al. (2008) only examined full intensities of emotional expressions, that the accuracies of lower intensities of expressions may have diminished the total accuracy for each emotion. Analyses were conducted and it was found that happiness and surprise had the greatest accuracy rates and they were not significantly different from one another (see Figure 6), which supports results from Cooper et al. (2008).

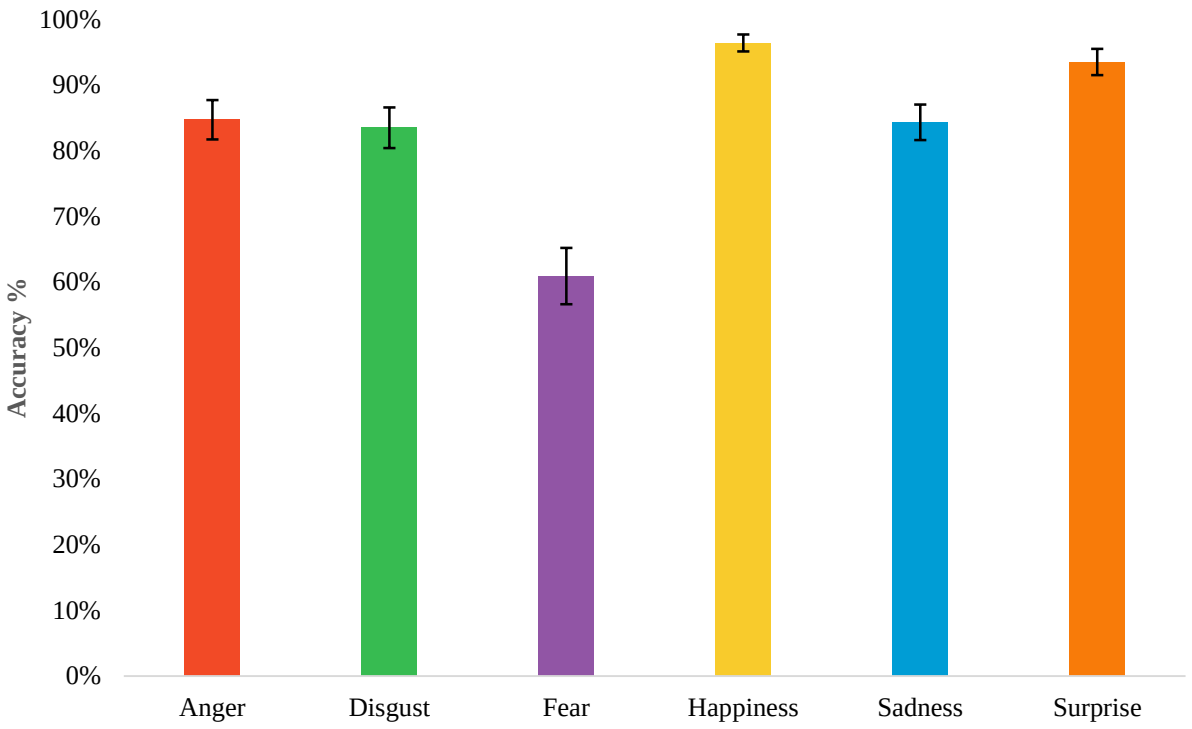

Figure 6. Mean accuracies (%) for the identification of the six basic emotions at 100% intensity.

In sum, the results from the current study support findings from previous literature on emotional facial expressions as it is typically found that happiness was most accurately recognized and fear was least accurately recognized (Beaudry et al., 2014; Ekman & Friesen, 1971, 1986; Ekman, Sorenson, & Friesen, 1969; Gosselin & Kirouac, 1999; Matsumoto & Ekman, 1989). However, the majority of research has examined emotional facial recognition in an undergraduate sample, and did not screen for anxiety level, thus, the results from the current study not only support the overall order of recognition rates for the six basic emotions, but it also provides evidence that individuals with higher levels of self-reported trait anxiety do not significantly differ from accuracy rates achieved by the general population. The results from the current study may emphasize the differences between nonclinical and clinically diagnosed anxious populations in terms of the differences between their recognition of emotional faces. Future research could examine nonclinical, clinical and a control group for their recognition of the six basic emotions.

Lastly, it was hypothesized that participant's accuracy for the recognition of emotional faces would be significantly correlated to their total score on the Difficulties in Emotion Regulation Scale (DERS) as it was hypothesized that if one had difficulty with regulating their own emotions, they may have more difficulty recognizing emotions in others. Accuracy for the recognition of emotional facial expressions was not significantly correlated to the total DERS score, with the exception of sadness, which was found to have a positive relationship. Results found that as emotional dysregulation increased, accuracy for sadness also increased. An explanation for the significant relationship for sadness is that 11 of the total 93 participants reported having a clinical diagnosis of depression, therefore, it may be possible that the increased attention towards the emotional facial expression of sadness may be a result of participants'

depressive experiences (Clasen, Wells, Ellis & Beevers, 2013). However, analyses were run without the 11 individuals with reported diagnosis of depression, and the analysis was still significant ($r(82) = .22$, $p = .04$). An explanation for the results may be that many more participants had symptoms of depression but as they did not have a clinical diagnosis, that they would have left that section blank. It is possible that individuals without a clinical diagnosis but who experience symptoms of depression, would have still had a bias towards the expression of sadness. Future research should explore the role of depression symptoms, anxiety and emotional facial expression recognition.

Viewing Time

It was hypothesized that the high trait anxiety group would have faster reaction times for the recognition of the emotional facial expression of fear than any other emotion (Surcinelli et al., 2006). However, as no significant difference was found for accuracy as a function of trait anxiety level, it is not surprising that no difference was found for viewing times. Thus, it can be assumed that the high trait anxiety group did not process the emotional faces any faster than the low trait anxiety group, supporting results found by Cooper et al. (2008).

Cooper et al. (2008) found that happiness was recognized faster than all other emotions and that disgust, sadness, and surprise did not significantly differ from each other, and anger and fear had significantly longer reaction times. The current study found that happiness and disgust had significantly faster reaction times than all, and that anger, sadness, and surprise were not significantly different from each other. Again, similar to comparing the emotion main effect for accuracy with the results from Cooper et al. (2008), it may have been possible that the four levels of intensity of emotion expression could have resulted in diminishing the total response times. Analyses were conducted and it was found that happiness and surprise had the fastest response

times as they were not significantly different from one another (see Figure 7), which provided additional support for results found by Cooper et al. (2008). The implications of similar results between the current study and those found by Cooper et al. (2008) is that it can be assumed that a nonclinical university sample of high and low trait anxious individuals do not significantly differ in time during a recognition task of emotional faces.

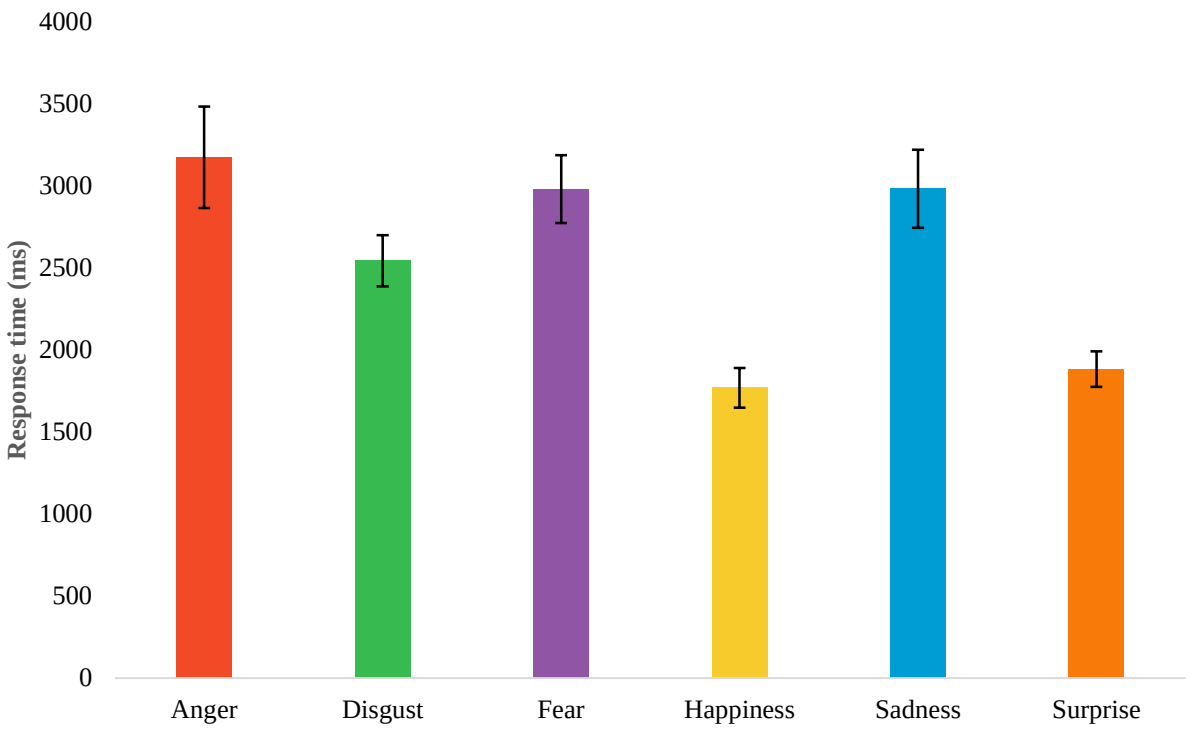

Figure 7. Mean response time (ms) for for the identification of the six basic emotions at 100% intensity.

Proportion of Time

The current study hypothesized that the results found would be in line with results found from Beaudry et al. (2014) as they were the first to examine proportions of time spent in the eyes/brow and mouth area for the six basic emotions. The hypothesis was supported, the current study found that for all emotions, there were greater proportions of time spent in the eyes/brow zone than for the mouth zone. Also consistent with Beaudry et al. (2014), greater proportions of time were spent in the mouth for happiness than all other emotions. The importance of the current study's results is that the pattern of proportions of time spent in the eyes/brow and mouth area for individuals with greater trait anxiety in comparison to healthy controls.

As it was suggested by Cooper et al. (2008) that further research should include eye movement measures in order to assess where on the face participants examine information pertaining to their identification of the emotions, the current study included eye-tracking in order to provide further explanations for any differences between anxiety groups. An innovative result was found from the current study for the relationship between proportion of time for the eyes/brow and mouth area as a function of trait anxiety. The high trait anxiety group were found to have greater proportions of time in the eyes/brow zone than the low trait anxiety group. Even though for all emotions, participants spent longer in the eyes/brow zone, it is clear from the results that the high trait anxiety group spent even longer in the eyes/brow zone. Some research has suggested that the eyes play a vital role in social interactions (Farroni, Csibra, Simion, & Johnson, 2002). With emphasis on social anxiety, research has demonstrated that higher levels of social anxiety demonstrated greater avoidance to the eyes than those who were not socially anxious (Kret, Stekelenburg, de Gelder, & Roelofs, 2015). Perhaps as the current sample was not

from a clinical population, that they followed a similar pattern to those with lower levels of social anxiety, therefore, attending to the eyes.

To our knowledge, the current study was the first to examine proportions of time for the recognition of the six basic emotions, using a nonclinical sample of trait anxious participants. The results from the present study may lead to additional research examining the role of the eyes/brow area, specifically the greater proportions of time spent in that area in individuals with higher levels of trait anxiety than individuals with lower levels trait anxiety. As research has suggested there to be increased attention towards expressions of emotional faces in individuals with greater levels of anxiety (Beck & Clark, 1997), it may be interesting to examine the increased proportions of time in the eyes/brow area in order to add to the attentional bias literature for nonclinical individuals, which is lacking in current literature.

Self-Report

An influential result, however, was not a primary hypothesis, was the positive relationship between level of trait anxiety and participants total score on the Difficulties in Emotion Regulation Scale. Upon examining previous literature, there was a connection found between emotional dysregulation and anxiety disorders (Amstadter, 2008; Campbell-Sills et al., 2006; Gross & Levenson, 1997), and that connection is driven partially by emotional suppression, a maladaptive emotion regulation strategy. The current study's results supported theories and previous research regarding the connection between emotional dysregulation and anxiety, with particular emphasis on lack of effective strategies in their arsenal. Given the strong positive relationship between emotional dysregulation and level of trait anxiety, it can be expected that if individuals are seeking to reduce their anxiety symptoms, they will have to use more effective emotion regulation strategies in their everyday life.

Lastly, given the scores on the Positive and Negative Affect Schedule, it was found that the high trait anxiety group had greater scores for the negative affect word afraid before the experimental session than after. It may be possible that individuals in the high trait anxiety group had greater feelings of fear or unease in response to new and potentially frightening environments (i.e., testing laboratories). Also, results found that the high anxiety group demonstrated a lower guilt score before the experimental session, whereas after, there was a significant increase. It may be possible that individuals in the high trait anxiety group had greater feelings of guilt about their performance on the emotional facial recognition task and may have possibly felt embarrassed about their performance. From the two explanations for the significant negative affective words, perhaps it may be suggested that they have a role in the maintenance of anxiety symptoms for individuals with higher levels of self-reported trait anxiety.

Clinical Implications

An important result found from the current study was the strong relationship between emotional dysregulation and level of trait anxiety. The findings from the current study may lead to more education to clinicians regarding the importance of emotions and the negative consequences of emotional dysregulation, namely possibly prolonging the symptoms of anxiety. Recent models of psychotherapy have focused on the role of emotional regulation resulting in psychopathology, namely, Emotion Focused Therapy for Generalized Anxiety Disorder has focused on working through core emotional pain, emotional triggers, and unmet needs in order to transform the individual's anxiety through emotional expression and not suppression (Timulak, & McElvaney, 2016).

In addition, given the results from the current study, it would be important for clinicians to concentrate on imparting healthy and adaptive emotion regulation techniques and strategies to

their clients, as the DERS subscale that most significantly predicted trait anxiety level was limited access to emotion regulation strategies.

Moreover, as the sample from the current study was from an undergraduate university population, results from the current study may lead to a greater emphasis on emotion regulation education from educational institutions. Most universities hold a mental health awareness week, however, given that the current study was able to predict anxiety scores from level of emotional dysregulation, it is clear that more education is needed about what emotional dysregulation is as well as the negative consequences that it produces. Also, given that the current sample was not from a clinical population and a significant relationship was still present, it may be prudent for clinicians or other mental health professionals in the community to hold public symposiums educating the public on the topic of emotional regulation and its impact on mental health. Interestingly, research utilizing meditation to promote healthy emotional regulation found that the reduction of level of trait anxiety was associated with reductions in emotional dysregulation (Menezes & Bizarro, 2015). So it may be suggested that if healthy emotion regulation strategies are promoted, that symptoms of anxiety may partially subside.

Limitations and Future Directions

A main limitation of the current study was the use of a nonclinical sample of undergraduate students, therefore, reducing the generalizability of the current results to a clinical population. As the State-Trait Anxiety Inventory is more often used in research than clinical settings, it may have been sensible to also administer a clinical diagnostic measure of anxiety disorders, such as the Beck Anxiety Inventory. Perhaps, given the two anxiety measures, the marginally significant three-way reaction time interaction may have reached significance, as well as accuracy rates may have been affected.

In regards for future directions given the results from the current study, as there was a significant weak positive relationship found between emotional dysregulation and the total accuracy for the expression of sadness, and given that 11 of the total 93 participants reported as having a clinical diagnosis of depression, it may be possible that the increased attention towards the emotional facial expression of sadness may be a result of participants' depressive experiences. As the current study did not measure level of depression, another study should be deployed using the same procedure, while measuring depression and then use level of depression as a covariate in their analyses. This will be crucial to examine the validity of the current study's results, as the role of sadness is currently unclear whether level of anxiety has an impact or not.

In addition, given the strong positive correlation between the total score on the Difficulties in Emotional Regulation Scale and the State-Trait Anxiety Inventory, it is clear that more depth of research is needed regarding this relationship. Future studies could examine the scores on the Difficulties in Emotional Regulation Scale and the State-Trait Anxiety Inventory as a function of clinical psychotherapy sessions, focused on emotional awareness, identification and regulation.

Conclusion

The current study examined how individuals with different levels of trait anxiety recognize expressions of the six basic emotions. Given the inconsistent findings from previous research in the area of emotional facial recognition in anxiety disorders, the current study was conducted in order to examine the relationship and to possibly question findings from previous literature. As the current study did not find any significant accuracy or reaction time differences as a function of trait anxiety, results supported a part of previous literature proclaiming that there are no significant differences between the recognition and identification of emotional facial

expressions in individuals with high and low trait anxiety. A crucial result from the current study was the relationship found between level of trait anxiety and difficulties in emotional regulation. There is good evidence from the current findings that as an individual becomes more emotionally dysregulated, their vulnerability for experiencing greater levels of anxiety are increased. The implications from the current study are vast and future research should examine the connection between emotional dysregulation and anxiety disorders more thoroughly.

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