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The Effects of Trait-Anxiety on Young Children's Facial and Vocal Emotion Recognition and Attention

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Abstract

A series of three experiments explored the relationship between children's trait-anxiety and their performance on visual and vocal emotion recognition and attention. Children (N = 37) between the ages 4 and 6-years-old were given the Revised Children's Manifest Anxiety Scale (RCMAS-2) in order to determine each child's level of trait-anxiety. For each experiment, participants were presented with a series of Ekman's faces that demonstrated one of six different facial emotional expressions (e.g., happiness, sadness, anger, surprise, disgust or fear). The first experiment examined children's trait-anxiety level and their ability to recognize facial emotion expressions presented at varying intensities. The second experiment investigated the length of time at which children experiencing low levels of trait-anxiety and children experiencing high levels of trait-anxiety spent attending to negative facial emotion expressions (e.g., disgust, sadness, fear and anger) and to positive facial emotion expressions (e.g., happiness and surprise). Experiment 3 examined whether all participants (regardless of anxiety-level) spent more time attending to vocal or visual emotional stimuli. This experiment also looked at how the factor of trait-anxiety influenced one's attention towards either vocal or visual emotional stimuli. Results showed that trait-anxiety plays a role in a child's attention towards positive versus negative facial emotion expressions and also their attention towards vocal and visual emotion stimuli. However, it was not evident that trait-anxiety played a significant role in a child's ability to recognize facial emotional expressions.

Introduction

Charles Darwin noted commonalities in facial expressions across cultures as early as 1873. Following Darwin, after the mid-1800s, researchers gained curiosity for what he describes as "universal emotions" and for the past several decades researchers have specifically focused on how these emotions are recognized and attended to by others in association with variables such as, impaired mental health and age (Herba, Landau, Russell, & Phillips, 2006; Jarros et al., 2012; Tonks, Williams, Frampton, Yates, & Slater, 2007). The concept of "universal emotions" stemmed from commonalities Darwin observed among a variety of facial expressions demonstrated by multiple species. As Darwin argued, the portrayal of emotion may be innate, allowing emotional cues to be shared between people and cultures (Darwin, 1873). Even though emotions are expressed for numerous reasons and at varying intensities, facial expressions of happiness, surprise, sadness, fear, anger and disgust seem to be demonstrated similarly cross-culturally, despite highly varied cultural traditions. Shared emotional facial characteristics exhibited worldwide emphasize the significance of emotion information in regards to human functioning.

The importance of emotion recognition is brought to awareness based on the absoluteness of emotion expression within all human populations. The ability to gather emotion information from facial appearance and vocalizations allows humans to effectively communicate with each other, even in the absence of either a person's sight or hearing (Massaro & Egan, (1996). The expression of emotion through multiple faucets (face and voice) makes it possible for more people to reap the benefits of social communication. Furthermore, because emotions are able to be decoded in multiple ways suggests an evolutionary relevance of emotion perception.

For instance, recognition of emotional cues are significant to an individual's social development and frequently allow for better understanding of a person's thoughts, beliefs and attitudes towards a particular topic or situation. In many instances an individual will portray emotion unintentionally, making it difficult for him or her to conceal their psychological or emotional state. Therefore, without the ability to accurately recognize and attend to visual and vocal emotional expression, individuals would be unable to effectively or accurately make inferences about the emotional context of a situation or event.

In response to effects of impaired emotional recognition and attention, scientists have conducted a plethora of research studies that investigate specific influential factors on emotion recognition and attention such as clinical and non-clinical psychological disorders (Bozikas, Kosmidis, Giannakou, Saitis, Fokas, & Garyfallos, 2008; Masten et al., 2007), age (Batty & Taylor, 2003), gender (Herba, Landau, Russell, Ecker, & Phillips, 2006), and brain injury (Calder, Young, Rowland, Perrett, Hodges & Etcoff, 1996). However, results have been inconsistent, which is particularly evident of research dealing with younger populations. This may be due to a scarcity of studies working with young children in relation to emotional expression. The lack of research involving childhood emotion processing becomes an important issue when considering the negative impact that impaired emotion recognition and attention has on a child's social development. Children may develop long-term problems in regards to social interaction which, in turn, causes children discomfort in school and later working environments (Gee, Antony, Koerner, & Aiken, 2012).

Furthermore, few studies have been conducted examining relationships between development and emotion processing shown by younger populations such as infants and children. It is also becoming known that certain moderating variables such as anxiety lead to

abnormal neural activity which may increase the likelihood that children will experience an inability to accurately perceive emotion. If left unattended, this impairment could cause permanent developmental problems. For instance, negative effects of anxiety on children are commonly dismissed due to a misunderstanding that children are free from worry. However, this is not the case. In fact, it is understood that preschoolers commonly meet diagnostic criteria indicative of someone suffering from various types of anxiety disorders such as separation anxiety and social phobia (Spence, Rapee, McDonald, & Ingarm, 2001).

Children's experience of anxiety is of further concern when it is frequent. Repeatedly experienced anxiety has an ability to alter brain function which may persist throughout an individual's lifetime. Brain plasticity in relation to anxiety puts children at risk for experiencing inefficient and inadequate emotional processing that may result in social dysfunction. Thus, with further investigation of children's emotion processing and attention and a gained understanding of how emotion processing differs between ages, prevention methods for children's impaired emotion perception may develop. Furthermore, increased awareness of child anxiety detriments may also help children gain relief from their symptoms and prevent children from experiencing permanent developmental consequences.

Based on the seriousness of the previous allocations and the neglect researchers demonstrate towards young child populations in regards to emotional expression investigation, the present study focused on the inconsistencies in research dealing with anxious children's ability to recognize and attend to facial and vocal emotional cues. The present study introduced children to three different tasks in which their performance was scored and analyzed in comparison to their level of trait-anxiety. The three tasks dealt with facial emotion recognition, facial versus vocal emotion attention and positive versus negative facial emotion attention.

However, before embarking on narrow topics of this study, evidence will be presented relating to broad topics of emotion recognition and attention. First, in order to support the present study's participants' ability to perceive and understand emotional information, differences in emotional processing between ages will be discussed. Furthermore, an overview of several variables affecting emotional processing will also be offered in order to gain an understanding about the significant effects anxiety may have on emotion processing. In particular, the study will review effects of neural plasticity in response to physical (brain injury) and psychological factors (anxiety) on one's ability to process emotion information. The close relationship between age and brain development will allow for inferences to be made about when and how children are able to process emotion information and how this processing may be disrupted by factors of injury and, of particular importance for this study, psychological occurrences such as heightened anxiety.

The Effects of Age on Emotion Recognition

Within the first moments of life, children's capability of understanding emotion strengthens. In fact, as children age they tend to more accurately recognize facial emotions, with the exception of anger (Herba et al., 2006). Furthermore, the ability to associate facial expression with emotion has been commonly shown to develop by age two, allowing early school-aged children to make inferences about facial emotion and what those emotions may associate with in regards to one's environment (Gagnon, Gosselin, Hudon-ven der Buhs, Larocque, & Milliard, 2009).

Despite children's early development of facial emotion processing, the ability to make distinctions between facial expressions that exhibit similar muscle formation may not developed until late childhood (Tonks, Williams, Frampton, Yates, & Slater, 2007). For instance, as

explained by Gagnon and colleagues (2009), recognition of fear and disgust improve from when a child is between the ages of 5 and 6-years-old compared to when they are between the ages of 9 and 10-years-old. Furthermore, older children show improved accuracy in judgment between certain facial emotion pairs such as, fear and surprise, disgust and anger and fear and sadness in comparison to younger children.

Regardless of perception advancements 9 and 10-year-olds display, it is evident that 5 and 6-year-olds perform above chance-level on facial emotion recognition tasks, indicating a sufficient ability to recognize fear and disgust. Young children are also able to adequately distinguish between fear and surprise; however, their performance decreases when asked to discriminate between disgust and anger, disgust and sadness, disgust and fear and disgust and surprise (Gagnon et al., 2009). The previous finding may occur because of an enhanced ability to discriminate between opposing emotions such as, fear and disgust rather than similar emotion pairings such as, disgust and anger, fear and sadness, and fear and surprise.

Neurocognitive studies implicate the importance of brain development to reach a maximum level of cognitive processing, allowing for effective deciphering of emotional cues. According to Batty and Taylor (2003), progression in amygdala development, the orbitofrontal cortex and the anterior cingulated cortex enhances one's emotion processing. This may be responsible for the improvement of emotion recognition observed between 5 and 6-year-old and 9 and 10-year-old children (Gagnon et al., 2009). Additionally, the ability to distinguish between facial emotions of children as young as 4-years-old may suggest that development of the previously mentioned neural structures is already underway during pre-school years (Herba et al., 2006). In fact, studies indicate that individuals between 5 and 7-months-old begin to show amygdala responses to emotional experiences such as stranger anxiety (Petola et al., 2009).

Furthermore, studies that have investigated effects of brain injury and psychological impairment such as depression and anxiety also support the significance of brain structure and neural pathway development in children's emotion-processing (Tonks, Williamson, Frampton, Yates, & Slater, 2007; Ladouceur, Dahl, Williamson, Birmaher, Ryan, & Casey, 2005).

When investigating 5 through 7-month-old infants' attention towards facial emotion expressions, older infants spent longer focusing on fearful faces rather than happy faces; whereas, younger infants focused on happy and sad faces for equally as long (Peltola, Leppänen, Mäki, & Hietanen , 2009). Thus, it may be inferred that individuals become aware of fearful faces around 7-months-old. However, younger infants are not completely unaware of emotional cues. At birth, infants may not have a sufficient awareness of fearful faces; regardless, evolutionary theory proposes that the human brain inherently allows for early development of cognitive processing of fear (Darwin, 1873). Additionally, the frequency of exposure to facial fear and sadness may influence an infant's attention towards those emotions. Peltola et al. (2009) argues that older infants' increased awareness of fearful faces may be a result of having more frequented exposure to fearful emotional stimuli than younger children who have not been alive as long. Thus, it is suggested that older children, almost always, are aware of more emotional stimuli than younger children due to more experience.

With repeated exposure to facial features, an infant learns to associate external precursors and consequences of facial expressions. For instance, adults commonly reward infants when they mimic positive facial characteristics such as, a smile. Furthermore, Peltola et al. (2009) refer to theories of affective significant processing, which explain that when infants are able to associate facial expressions with outcomes of those expressions, threat-related stimuli takes precedence. These theories reinforce impacts of age on one's ability to process negative

emotions which are commonly associated with threat. Furthermore, beginning when infants are just months old, they become aware of emotional features and attend to those features, often times showing bias toward certain types of emotional expressions.

Based on the previous evidence, it is clear young children are able to make adequate inferences about emotional information and therefore their performance of emotional recognition and attention allows researchers to investigate certain factors that may jeopardize children's processing of emotional stimuli. It is likely that young populations of individuals have been ignored in regards to emotion detection investigation based on their abilities to understand emotions and to complete tasks dealing with emotion recognition. However, children are capable of responding sufficiently to emotional stimuli. There are numerous appropriate experimental designs dealing with emotion that may be applied to child populations. Furthermore, negative effects of impaired emotion recognition and attention on a child's development support the need for further examination of factors that provoke dysfunction in a child's ability to process emotional information. Unfortunately, if these factors are left unattended, then children may experience permanent cognitive damage and other developmental impairments.

The Relevance of Cortical and Neural Systems in Emotion Recognition

Facial expressions have been found to be processed by numerous systems such as the occipito temporal cortices, amygdala, orbitofrontal cortex, basal ganglia and the right parietal cortices (Adolph, 2002). However, due to the abundance of structures involved, the process by which a human brain decodes emotional information is relatively complex, making it difficult to pinpoint specific areas that become activated during emotion perception. Regardless, with technological advances such as brain imagining and investigation of brain injury consequences,

researchers are able to make suggestions about the location of specific emotion processing (Tonks et al., 2007). For instance, damage to the parietal and medial occipital cortices (Adolph et al., 1996) specifically, damage to the bilateral amygdala, right inferior parietal cortex and right anterior infracalcarine cortex is associated with a decline in fear recognition. Furthermore, damage of the right inferior parietal cortex causes impairment in the recognition of sadness (Tonks et al., 2007).

In addition to brain injury, psychological ailments have also been found to affect how the human brain processes emotional information. In fact, in relation to the brain structure versus impairment association mentioned above, it has been suggested that the brain's right hemisphere specializes in processing negative emotions. This concept is further supported by investigations of psychological phenomenon effects on neural processing of emotional information. Fox (2002) describes a tendency of highly anxious individuals to attend more readily towards fearful faces when they are presented in the left visual field as opposed to the right visual field, suggesting that the right cortical hemisphere plays an active role in determining the perception of a fearful face.

The above argument about specific brain areas corresponding to the processing of various emotions is supported by the "separate substrates hypothesis" (Calder et al., 1996). This hypothesis theorizes that single emotions are processed by separate substrates within the brain, which is shown by neurocognitive and evolutionary studies (Adolphs et al., 1996; Darwin, 1873). Speaking in Darwinian terms, certain emotions such as fear or anger may be more beneficial for a person's perception of threatening stimuli (Whalen et al., 2001). Thus, it may be suggested that rapid processing of negative facial emotions may increase the likelihood of an individual's survival (Darwin, 1873; Calder et al., 1996). If this is the case, it is likely that an

organism may attend more readily to fear based on a cognitive predisposition that allows emotional information to be processed by a specific set of neural pathways (Calder et al., 1996).

Furthermore, of particular importance to the present study, processing of both anxiety and emotion has been found to occur within the occipitotemporal cortices, amygdala, orbitofrontal cortex, basal ganglia and right parietal cortices (Adolph, 1996). In fact, it has been explained that high levels of anxiety may heighten an individual's ability to detect fear and disgust (Fox, Calder, Matthews, & Yiend, 2007). Therefore, it may be inferred that anxiety causes parts of the brain involved in the processing of facial features to respond differently towards emotional stimuli. However, few studies have investigated how anxiety affects facial emotion processing areas within the brain and therefore, it is not certain where and to what extent anxiety influences brain functioning (Ball, Sullivan, Flagan, Hitchcock, Simmons, Paulus, & Stein, 2012).

Regardless there has been speculation that the amygdala, an essential brain structure to the processing of anxiety, plays a role in processing and recognizing fear (Whalen, Shin, McLnerney, & Fischer, 2001), especially when compared to processing anger (Calder et al., 1996). Peltola et al. (2009), suggest that the ventral amygdala reacts similarly to both fear and anger. In support, Whalen et al. (2001) suggest that both anger and fear should comparably activate the amygdala because both emotions are commonly associated with danger. In fact, Peltola et al. (2009) comments that the amygdala's role in associating facial emotion expression with environmental factors allows people to accurately and rapidly respond to threatening stimuli. Regardless, it may also be argued that fear, rather than anger, exhibits more subtle facial features, causing the brain to work harder to process fear-related stimuli. If the brain uses more energy to process fear then it is likely that less energy will be used to process anger, causing fear to take precedence in emotion processing (Peltola et al., 2009). The preceding phenomena may

be explained by the "perceptually difficult hypothesis", a theory that deals with minor facial feature differences evident between two emotion expressions. For instance, fear and surprise share many similar characteristics such as wide eyes and an opened mouth that contribute to inaccurate recognition of these two emotions (Calder et al., 1996). Thus, when two similar emotions are presented a person may have difficulty distinguishing between the emotions.

Brain Processing of Vocal Emotion Information

Even though cognitive processing of visual emotion stimuli is important for a person's well-being, it may be argued that the processing of vocal intention is just as, if not more, important for a person's ability to accurately perceive emotional cues. In fact, researchers have noted that vocal intonation is a key outlet that allows individuals to make inferences about other people's emotional states (Johnstone, Reekum, Oakes, & Davidson, 2006). Furthermore, comparable to facial expressions observed cross-culturally, vocal expressions may also be recognized among various cultures. However, while there is an abundance of neural imaging investigations about how the brain processes facial emotion, information regarding neural pathways involved in vocal emotional processing is scarce.

Nonetheless, it has been suggested that vocal interpretation of happiness involves complex neural pathways involving the sensory cortex, limbic and somato sensory regions and prefrontal cortex, which are all associated with decoding social information (Johnstone, 2006). Both facial and vocal emotional expressions of happiness elicit activation of the left middle temporal gyrus (Johnstone et al., 2006). However, recognition of happiness seems to be most accurate when happy facial images are paired with happy vocal expressions. Furthermore, the left insula, left amygdala and hippocampus became more activated when presented with happy vocal cues than angry vocal cues. This outcome only occurred when vocal stimuli were

presented without the accompaniment of facial expressions (Johnstone et al., 2006). Thus, activation of specific neural structures seems to respond in direct accordance with an individual's attention towards facial versus vocal stimuli.

Whether or not it is visual or vocal stimuli that allow a person to more accurately and rapidly detect emotional information holds little importance when considering general effects neural processing of emotional information has on a person's social behavior. In fact, the present study focuses on children's recognition and attention of emotional cues in order to gain insight about the effects anxiety may have on emotional processing, which later in life could lead to social interaction impairment. Unfortunately, neurocognitive studies have not extensively investigated the relationship between emotion recognition impairments and socio-emotional difficulties in children; whereas, the effect of adult brain injury on sociality is commonly explored. For instance, Tonks et al. (2007) explain that the influence of pediatric brain injury on one's social skills is left ignored by the majority of researchers. When an individual is unable to effectively process information during social interaction they are ultimately unable to gain an understanding of another person's intentions and emotional state. The inability to grasp an understanding of useful social cues may cause anxiety towards approaching other individuals (Tonks et al., 2007). This consequence may be preventable if dealt with during childhood, which further emphasizes the importance of research on children's emotion recognition.

The Effects of Emotion Perception on Social Interaction

After reviewing the entirety of the previous sections, one may ask "So why is adequate perception of emotion important?" The significance of inadequate emotion recognition lies within the realm of a child's social interactions. Masten et al. (2008) explain emotion processing deficiencies as being "invaluable" for children's social development. Furthermore, children

develop an ability to distinguish separate emotions during infancy and therefore have the potential of experiencing emotion perception impairment early in development. When children are unable to communicate efficiently with their peers then they are at risk of experiencing increased anxiety when approaching social interactions. For instance, adolescents suffering from clinical anxiety disorders show impairment during social interaction. According to Jarros et al. (2012), individuals suffering from disorders characterized by high levels of anxiety may show difficulties with social communication due to their seemingly inability to accurately recognize negative facial expressions such as anger or sadness. This accords with cognitive models of anxiety that suggest an increase in misinterpreted social information by individuals suffering from anxiety disorders. Impairment in processing social cues may also explain why anxious individuals tend to have distorted perceptions of threat within their surroundings. Such impairments lead to early abnormal social behaviors (Jarros et al., 2012).

Understanding associations between facial and vocal emotional expression and possible motivators of these expressions allows humans to physically and psychologically prepare for unexpected situations and events. For instance, observing sad facial expressions or hearing angry vocal intonations may allow an individual to expect and prepare for a dangerous event (Fenster, Blake & Goldstein, 1977). Furthermore, knowledge of another person's emotional states could help make it possible for someone to offer relief to that person's suffering. Thus, if an individual experiences a disruption in their cognitive development to process emotional information then, they will not be as socially valuable for others during emotional instability.

Adequate processing of emotional information may also enhance an individual's likelihood of survival. For instance, the ability of maltreated children to quickly process partial emotional signals enables them to generate hypotheses about what a person may be feeling

earlier than children who are unable to decode these partial emotions (Pollak and Sinha, 2008). When a person is able to quickly draw conclusions about an emotional state of another person, they are able to respond to that person appropriately. Therefore, abnormal abilities to recognize emotional expressions are not always negative in regards to a person's social development; they may also enhance a person's ability to communicate and to gather information about a threatening situation. On the other hand, ineffectively decoding emotional cues within social contexts commonly causes a child to experience complex learning problems (Pollak & Sinha, 2008). It may be assumed that there are several biological predispositions that allow an individual to recognize emotional expressions; however, efficient perception of emotion also results from continual exposure to emotional representations. Pollak and Sinha (2008) suggest that children may learn to associate certain facial emotions with danger by pairing facial expressions with outcomes of situations embodying a facial expression.

Increased attention towards threatening and fearful emotional stimuli has the ability to negatively influence several components of a person's social development such as appropriate communicative behaviors, perception of emotions and motivation to partake in social interactions (Surcinelli et al., 2006). By allocating heightened attention towards certain stimuli it is likely that an individual may over read emotional information, causing them to introduce tension and awkwardness into social interactions. For instance, if a person detects miniscule features of anger exhibited by another's facial expression, then they may negatively react when, in fact, their perception of anger was erroneous. When people experience shortcomings in the previous areas, they are subjected to avoidance of interpersonal relationships, poor communication, maintained anxiety and oversensitivity to minor threatening cues (Surcinelli et al., 2006).

It has been assumed that individuals suffering from anxiety experience fear about displaying their anxiety symptoms during social interactions, which may reinforce their level of anxiety. It has been noted that anxious people believe that characteristics of their anxiety will be negatively conceptualized by others (Gee, Antony, Koerner & Aiken, 2012). These feelings are typically experienced by individuals who specifically struggle with social anxiety; nonetheless, social anxiety is commonly associated with other classifications of anxiety such as, state-anxiety (non-clinical anxiety that causes a sudden interruption in one's emotional state) or trait-anxiety (a general non-clinical experience of anxiety).

Despite highly anxious people's fear of being negatively judged by others, their keen awareness of anxious behaviors allow them to more easily decipher other people's emotional states. Unexpectedly, their fear of social interactions does not prevent them from being judgmental of anxious individuals and in fact, they have described other anxious people as being less attractive and weak (Gee, Antony, Koerner, & Aiken, 2012). Individuals experiencing high levels of anxiety compared to individuals experiencing low levels of anxiety seem to harshly describe other anxious individuals, which may be based on heightened brain caused by the experience of high levels of anxiety. Furthermore, they may also judge other anxious people negatively in response to their perceptions of how non-anxious people view highly anxious individuals during social interactions.

The previous negative perception of anxious behavior is not supported by similarity theories presented in the field of social psychology (Gee, Anotony, Koerner, & Aiken, 2012). It has been argued that when an anxious individual observes other people demonstrating similar behavior characteristics to their behavior they are more likely to view those people in a positive manner. Therefore, it would be expected for a high socially anxious person to rate another

anxious person's behavior as attractive. Regardless, Gee, Anotony, Koerner and Aiken (2012) presented findings discordant to claims of similarity theories. They argue that anxiety does not cause individuals to view anxious people more harshly than those without anxiety. In fact, one's own experience of anxiety did not play a role in their judgment of others displaying anxious behaviors. Despite this lack of relationship between anxiety and judgment, a person's own perception of his or her anxiety versus their actual anxiety showed to be more relevant when predicting that person's judgment of other anxious individuals. Those who thought to be similarly anxious to others were more likely to view them as attractive; whereas when there were differences between their behaviors they were rated less positively. Thus, despite the non-significant effects of actual anxiety on one's character ratings, perceived anxiety predicted a person's social response towards other anxious individuals (Gee, Anotony, Koerner, & Aiken, 2012).

Distinction between actual and perceived similarity relies on the absence or presence of a person's evaluation of similarity with another person (Montoya, Hurton, & Kirchner, 2008). It is understood that people value consistency and predictability within aspects of their daily lives. Therefore, people who share similar beliefs and attitudes are positively reinforced to interact with each other. Furthermore when similarity is perceived between two people, the fear of social apprehension is likely reduced, which may be particularly evident among anxious individuals (Montoya, Hurton & Kirchner, 2008). However, as noted previously, when an anxious person encounters another person demonstrating elements of anxiety such as a fearful facial expression it is likely that the person will draw an association between the emotional expression and potential environmental dangers, ultimately reinforcing their anxiety. This attention towards possible danger could distract a person from perceiving emotion expression similarities of

another person, eliminating the similarity effect of attraction and also predictability and consistency of interaction with similar people. Thus, one may argue that a person who does not exhibit threat-related characteristics would hold precedence in social interactions of people suffering from anxiety because they do not signal potential environmental danger; not because perceived similarities reduce fear of social apprehension.

In addition, individuals seem to be more attracted to people who demonstrate characteristics that initiate sufficient communication (Montoya, Horton & Kirchner, 2012). However, this does not seem to be true of anxious individuals. As previously discussed, it has been shown that anxious people commonly interact with other anxious people, despite common social interaction deficits experienced by people suffering from high levels of anxiety. Non-anxious people may not perceive sufficient communication when associating with an anxious person but anxious people may prefer communicating with anxious individuals based on the type of emotional stimuli they frequently express. People experiencing high levels of anxiety may commonly display emotional features that are regularly associated with threat or danger. Furthermore, anxious people tend to gravitate towards these emotions in order to predict the degree of threat exhibited in their environment, preventing them from encountering danger. However, it has been argued that people suffering from anxiety may habituate to this type of stimuli. For instance, if an anxious person participates in social interactions with others struggling with anxiety, then they may eventually become desensitized from the fear they experience when detecting miniscule and possibly irrelevant threat-related stimuli displayed by anxious individuals (Montoya, Horton, & Kirchner, 2012). In other words, repeated exposure to threat-related stimuli without actually encountering danger should decrease one's experience of anxiety towards trivial cues of threat.

Evidence that is offered dealing with how perception of emotional information influences an individual's social interactions helps gain an understanding of the importance of emotional information when dealing with communication. If an individual is unable to properly perceive emotion then they are in danger of jeopardizing the quality of their social relationships. Being unable to comfortably engage in frequent social interaction may lead individuals to experience other psychological suffering and will prevent the incorporation of social support into a person's daily life. Furthermore, without social support, an individual will have more difficulty receiving relief from their anxiety and will have little opportunity to improve social skills. Thus, investigating factors contributing to impairment in emotional information perception may prevent individuals from experiencing social dysfunction and corresponding psychological issues such as depression.

The Present Study

The present research will investigate the ability of 4 to 6-year-old children with various levels of trait-anxiety, a non-clinical type of anxiety that deals with the anxiety a person experiences in daily life, to recognize and attend to facial and vocal emotional stimuli and how their emotion perception impacts their social interactions. The present study includes three separate experiments; the first experiment investigates the relationship between children's level of anxiety and their ability to recognize six facial emotional expressions (e.g., happy, sad, fear, surprise, disgust and anger) at varying intensities. The second experiment deals with children's attention towards positive (happy and surprise) or negative (disgust, anger, fear and sad) facial expressions. The third experiment investigates children's attention towards facial versus vocal emotional cues of the six previous emotion expressions. Facial images and vocal intonations

will be simultaneously presented to participants in a way that allows for one to gain an understanding of which type of emotion perception (facial or vocal) holds precedence.

Some concern may be expressed in relation to young children's ability to participate in emotion perception tasks due to an inability to understand certain emotions and children's undeveloped cognitive level. However, it is believed that preschoolers typically perform well on tasks that require them to point to facial expressions that demonstrate various emotions (Gagnon et al., 2012). Therefore, tasks will be presented that consider the participant's age range.

Experiment 1: Facial Emotion Recognition

This experiment considers possible effects of trait-anxiety on a child's ability to recognize facial emotional expression. Literature that examines the previous factors does not present consistent results indicating a specific effect of anxiety on emotion perception (Cooper et al., 2008; Surcinelli et al., 2006). Furthermore, disagreement is evident between studies about the influence of clinical versus non-clinical relationships on emotion recognition. In some cases it is argued that an individual must experience clinically severe anxiety in order to demonstrate any impairment or enhancement in emotion recognition abilities (Mogg, Millar, & Bradley, 2000). On the other hand, it has also been argued that individuals suffering from chronic and severe trait-anxiety also show facial emotion recognition abilities that deviate from the norm (Manguno-Mire, Constans, & Geer, 2005; Richards, Calder, French, & Fox, 2002). Nonetheless, it is uncertain how anxiety, clinical or non-clinical, influences a person's ability to recognize facial emotion information. What follows is a review of various studies that offer insight about the relationship between anxiety and emotion recognition examined in Experiment 1. Even though the present study focuses on non-clinical trait-anxiety, investigations involving clinically

anxious participants will also be discussed in order to gain an understanding of how the degree of anxiety may provoke differing behaviors in regards to emotion recognition.

As suggested by cognitive models of anxiety, individuals suffering from anxiety disorders commonly show disruptions in their ability to process emotion which may be a result of their experienced anxiety symptoms (Masten, Guyer, Hodgdon, McCure, Charney, Ernst, Kaufman, Pine, & Monk, 2008). However, a cognitive model of anxiety known as, the hypervigilant theory explains that anxiety is used as a factor to provoke an early evaluation of suggestible threatening emotional cues rather than eliciting impairment of one's ability to recognize an emotion (Bishop, Duncan & Lawrence, 2004). In other words, the hypervigilant mode enhances one's ability to recognize emotional cues. For instance, it has been reasoned that anxiety may increase sensitivity of the thalamoamygdala route, creating a strengthened amygdala response to mild expressions of threat (Bishop, Duncan & Lawrence, 2004).

In fact, children do not process every stimulus within an environment equally; rather, they attend to factors that are linked with either highly positive or highly negative situational outcomes (Pollak & Sinha, 2008). Masten and others (2008) suggest that this type of enhanced processing may be exhibited by maltreated children in regards to the emotional information associated with their experiences of abuse, allowing them to avoid future maltreatment. A hypervigilant mode may develop in response to anxiety that forms in anticipation of experiencing another abusive episode. Furthermore, this heightened mode is presumed to occur within early stages of cognitive processing which would allow an individual to immediately detect danger and possibly avoid harmful situations. For example, continuing with Masten et al.'s study (2008), maltreated children require minimal emotional information to decipher facial expressions, specifically those associated with fear and anger. Abused children are also faster at

recognizing facial emotions than non-abused children. This may be a result of the activation of a hypervigilant mode formed in response to increased anxiety when encountering similar emotions to those experienced during times of abuse. In fact, early heightened activation of cognitive processes is believed to have developed as an evolutionary adaptation, increasing an organism's likelihood of survival when faced with life-threatening situations such as the encounter of a predator (Mogg, Millar, & Bradly, 2000).

As explained by Masten and colleagues (2008), the previous conclusion parallels past research that posited an enhanced sensitivity towards negative emotions by abused children. This finding extends to maltreated children who have been clinically diagnosed with severe post-traumatic stress disorder, which involves symptoms of severe anxiety. Masten and colleagues (2008) suggest that children, who live in environments where they regularly experience abusive behaviors and commonly observe fearful faces by those around them, such as their mother or siblings, extensively utilize energy towards cognitive processing of fearful expressions.

Similarly, children who routinely encounter parental hostility seem to require less perceptual facial emotion information for anger; physically abused children have shown to need more emotional information to decode sad facial expressions (Pollack & Sinha, 2002). Therefore, it may be suggested that there is a relationship between children's ability to detect facial emotions and the expressions displayed by their abuser during times of attack. If a child's abuser repeatedly shows angry expressions, then the child's emotional processing will become conditioned to respond more rapidly towards similar expressions, which is explained as the theory of "heightened negative emotional perception adaptation". The emotions that a person frequently encounters will be readily processed allowing for more rapid emotion detection.

Despite beneficial qualities of such an adaptation, the occurrence of an overactive emotional awareness may reinforce anxiety experienced by individuals suffering from clinical anxiety disorders (Mogg, Millar, & Bradly, 2000). Based on claims of the hypervigilant theory, an individual experiencing a high level of anxiety may consistently experience elevated activation within the brain's threat detection center, enabling them to detect minimal facial and vocal signals of threat that are relatively meaningless. For example, a slight rise of a person's eyebrows or a brief moment of a high pitched vocal tone may cause an anxious person discomfort, giving them the perception that something threatening may be about to occur. This repetitive erroneous response to emotional expression may cause an anxious person to avoid social situations or to act awkwardly during a social interaction.

For some studies, differences in identification of threatening emotions have only demonstrated significant between groups of anxious individuals and groups of non-anxious individuals. This difference has been evident when displaying a facial image with partial emotion information as opposed to faces presenting the highest intensity of a facial emotion (Pollak & Sinha, 2002). Therefore, it may be argued that anxious individuals are better able to recognize minuet features of a facial emotion expression than non-anxious groups. Despite enhancement in visual emotion recognition, it is still likely that children who experience anxiety are at risk for dysfunctional social relationship due to their constant perception of threat. In fact, regular activation commonly causes anxious individuals to falsely classify certain elements of a stimulus.

The previous claims are supported by the finding that adolescents suffering from anxiety disorders show deficiency in their ability to recognize angry faces as opposed to neutral faces (Jarros et al., 2012). Furthermore, anxious patients show better accuracy in recognizing neutral

faces than non-anxious adolescents; however, when anxious individuals make errors in facial emotion recognition they tend to identify the face's emotion as sad more often than non-anxious participants. These results are also supported by an "emotion-congruent phenomena", presuming a relationship between a person's emotional state and their likelihood to incorrectly decode facial stimuli based on that emotional state. Emotion congruency is evident when a depressed individual, who is frequented by the presence of sadness, selectively shifts their attention towards sad facial emotional cues and also commonly inaccurately recognizes other facial expressions as displaying sadness (Mogg, Millar, & Bradley, 2000; Bower, 1981). For example, studies show children suffering from depression or comorbid anxiety-depression as having a bias towards negative emotional stimuli and non-anxious and non-depressed people as having bias towards positive stimuli (Landoucer et al., 2005). Thus, anxious individuals may show enhanced performance of recognition when presented with emotional expressions they commonly demonstrate or encounter.

Similar to inconsistencies found within research dealing with clinically diagnosed disorders, non-clinical psychological problems also show varying results. For example, Cooper, Rowe and Penton-Voak (2008) found that people suffering from high levels of trait-anxiety do not perform worse on facial emotion recognition tasks than people with low levels of trait-anxiety. On the other hand, Surcinelli et al. (2006) suggest that higher levels of anxiety cause individuals to experience difficulties in recognizing disgust; whereas, people experiencing low levels of anxiety do not show this difficulty. Additionally, anxious individuals tend to have better recognition of fear opposed to the non-anxious group; however, both groups have shown similarities in their ability to recognize anger, sadness, happiness, surprise, disgust and neutral facial expressions (Surcinelli et al., 2006).

Thus, Surcinelli et al. (2006) argue against the "emotionality theory" that all emotional stimuli, rather than just threatening emotional expressions, are detected more readily by anxious individuals. In support of the previous claims, Mogg, Millar and Bradley (2002) discuss a tendency for anxious individuals to remain focused on threat provoking stimuli and Fox (2002) also shows that people with high anxiety attend to fearful faces but avoid happy faces. Persistent attention towards fear may cause anxious people to frequently experience fear. Regular experiences of fear may possibly enhance one's learning of fearful facial formations, ultimately giving them the ability to easily detect fear displayed by others (Surcinelli et al., 2006).

Despite strong evidence against the emotionality theory, Cooper et al. (2008), discredit Surcinelli and colleagues' (2006) research due to potential inappropriate methodology. It is suggested that the methods did not allow for proper understanding of a correlation between high trait-anxiety and an enhanced ability to decode fear within facial expressions. For instance, Cooper et al. (2008) claim that the previous study used longer than usual time lapses for participant observation of facial images. It is understood that a person may respond to a facial image in a matter of 100 ms (Adolphs et al., 2006); however, Surcinelli and colleagues (2006) exposed their participants for a longer duration of 10 s.

It is argued that when a person observes a fearful image for a long period of time, the effect of immediate danger is resolved. Furthermore, by increasing exposure time of facial images, confounding variables such as decreased interest in the task at hand may cause researchers to believe there is a relationship between two variables when there is not (Cooper et al., 2008). In support, other studies have found that the earliest at which an individual is able to distinguish between two facial emotions occurs at 80 ms to 110 ms (Adolph, 2002). However, when considering stimuli exposure time one should take into account specific brain structure

functioning. For instance, brain activation after 80 ms through 110 ms is seen specifically within the midline occipital cortex; whereas, amygdala responses towards facial emotion has shown to occur after 120 ms. Furthermore, distinctions between emotions may not be made until 150 ms after exposure (Adolphs, 2002).

Fear may not be considered as a direct threat but rather, it may be perceived by highly anxious individuals as a warning sign for various dangers within an environment. When an anxious person continuously detects partial emotional cues then they frequently worry of being in potential danger (Surcinelli et al., 2006). Therefore, a counter argument in regards to facial emotion stimuli exposure may be made in regards to the amount of time facial images should be presented to participants. It may be inferred that length of exposure would not be relevant to an anxious versus non-anxious individual's recognition of fear or other threat provoking stimuli because whether or not a highly anxious person views an image for 10 s versus 100 ms, it is still commonly shown that they would continue to be aware of a threat related image.

Furthermore, by revisiting the idea that anxiety heightens a person's hypervigilant mode, one may infer that being shown an image for 10 s versus 100 ms would be irrelevant to an individual's initial processing of an emotion because the hypervigilant theory suggests that an anxious person's recognition of facial expressions should be enhanced during initial perception of a stimulus, which has been shown to occur within milliseconds after viewing a stimulus (Mogg, Millar, & Bradly, 2000). Therefore, observation past milliseconds of exposure time would be unnecessary for sufficient analysis of emotional information by highly anxious individuals, or even for non-anxiety people. The majority individuals experience a hypervigilant mode during facial emotion processing; the only difference between anxious and non-anxious individuals is that this hypervigilant mode persists in anxious people.

Richards, Calder, French and Fox (2002) support the previous claims of the hypervigilant theory with their finding that highly socially anxious people show a slight enhanced awareness of fear, likely due to increased activity within the amygdala. In addition, Fox (2002) alludes to heightened right hemispheric processing of fearful facial expressions in people with high levels of trait-anxiety. Therefore, even though a 10 s duration exposure time allows for anxious individuals to process facial emotion information to a greater extent, Cooper et al. (2008) cannot be certain that the reason non-anxious individuals show lower abilities than anxious individuals to recognize fear is a direct response of their lack of maintaining focus on the fearful face.

In addition to facial emotional expression, Manguno-Mire, Constans and Geer (2005) hypothesized that anxious individuals demonstrate a heightened ability to recognize negative lexical stimuli (items of vocabulary) versus positive stimuli. However, participants experiencing high levels of trait-anxiety did not show a significant difference in their attention towards negative emotional signals compared to people demonstrating low levels of trait-anxiety. Furthermore, the presence of anxiety did not seem to quicken a person's ability to classify threat-related words, going against the hypervigilant theory. However, a mood congruency phenomenon was evident throughout this study when researchers masked the emotionality of words. It was found that highly anxious people were more likely than individuals experiencing low levels of anxiety to classify stimuli as dangerous. When experiencing mood congruency, people displaying a certain emotion will have an increased tendency to classify a facial image as exhibiting that same emotion. Interestingly, unambiguous stimuli were not more likely to be perceived as threatening by people with high anxiety (Manguno-Mire, Constans, & Geer, 2005), suggesting that ambiguity plays a role in a person's perception of emotional cues.

In contrast, based on the mood congruency theory, Richards, Calder, French and Fox (2002) hypothesized that individuals with high social anxiety will classify an ambiguous face as fearful at lower intensity levels than less severe socially anxious individuals. Regardless of these stipulations, anxious and non-anxious participants show minimal differences in their categorization of fearful faces. However, highly socially anxious individuals are quicker at identifying fearful facial expressions than individuals exhibiting low levels of anxiety; whereas, less severe socially anxious people tend to classify facial expression as happy when discerned next to controlled facial images, supporting the mood congruency theory (Richards, Calder, French, & Fox, 2002). An increased sensitivity towards fear may be responsible for the bias demonstrated by high-trait anxiety people to more rapidly recognize stimulus of fear.

Contrary to what has been seen in clinically anxious and depressed people, those experiencing mild forms of anxiety and depression do not show congruency in their abilities to recognize emotional information (Surcinelli et al., 2006). Despite characteristics of anxiety that are shared between anxious and depressed individuals, depression does not seem to provoke specialized attention towards threatening stimuli. Instead, depression shows correlation with impairments in recognition of both positive and negative facial emotional expressions. Surcinelli et al. (2006) argue that, while depression seems to be a cause of deficits in one's ability to recognize all facial expressions, people suffering from anxiety problems have an enhanced ability to decipher fearful emotional cues.

Reviewing the previous studies, it is evident that literature embodies a variety of conclusions about anxiety effects on a person's ability to recognize facial emotion expression. Furthermore, it should also be mentioned that many of the study's discussed above include adolescents and adults; whereas, child populations are not as commonly approached when

researching influential factors of facial emotion recognition. Thus, Experiment 1 will involve children in order to gain a better understanding of emotion recognition by younger populations. Furthermore, the present study hopes to gain evidence for or against various theories such as the hypervigilant theory. It is hypothesized that children who experience a high level of trait-anxiety will recognize facial emotional cues at lower intensities than children experiencing low levels of trait-anxiety.

Method

Participants

A total of 12 children (6 boys and 6 girls) from the College of Wooster Nursery and 23 children (13 boys and 10 girls) from two kindergarten classes of a Wooster City School, all within a 4 to 6-year-old age-range participated within this study. These children were all from a similar socioeconomic background and resided within semi-urban areas. None of the children presented with brain injury or other forms of handicaps that could alter the validity of this research. Three children's data were excluded from this study based on changes made to methods after their participation in the study. Changes were made to the initial procedure because it was discovered that the initial procedure did not demonstrate acceptable content validity. Furthermore, it was also clear that the procedure inadequately measured children's performance of facial emotion recognition. A letter explaining the basic details of the present study, consent forms and permission to participate forms were given to each child's guardians in order to gain approval for their child's participation within this study.

Procedure

Children were tested individually in an approved classroom located within their elementary or nursery school. The participants were removed from their classrooms for

approximately ten minutes in order to observe female facial emotion expressions. At least one teacher or supervisor was in attendance during each child's testing. Once participants completed the task they were excused to return to their regular classroom.

Each child sat approximately 18 inches away from a Toshiba, Satellite (17 inch) computer screen. Upon arrival, the computer displayed a black screen. Once participants showed an understanding of task instructions, the black screen disappeared and was replaced with images. Images were shown on successive slides within a PowerPoint presentation. A series of eight sets of paired facial emotional images were shown one at a time. One of the facial images of the pair represented 10% of a certain emotion and the other image represented consistently increasing levels of an emotion (the intensity getting stronger with each new slide). Participants were exposed to each of the six emotions (happy, sad, fear, disgust, surprise, anger) at steadily increasing intensities (starting at 10% intensity and ending at 90% intensity). An example of a facial paring set includes the following intensities and facial emotion: 10% happy and 20 % happy, 10% happy and 30% happy, 10% happy and 40% happy, 10% happy and 50% happy, 10% happy and 60% happy, 10% happy and 70% happy, 10% happy and 80% happy, 10% happy and 90% happy (See Appendix B). A 10% intensity image is only slightly above neutral and therefore was treated as a neutral image within a given set of image pairings.

Each emotion (happy, sad, angry, disgust, surprise and fear) was represented in a similar set to the one demonstrated above. Each participant was asked to verbally state when they thought a pair of facial images did not match in facial expression, making it clear at which intensity the children were able to perceive an emotion. For instance, if a child perceived a difference between a 10% happy face paired with a 40% happy face, then it would be recorded that the child was able to detect happiness at 40% intensity.

When the children viewed all ten sets of facial image pairings, or when they expressed discomfort, they were excused from the testing area and returned to their classrooms.

Mean percentage of recognition was compared based on participants' level of anxiety, which were determined by the Revised Children's Manifest Anxiety Scale (RCMAS-2).

Materials

Facial emotion expression images were 54 faces chosen from Young, Perrett, Calder, Sprengelmyer and Ekman's (2002) program known as, Facial Expressions of Emotion: Stimuli and Tests (FEEST). This set of faces includes facial emotion expressions of sadness, happiness, disgust, surprise, fearful and angry. For each emotion, nine intensities of the emotion were presented to participants, ranging from 10% to 90% intensity levels. All facial images portrayed the same female face, no male faces were used. Images were presented on a 17 inch computer screen using the program, PowerPoint. The series of faces were presented in a slideshow presentation.

The Revised Children's Manifest Anxiety Scale: Second Edition

Each child completed a ten minute anxiety assessment known as The Revised Children's Manifest Anxiety Scale: Second Edition (RCMAS-2). This test is short; containing 49 yes/no response formatted questions directed towards children between the ages 6 and 15-years-old (Reynolds & Richmond, 2008). Due to the present study's incorporation of 4 through 6-year-olds, questions were reworded, using appropriate vocabulary for children under 6-years-old. Furthermore, questions 12, 15, 27, 31, 44, 45, 47 and 49 were omitted from the test, leaving 41 questions to be answer by participants (See Appendix A). The preceding questions were omitted based on the majority of the children's unwillingness to answer these questions and their misunderstanding of the questions. For instance, regarding the assessment item, "I worry about

saying something dumb." children did not completely understand what constituted as "dumb". Furthermore, participants would commonly respond to this question with a response such as "I don't know.". The key subareas that are measured by the RCMAS-2 include physiological anxiety, worry, social anxiety and defensiveness. Each child completed the whole assessment rather than only a subset, making it possible to report their total (TOT) level of anxiety (Reynolds & Richmond, 2008). This assessment is commonly used in education environments and is based on an ethnically diverse sample of individuals. Due to the young age-range of participants (4 through 6-year-olds), questions were read aloud to each child and they responded verbally, stating "yes" or "no". With the completion of the RCMAS-2, scores were placed within two groups, low level of trait-anxiety and high level of trait-anxiety. Levels of anxiety were determined by finding the median of the participants' scores. Children who scored above the median number were classified as demonstrating a high level of trait-anxiety and children who scored below the median number were classified as demonstrating a low level of trait-anxiety.

Scoring of each participant's level of anxiety was determined by using scoring sheets provided by the RCMAS-2. Each of the 41 assessment items was scored separately. The score sheet listed a number for each question (1-49); each specifying whether or not to place a checkmark in the box depending on a child's response. If a participant did not respond with the answer inferred by the scoring sheet, then a check mark would not be placed within the box. Once all questions were addressed, the number of total checks for each column was determined (columns corresponding to different subtypes of anxiety). Then, a total (TOT) anxiety measure was calculated by adding the number of checks from each of the scoring sheet's columns. For the present sample, scores ranged from 0 through 23. The median number of the participants'

anxiety scores was determines (*ME* = 12). Anyone's score who fell below 12 were considered a part of the low anxiety group and participants who scored at or above 12 were considered a part of the high anxiety group.

Results

Results were examined using an independent-samples t test for each of the six emotions (e.g., happy, sad, angry, disgust, surprise and fear). Mean intensity scores of children's recognition of the six emotions were compared between children suffering from a high level of trait-anxiety and children suffering from a low level of trait-anxiety. The alpha for this analysis was set to .05. Cohen's *d* was utilized in order to determine effect size between the two anxiety groups.

The primary hypothesis of Experiment 1 was that children experiencing high levels of trait-anxiety would recognize facial emotional expressions at lower intensities than children experiencing low levels of trait-anxiety. Table 1 shows the means, standard deviations, *t* values, *p* values, and *d* values for each emotion. These values indicate that the hypothesis was not supported. In fact, at least for one emotion the opposite trend was demonstrated. However, the analysis offers some support for a possible trend between anxiety level and recognition of anger. Furthermore, only two emotions (happiness and anger) showed moderate to high effects. Therefore, anxiety may not be a determining factor of one's ability to recognize facial emotions.

Table 1

The Effect of Trait-Anxiety on Children's Facial Emotion Recognition

	High Anxiety		**Low Anxiety**		***t* Value**	***p* Value**	**Cohen's *d***
Expression	*M*	*SD*	*M*	*SD*			
Happy	2.71	0.58	3.18	1.07	1.58	.123	0.6
Sad	4.71	2.34	5.35	1.94	0.88	.386	0.3
Disgust	3.71	1.44	4.35	1.83	1.14	.262	0.4
Anger	5.06	1.75	3.94	1.75	.-1.86	.072	0.7
Surprise	3.41	0.94	3.76	1.68	0.75	.445	0.3
Fear	3.76	0.97	3.47	1.23	-0.77	.445	0.3

Note. Mean difference values are represented as percentages (e.g., 3.76 = 37.6%). Thus, children suffering from high levels of anxiety recognized fear, on average, at 37.6% intensity.

An independent-samples t test showed that the difference in facial emotion recognition of sad, happy, disgust, fear, surprise and angry facial expressions between children receiving a high score on the RCMAS-2, indicating a demonstration of a high level of trait-anxiety, and children receiving a low score on the RCMAS-2, indicating a demonstration of a low level of trait-anxiety, is not completely conclusive as to whether or not children with high levels of trait-anxiety are able to recognize images of facial emotional expressions at lower intensities than children experiencing low levels of trait-anxiety. However, results show some evidence approaching significance, implying that for at least angry expressions, children with low levels of anxiety recognized emotion at lower intensities than children with high levels of trait-anxiety.

For instance, the analysis indicates that difference in recognition of anger between children experiencing high levels of trait-anxiety versus children experiencing low levels of trait-

anxiety is not statistically significant and demonstrates a high effect (See Table 1). Despite the insignificant findings, one may infer that results are approaching significance, indicating that children with low levels of trait anxiety are able to recognize anger at lower levels of intensities than highly anxious children. Nonetheless, the previous finding does not support the hypothesis.

Similarly, it was shown that difference in recognition of disgust between children suffering from high levels of trait-anxiety versus children experiencing low levels of trait-anxiety is not statistically significant and demonstrates a small effect (See Table 1). While this finding does not indicate significant differences between anxiety groups in their ability to recognize facial emotional expressions at various intensities, in regards to reported mean scores, the low levels of trait-anxiety group took longer to recognize disgust in comparison to children experiencing high levels of trait-anxiety. This non-statistically significant finding is in the predicted direction; however, the difference is not strong enough to indicate a concrete difference between the two anxiety groups or that anxiety plays a role in a child's ability to recognition facial emotions.

The difference in recognition of fear between children experiencing high levels of trait-anxiety versus children experiencing low levels of trait-anxiety was not found to be statistically significant and shows a small effect (See Table 1). This result does not support the present study's hypothesis; however, the non-statistical difference between the presented means does show that children suffering from high levels of trait-anxiety recognized fear at lower intensities than children suffering from low levels of trait-anxiety. Regardless, results show a relatively low effect size, which rebukes any indication that anxiety plays a role in a child's ability to recognize fear.

In continuation, the analysis showed that the difference in recognition of happiness between highly anxious children and less sever anxious children is not statistically significant and shows a medium effect (See Table 1). This finding does not support the present study's hypothesis but the non-statistically difference between the two groups of anxiety does demonstrate the same trend as hypothesized. In other words, children experiencing high levels of trait-anxiety were able to recognize happiness at lower intensities than children experiencing low level of trait-anxiety. Furthermore, unlike disgust and fear, the recognition of happiness in regards to anxiety levels shows a medium effect, which indicates a stronger likelihood that anxiety plays a role in a child's ability to recognize happiness.

Similarly, the difference in recognition of sadness between highly anxious children and children suffering from low levels of anxiety is not statistically significant and shows a small effect size (See Table 1). Regardless, the non-significant difference between the two anxiety groups does support the trend that is explained by the present study's hypothesis. Highly anxious children were able to recognize happiness at lower intensities than children suffering from low levels of anxiety. Unfortunately, the effect size is relatively low, indication that anxiety may not be a factor in a person's ability to recognize happiness.

Lastly, an independent-samples t showed that the difference in recognition of surprise between children with high levels of anxiety versus children with low levels of anxiety does not show a statistically significant difference and also shows a small effect size (See Table 1). Despite the previous insignificant finding, similar to highly anxious children's ability to recognize to recognize happiness, sadness and disgust, highly anxious children show some ability to recognize surprise at lower intensities than children experiencing low levels of trait-

anxiety. However, in accompaniment with a small effect size, intensity does not seem to play a role in a person's ability to recognize facial emotional expressions of surprise.

Overall, the present findings indicate that a child's ability to recognize various facial expressions does not seem to be correlated with a child's level of trait-anxiety, excluding the recognition and anger. The results of the remaining emotions (disgust, fear, happiness, sadness and surprise) do not support the hypothesis that anxiety influences a child's ability to recognition facial emotional information. In fact, results regarding emotional expressions of disgust, fear, happiness, sadness and surprise show small to medium effect sizes, further supporting that anxiety does not play a role in a child's ability to recognize the previous emotions.

Discussion

In Experiment 1, the study's main objective was to examine children's ability to recognize six facial emotional expressions (happiness, sadness, angry, fear, disgust and surprise) at varying intensities when presented next to a semi-neutral facial image. Primarily based on anxiety theories of hypervigilance, it was hypothesized that children experiencing high levels of trait-anxiety would be able to recognize facial emotional expressions presented at lower intensities than children experiencing low levels of trait-anxiety. There was, however, no significant difference in recognition performance between the two anxiety groups. In fact, even when means are compared, it is shown that recognition of facial emotional expression seems to be random in regards to a child's level of anxiety such as the amygdala. Thus, one cannot suggest that highly anxious children or children experiencing low levels of trait-anxiety show any degree of bias towards particular faces or category of faces such as positive and negative emotional expression.

When referring to the explanation of the hypervigilant theory, it is understood that children with high levels of anxiety experience continuous hyper activity of particular brain structures that deal with emotion processing and anxiety. It has been suggested that this hyper activity allows individuals suffering from anxiety to quickly detect minimal cues of facial emotional expression (Mogg, Millar, & Bradley, 2000). However, the present experiment's lack of significant findings may be a reflection on the mild severity of anxiety experienced by participants. For instance, Mogg, Millar and Bradley (2000) focused their research on individuals with clinically-diagnosed anxiety such as generalized anxiety disorder; whereas, the present study examined non-clinical anxiety. Therefore, it may be that the influence of the hypervigilant mode is more pertinent when dealing with individuals suffering from clinically severe anxiety.

Furthermore, the present study's results were not supported by Surcinelli et al. (2006) whose research showed that children with high levels of trait-anxiety were better able to recognize fearful facial expressions than the low anxiety groups. Even when comparing means, there is minimal difference in the intensity at which emotions are recognized. However, it was also shown that in regards to other emotions, children experiencing high and low levels of trait-anxiety did not differ in their ability to recognize other emotions, which supports the present study's finding. It was argued that children who experience higher levels of anxiety associate many daily situations as threatening, which elicits more fear for what may happen in the future. Thus, even though a fearful facial expression alone is not threatening, highly anxious individuals may perceive the expression as a signal of threat within an environment (Surcinelli et al., 2006).

The previous explanation seems highly plausible; however, associating an emotion with threat within one's environment may be reasoned in a different way that offers support for the

present study's results. If children with high levels of anxiety associate certain facial expressions with the level of threat within their environment, then it may be that when they first perceive danger they may have a tendency to orient their focus away from a face and towards their environment (Ladoucer et al., 2005). In other words, they are attending to potential danger within an environment rather than focusing on the threatening cue (facial image). Therefore, it may be that within the present study children with high levels of anxiety may not have recognized facial expressions at lower intensities in comparison to children with low levels of anxiety because once first detecting a signal of threat they may have shifted their attention away from the task at hand and towards other stimuli, distracting them from accurately responding to the task. If this phenomenon occurred, then participants may not have accurately reported when they noticed a particular emotional expression.

The differences in results between Surcinelli et al. (2006) and the present study may also be due to differences in methodology. For instance, their study involved 80 participants; whereas, the present study only included 37 participants. In regards to statistical power, the present study is lacking. Cooper, Rowe and Penton-Voak (2007) show agreement with the influence various sample sizes may have on the results of these particular studies. They performed the same experiment as Surcinelli et al. (2006) and found no correlation between levels of anxiety and ability to recognize facial emotional expressions with the use of 102 participants. Additionally, because the results of the present study's Experiment 1 closely resemble those of Cooper, Rowe and Penton-Voak (2007), even with a small sample size, it may be argued that another factor other than sample size may have influenced Surcinelli et al.'s (2006) findings. Additionally, the results of Experiment 1 showed some differences in emotion

recognition between anxiety groups. Therefore, had the sample size of the present study been larger then, results may have been found to be statistically significant.

In summary, the hypothesized difference in facial emotional expression recognition between children experiencing high and low levels of trait-anxiety may not hold relevance with the hypervigilant theory. Further research may be beneficial that examines both clinically and non-clinically anxious individuals, possibly allowing investigators to gain an understanding of the severity at which a person's anxiety must be in order to be influenced by persistent hypervigilant brain activity. Furthermore, changes in the methodology of Experiment 1 may increase not only the study's validity but also the reliability. The sample was not widely diverse and also included a small sample size, jeopardizing the power of the study. Nonetheless, standardization of methods between studies must be initiated in order to approach an elimination of inconsistency demonstrated by results dealing with the effects of anxiety on facial emotion recognition.

Experiment 2: Positive versus Negative Emotion Attention

Experiment 2 investigated possible effects of trait-anxiety on a child's tendency to attend to either positive (happy and surprise) or negative (disgust, sadness, anger and fear) facial emotional expressions. Current literature offers numerous theories and explanations for the relationship of the previous factors. However, as seen in research investigating effects of trait-anxiety on children's ability to recognize facial emotions, the following review of studies dealing with the construct on Experiment 2 will exhibit several inconsistencies. A topic of particular interest deals with the importance of anxiety degree on one's bias towards a particular type of facial emotion stimuli. For instance, several investigations offer insight about findings in regard to clinically versus non-clinically anxious people. It is likely that only clinically severe anxious

individuals exhibit significant attention bias; however, this finding is not certain and therefore, will be further investigated with Experiment 2. Furthermore, the following will also discuss facial emotion stimuli that may be more highly attended to by individuals experiencing high levels of trait-anxiety than individuals experiencing low levels of trait-anxiety.

Reinforcement of anxiety by a non-relieving hypervigilant mode has not been associated with individuals suffering from depressive disorders despite symptom similarities to anxiety disorders. For example, individuals suffering from generalized anxiety disorder tend to focus their attention towards threatening facial expressions more often than individuals with depressive disorder, even though anxiety plays a role in both disorders (Mogg, Millar, & Bradly, 2000). The lack of relationship between depressive disorder and a reinforcement of anxiety is troublesome because both depressive and anxiety disorders are characterized by high levels of anxiety (Ladouceur, Dahl, Williamson, Birmaher, Ryan, & Casey, 2005; Mogg, Millar, & Bradly, 2000). Thus, it may be argued that anxiety may not be a factor causing anxious individuals' tendency to frequently attend to threat.

Despite the preceding argument against effects of anxiety on emotion attention, it is probable that depressed individuals may not attend as frequently or strongly towards threatening stimuli as anxious individuals because of their tendency to avoid social situations; rather than a lack of effect of anxiety symptoms. Thus, a person suffering from a depressive disorder may be less likely to encounter stimuli that elicit a hypervigilant mode of brain functioning, such as minimal expressions associated with threat. On the other hand, Surcinelli and colleagues (2006) argue that an anxious person's advanced ability to indentify minor expressions of threat may be a cause of their oversensitivity to threat; however, depressed individuals do not typically show

increased identification ability for threatening stimuli, even though it has been claimed that depressed individuals also show evidence of hypervigilant activity.

Regardless, people suffering from clinical anxiety and major depression disorders do not show strong similarities in their portrayal of anxiety symptoms (Ladouceur, Dahl, Williamson, Birmaher, Ryan, & Casey, 2005). Therefore, it may be suggested that anxious and depressed patients experience anxiety differently, causing a difference in their attention towards emotional visual stimuli. For instance, individuals with generalized anxiety disorder not only focus on threatening cues more frequently than individuals with depressive disorders but they are also known to shift their eye-gaze more rapidly towards negative stimuli (Mogg, Millar, & Bradley, 2000). This pattern of threat-related attention has been observed during initial stages of stimuli detection. However, attention towards threatening stimuli has not been shown to persist; this finding may be due to the progression of cognitive processes past initial stages of perceptions, which is when hypervigilance is experienced. In other words, an anxious person's cognitive hyperactivity will diminish the longer a stimulus is presented and no negative consequences follow (Mogg, Millar, & Bradley, 2000). Nonetheless, it may be suggested that individuals diagnosed with depression may not experience as strongly a hypervigilant mode as individuals diagnosed with anxiety disorders.

However, even though it is possible for depressive-disorder patients to lack the symptom of persisting hypervigilance, they still show biases towards stimuli that are commonly associated with threat by individuals experiencing severe levels of anxiety. For instance, Ladoucer and collaborators (2005) discovered that when an insignificant stimulus is placed in front of a neutral or negative background, individuals suffering from major depression and comorbid anxiety-depression commonly disregard the insignificant stimuli and focus on the negative background.

In contrast, sufferers of clinical anxiety disorders have not shown to be significantly influenced by the presence of negative backgrounds; regardless, in comparison to neutral backgrounds they did exhibit slightly longer reactions times towards the negative rather than the neutral backgrounds (Ladouceur, 2005). Thus, the previous findings go against the assumption that highly anxious individuals attend readily to negative stimuli.

However, it is possible anxious individuals did not attend to negative backgrounds more frequently because of the insignificance of the stimuli placed in front of the background. For instance, if anxious participants did not perceive threat-related cues from the neutral stimulus, then they may not have felt urgency to attend to the background of the stimulus. In fact, it has been shown that lack of maintaining attention towards threat-related stimuli may be a result of an individual's shift of attention towards their surroundings, in search of possible danger (Jarros et al., 2012). Thus, if a stimulus does not exhibit threats alluding to possible danger then an anxious individual will likely lose interest in the stimuli and surroundings. Furthermore, these findings also suggest that the likelihood to attend towards negative stimuli is stronger when symptoms of both depression and anxiety disorders are experienced comorbidly, suggesting that factors of depression rather than anxiety moderate a relationship between facial emotion stimuli and attention.

Based on Martin, Williams and Clark's (1991) investigation of whether people suffering from anxiety show attention bias towards threat-related information or all emotional information, it may be surmised that distinctions between clinically anxious and non-clinically anxious individuals may be an influential factor in an anxious person's rate and frequency in recognizing emotional expression. For instance, non-clinical anxiety does not seem to influence a person's selective attention towards emotional information of a threatening suggestive quality, which

opposes studies examining clinically anxious populations (Mogg, Millar, & Bradley, 2000; Masten et al., 2008; Bozikas et al., 2009; Jarros et al., 2012). According to Martin and colleagues (1991), clinically anxious groups are more distressed by the experience of an emotional state than non-clinically anxious groups. This greater activation of certain emotional states in clinically anxious people may cause them to perceive themselves in continuous danger when compared to non-clinical individuals responding to the same threatening stimuli.

There may be several factors influencing the previous distinction between non-clinically anxious individuals and clinically anxious individuals. In fact, Fox (2002) suggests that emotion type, the field of vision in which a stimulus is perceived and level of anxiety all influence a person's attention towards specific facial emotional cues. However, research investigating the previous factors strictly examines them in regards to non-clinically anxious populations. For instance, people suffering from high trait-anxiety are more influenced by fear than those who experience low trait-anxiety (Fox, 2002). In continuation, highly anxious groups have shown to be influenced more by facial expressions presented in their left visual field than facial images presented in their right visual field than those with low levels of anxiety. For instance, when a fearful stimulus has been presented in a person's left visual field they were highly attentive towards the stimulus opposed to when presented in the right visual field. On the other hand, when the fearful face was replaced with a happy face, the stimulus was avoided by highly anxious participants (Fox, 2002).

It is likely that there is a right hemispheric bias towards negative emotions, rather than all emotional stimuli and seems only to be evident in high trait-anxiety participants in comparison to non-anxious individuals. Since this cognitive bias is only observed by anxious individuals, one may argue that heightened activation of negative emotion processing occurs within the right

hemispheric sphere, supporting the hypervigilant theory. Nonetheless, it may be proposed that the right hemisphere is where negative emotions are generally processed and therefore, with or without high levels of anxiety, enhances a person's ability to respond to fear when viewed in the left visual field.

Bishop, Duncan and Lawrence (2004) support the tendency for anxious people to attend more rigorously to fearful faces rather than happy faces; however, they do not support the theory of a hemispheric bias in one's emotion perception. Regardless, it is evident that the amygdala of highly anxious individuals show enhanced activation in response to fearful faces when presented out of spatial awareness. Thus, cognitive processing of anxious individuals may likely present a general enhanced activation despite whether the fearful stimuli are perceived in the left or right visual field. However, supporting Fox (2002), spatial attention deems importance by a reduced amygdala response in less severely anxious individuals when fearful faces fall outside their spatial awareness, which does not seem to be evident in individuals experiencing high levels of anxiety.

In response to the previous explanations, the present study hypothesized that children demonstrating high levels of trait-anxiety will attend more frequently towards negative facial images such as, fear, anger, disgust and sadness than positive emotions such as happiness and surprise. As evident in Experiment 1, evidence for a relationship between anxiety and attention bias is inconsistent. Thus, Experiment 2 examines the possibility of a correlation. However, as mentioned previously, the mildness of trait-anxiety may not be strong enough to provoke a relationship between anxiety and emotion perception. Regardless, the following experiment may offer insight about the effects of trait-anxiety on emotion attention.

Method

Participants

The same children from Experiment 1 also participated in Experiment 2.

Procedure

Participants were removed from their classroom for approximately ten minutes to view female facial emotion expressions. Children were asked to sit in a chair placed approximately 18 inches away from a Toshiba, Satellite (17 inch) laptop computer screen. At arrival, the computer screen was completely black. After participants demonstrated an understanding of the researcher's instructions, a series of slides were presented that display pairs of facial images, each portraying one specific and different facial emotion (i.e., happiness, sadness, fear, anger, surprise and disgust) (See Appendix C). After ten seconds, the facial images were removed from perception and were replaced with a black screen. After three seconds, a white dot probe appeared in place of one facial images was previously displayed. Once again, the child was asked to look at the screen for the duration of ten seconds. The previous steps were repeated 40 times, each displaying a new pair of facial images. After the children viewed all 40 slides, or when expressing discomfort, they were excused from the testing area and returned to their classroom.

A camera on top of the computer screen recorded the children's eye-movements in relation to the images on the screen. Once completing the task, each child's video of recorded eye movements was analyzed. Specifically, the length at which the child focused on a certain stimuli was timed in seconds using a stopwatch. The stimuli a child attended to and the length of time at which the child spent looking at a stimulus was recorded. Manual recording of the participants' attention made it difficult to acquired precise lengths of time attending to a

particular facial emotion expression. For instance, when timing each participant's attention, the video of a child's eye movements played and had to be stopped simultaneously with a stopwatch every time participant moved their eyes to a different stimulus. This allowed the investigator to write down the time at which the child stopped paying attention to a stimulus and started paying attention to a different stimulus. After recording time spent focusing on particular facial expression, a calculator was used to determine the total time each participant spent looking at negative versus positive facial emotion expressions.

Materials

Facial emotion stimuli consisted of six facial images from Young, Perrett, Calder, Prengelmyer and Ekman's (2002) FEEST program, each representing a different emotional expression (happiness, sadness, fearful, angry, surprise and disgust). Images were shown at a 100% intensity level and were presented using the program, PowerPoint.

Results

Experiment 2 used a 2x2 experimental design, involving level of trait-anxiety and positive versus negative facial expressions. Participants were exposed to one condition in which type of facial expression was the independent variable. They viewed either negative facial expressions (sad, angry, disgust and fear) or positive facial expressions (happy and surprise). In regards to the dependent variable, participants were divided into two groups based on whether they demonstrated a high level of anxiety or a low level of trait-anxiety. All participants were exposed to this condition and were assigned to anxiety groups based on their RCMAS-2 total score.

The length of time at which a child spent attending to the white dot-probes and the area of the slide corresponding to the white dot screen were recorded; however, this data was not

included in the final data analysis. It was determined that these slides did not add to the information needed in order to discover whether or not there was a relationship between level of trait-anxiety and facial emotion attention. Thus, recorded times for negative facial emotional information were totaled, resulting in an overall length of time a participant spend observing negative facial emotions. The same procedure was done for positive facial emotion expressions. These steps allowed for the investigator to determine which type of facial emotion expressions participants spent longer observing (negative or positive). The previous modification also reduced the cumbersomeness of the tedious calculations needed when including both probe slides and facial image slides.

The results of Experiment 1 were examined using an independent-samples t test, comparing the means between duration of attention towards negative facial expressions (sad, angry, disgust and fear) and positive facial expressions (happy and surprise) in regards to level of trait-anxiety. The alpha was set at .05. Effect size was determined by using Cohen's *d*. An ANOVA was not used for this experiment's analysis because of the correlation between viewing positive and negative facial expressions. For instance, if a participant spent more time looking at a negative face, then they would undoubtedly spend less time focusing on a positive face because each set of facial images were shown for a specific duration.

The present study hypothesized that children experiencing high levels of trait anxiety would more frequently attend to negative facial expression (disgust, sadness, fear and anger) than positive facial expressions (happiness and surprise) in comparison to children experiencing low levels of trait-anxiety. An independent-samples t test shows that the difference in attention towards positive facial expressions between highly anxious children (N = 19, M = 19.70, SD = 3.51) and children suffering from less severe anxiety (N = 18, M = 14.71, SD = 6.12) is

statistically significant and a calculation of Cohen's d shows a large effect size, t (35) = -3.06, p = .004, d = 1.03. Thus, children with high levels of trait-anxiety focused more frequently on positive facial expression than negative facial expression compared to children suffering from low levels of trait-anxiety. Despite the contradiction that this result exhibits in relation to the previous hypothesis, the analysis still shows a significant relationship between a child's level of anxiety and their likelihood to attend to either positive or negative facial expressions. Furthermore, the effect size of the difference between anxiety groups attention towards negative facial cues is quite large (d = 1.03); thus, anxiety plays an important role in the determinacy of which stimuli children suffering from low or high trait-anxiety will focus their attention more frequently.

In contrast, the analysis shows that the difference in attention towards negative facial expressions between children suffering from high levels of anxiety (N = 19, M = 18.32, SD = 3.83) versus children suffering from low levels of anxiety (N = 18, M = 20.21, SD = 7.86) is not statistically significant and demonstrates a small effect size, t (35) = .93, p = .357, d = .31. Thus, this result does not support the hypothesis that children suffering from high levels of anxiety will attend more frequently towards negative facial stimuli. However, even though this analysis does not show significance, the results still show some difference in facial emotion attention between anxiety groups (high anxiety, M = 18.32; low anxiety, M = 20.21). Thus, children with high levels of anxiety slightly paid less attention to negative facial expressions versus positive facial expressions and children with low levels of anxiety paid more attention to the negative facial stimuli.

Discussion

Experiment 2 investigated the effects of trait-anxiety on children's likelihood to attend more frequently towards either negative (disgust, sadness, fear and anger) or positive (happiness and surprise) facial emotion expressions. The present study hypothesized that children suffering from high levels of trait-anxiety would spend more time focusing on negative facial emotion expressions than positive ones. However, results do not support the previous assumption. In fact, results show statistical significance for the inverse of the previous hypothesis. The high trait-anxiety group focused on positive facial emotion expressions longer than negative facial emotion expressions. On the other hand, even though mean scores demonstrated that children with low-levels of anxiety paid more attention towards negative facial expression, this result was not statistically significant.

Thus, trait-anxiety seems to be a determining factor in whether highly anxious individuals focus their attention more towards either positive or negative faces; whereas, the absence of high levels of anxiety does not predict which facial emotion category children experiencing low levels of trait-anxiety will orient their attention. In other words, the presence of high anxiety acts as the moderator between the perception of facial emotion expression and response outcome. A high degree of anxiety strengthens the relationship between perception and outcome. Thus, unless an individual is highly anxious, facial emotion attention will appear random.

However, it may also be that threatening cues elicited by negative facial emotion expressions may increase one's current level of anxiety, which may cause anxious groups to avoid further examination of a negative facial emotion (in order to prevent experiencing more anxiety related discomfort). Those with high anxiety may avoid negative stimuli by looking

away from presented negative facial emotion images, forcing participants to either focus on positive facial expressions or away from the computer screen. Furthermore, experience of increased anxiety after viewing negative facial emotional expression may have provoked children experiencing low levels of trait-anxiety to be more aware of information presented by the negative faces. In other words, the slight increase of anxiety in response to the task may have enhanced the low-anxiety group's perception of negative emotion, causing them to orient their attention towards the more novel information, rather than positive expressions that they commonly experience.

The hypervigilant theory may also offer support for the previous conjecture. Since hypervigilance affects early processing of facial information, it is likely that the length of time at which stimuli were presented caused children with high levels of trait-anxiety to become bored with the information presented by negative facial expressions. Early in perception, this group may have gained an understanding that threatening cues elicited by negative facial expression did not associate with any immediate danger within their environment and thus they lost interest in orienting towards negative emotions. On the other hand, children who experience low anxiety may have needed to focus longer on the negative facial expression in order to perceive the information gathered from the negative stimuli. By not having heightened brain activity, it is likely that the biology of participants with low anxiety needed to work harder at emitting energy to decode negative emotional expression.

In support of the experiment's finding that children experiencing high levels of trait-anxiety consistently oriented their attention towards a specific type of facial emotional expression, other studies have sound that individuals demonstrate different neural responses in the amygdala, insula and dorsal ACC when viewing negative versus positive faces in regards to

their level of trait-anxiety (Ball et. al., 2012). Thus, differences in processing positive and negative facial emotional stimuli provides evidence that children with anxiety may show biases in which type of stimuli they attend to most frequently. Ball and others (2012) found that highly anxious individuals spent more time viewing negative facial emotional expressions. However, their finding is not completely discrepant from the results of Experiment 2. As stated previously, participants of the present study may have spent more time focusing on positive faces because they were able to decode negative information more quickly based on the differential between the processing of negative versus positive facial emotional expressions.

Furthermore, it has also been shown that contextual stimuli play a role in anxious individuals' orientation towards facial stimuli. For instance, when an anxious person resides in a highly stress-provoking environment they are more likely to attend to negative facial expressions (Richards et al., 2002). In the present study, children completed Experiment 2's task within a calm environment, which did not present any abnormal stressors. Therefore, the high anxiety group may have been less likely to orient their attention towards negative stimuli. This rationale does not explain why children experiencing lower levels of anxiety spend slightly more time looking at negative facial expression; although, it may be that they were attending to the novelty of negative facial expression rather than threat the faces may have predicted.

However, Mogg, Millar and Bradley (2002) suggest that anxious individuals showed enhanced processing of not only negative emotions but also positive. Their analyses showed that highly anxious individuals initially focused their attention on negative facial expression when paired with a neutral face and also shifted their gaze towards negative facial emotional stimuli more rapidly. At first, Mogg, Millar and Bradley' (2002) study does not seem to support the findings of Experiment 2; however, researchers argue that highly anxious individuals may

initially direct their attention toward negative facial expressions but it has also been show that their attention does not consistently remain on negative facial expressions. Thus, highly anxious individuals may direct their attention towards negative stimuli before other non-negative stimuli and at a quicker rate but that does not mean they focus on the negative stimuli for a longer duration of time (Mogg, Millar & Bradley, 2000).

In summary, children suffering from high levels of trait-anxiety may spend more time focusing on positive faces rather than negative faces possibly due to the experience of hypervigilance, mood congruency (the effect of environment on one's response to anxiety) and the processing of negative and positive facial emotional cue using differing neural mechanisms. Therefore, there is evidence that supports the findings of the present study and that explains why highly anxious individuals do not show a bias towards focusing their attention on negative facial emotion. However, the present study may benefit from further investigation, exploring effects of trait-anxiety on children's attention towards facial emotion expression by using larger sample sizes and also a more efficient and precise way of determining length of time at which individuals spent looking at either positive or negative faces. Manually timing the length of time at which participants spent looking at a various area of a computer screen jeopardized the preciseness of the present study.

Experiment 3: Facial versus Vocal Emotion Attention

Experiment 3 examined which type of emotion information, facial or vocal, is most frequently attended to by children. Furthermore, it is also considered how levels of trait-anxiety affect a child's bias towards either facial or vocal emotion information. As made clear with the previous two studies, there is an abundant amount of research regarding various influential factors on facial emotion recognition and attention. However, it seems as though investigators

pay less attention to the perception of vocal emotion stimuli. Furthermore, as in facial emotion studies, the majority of research on vocal emotion recognition utilizes older populations and tends to touch minimally on children's ability to decipher vocal stimuli.

For instance, tasks determining an individual's response to various types of emotional expression have neglected to include participants of ages below 7-years-old (Nelson & Russell, 2011). Lack of investigation using young children is of concern because of the importance of vocal expression on children's social interactions. However, it has been found that emotional information is most effectively expressed visually, with the exception of fear, which is communicated more substantially through vocal intonation (Fenster, Blake, & Goldstein, 1977).

Regardless, from the earliest moments that an infant experiences life outside the mother's womb, they are exposed to numerous forms of emotional expression. They start to develop cognitively, allowing them to draw associations between emotion expression exhibited by facial expression, vocal intonation and body language and the environment in which they reside (Nelson & Russell, 2011). Thus, why does research rely heavily on children's recognition and attention towards facial emotions and not vocal emotion? Furthermore, there has been minimal research investigating which mode of emotional expression preschoolers respond most frequently towards (Nelson & Russell, 2011). Regardless, decreased ability in recognizing emotional expression through vocal intonation may emphasize developmental difference between avenues of emotional expression.

It may be argued that few studies have investigated young children's ability to perceive vocal and facial emotional expression because this age range tends to have trouble focusing on research tasks and because their undeveloped cognition prevents them from giving valid research results. In fact, Nelson and Russell (2011) argue that while preschoolers have shown adequate

performance in labeling emotions expressed by facial features or body postures, they show difficulties in recognizing vocal cues. For instance, young children inaccurately tend to characterize vocal stimuli as being angry or sad, which contrasts adult's enhanced ability to correctly label the majority of emotional expressions. The ability to accurately respond to vocal emotion seems to improve with age (Fenster, Blake, & Goldstein, 1977). In fact, developmental studies that investigate differences of emotion recognition between age groups support the previous claims. For example, children between the ages 7 and 9-years-old make more errors in emotion recognition than 10 to 12-year-olds. Similarly, Tonks et al. (2007) found that facial recognition errors decreased from 9 through 10-year-olds to older age groups.

Differences in vocal emotion recognition between children and adults emphasize children's immature cognitive development aiding in efficient processing of vocal emotional cues (Massaro & Egan, 1996). Therefore, it may be that presenting multiple types of emotional stimuli to children who are younger than 5-years-old will not heighten their ability to accurately recognize emotional expression as it does in adults. Adult's reaction times towards emotional expression have shown to increase when vocal and facial modes of expression were combined (Massaro & Egan, 1996). Nelson and Russell (2011) suggest that the incomplete development of children's neural structures may prevent them from being able to process multiple elements of emotional stimuli. Therefore, processing of facial features may prevent cognitive functions from attending to characteristics of vocal emotion.

On the other hand, Tonks et al. (2007) found that children accurately perceive vocal emotion and that children's vocal emotion recognition develops in response to vocal stimuli they commonly encounter within their environment. For instance, if a child frequently experiences angry voices, then they will likely be able to more rapidly and more accurately label vocal

expressions as angry. Additionally, when children begin being placed within situations that require them to better understand vocal emotional stimuli, their ability to recognize vocal emotional cues may result in progression of their cognitive development. For example, as children grow older they become involved in certain environments such as school that lead to regular social interaction. During these frequent interactions, comprehension of emotional information becomes crucial for sufficient social development (Masten et al., 2007). This explains findings that show substantial improvement of emotion recognition after 11 years of age. Therefore, it may be that when a child reaches age 11 they experience an increase in social interactions due to increased awareness of their peers, new environments (school and extracurricular activities) and the beginning of sexual and physiological development. Such experiences demand the brain to frequently process emotional information (Tonks et al., 2007).

In regards to differences in perception of specific emotions between older and younger age groups, adults tend to more accurately recognize fearful vocal cues than children (Fenster, Blake, & Goldstein, 1977). Despite children's impaired detection of fear, they were still able to communicate fear more accurately than older individuals. It is not clear why vocal emotion expression adequacy decreases with age and also exhibits a trend to the positive correlation found between age and recognition of emotional cues (Fenster, Blake, & Goldstein, 1977). It has been suggested that understanding vocal emotion does not require extensive learning but rather occurs in response to a predisposition of emotional expression recognition, which suggests that younger children should show adequate ability to recognize vocal emotion. Furthermore, regardless of age, negative emotional stimuli are better able to be detected in comparison to positive emotional expressions. This would indicate that negative emotional vocal expressions are more distinctive than positive ones. Identifying negative emotional information may also

pose evolutionary benefits, explaining an earlier development of the processing of sad, disgusted, angry and frightened expressions (Darwin, 1873, Fenster, Blake, & Goldstein, 1977).

In regards to Experiment 3, the present study hypothesized that children attend to a facial image of low intensity when presented next to a high intensity image when the less intense face is presented simultaneously with vocal intonation corresponding to the emotion being expressed by the less intense facial image. Furthermore, it was also predicted that children experiencing high levels of trait-anxiety attend to vocal emotional information more than intense facial emotion information.

Method

Participants

The same children from Experiment 1 and 2 participated in Experiment 3.

Procedure

Participants were removed from their classrooms for approximately ten minutes in order to observe female facial emotion expressions and vocal sentences. The participants sat approximately 18 inches away from a Toshiba, Satellite (17 inch) computer screen. The computer presented a black screen when each participant first approached the task. Once the child showed an understanding of the researcher's instructions, the black screen disappeared and was be replaced with a pair of facial images. Each pair was presented simultaneously with a vocal sentence. Each pair of images included a facial expression of the most intensity (100%) and a differing emotion of a low intensity (30%) (See Appendix D). The vocal sound portrayed a female voice relaying a meaningless sentence such as, "There are many different colors of paint; pink, purple, red, blue and many more.", "There are big trees and small trees that have different colored leaves during the fall.", "There are white clouds in the sky that cover the sun.",

"Libraries have many books for people to read.", "Toys are over there on the floor." and "We sit in chairs when we are at school during the day." that were expressed in the emotion of the less intense facial image. Participants were asked to observe the computer screen as each of the images and vocal sounds were presented for a length of five seconds. Between each portrayal of facial image pairs, a black screen appeared for the duration of one second. As children observed facial images, a computer camera recorded the participants' eye movements. Following task completion, the length of time at which a participant focused on a particular stimulus was recorded in seconds using a stopwatch. Then, the total time participants looked at the more intense facial emotion expressions was calculated and the same was done for the length of time in which participants spent looking at the less intense facial emotion expression paired with a corresponding vocal intonation.

Once the children viewed and listened to all facial and vocal stimuli, or expressed discomfort, they were excused from the testing area and returned to their classroom.

Materials

Both facial and vocal emotional stimuli were used. In regards to facial emotion images, 12 faces were used from Young, Perrett, Calder, Sprengelmyer and Ekman's (2002) program FEEST. These faces were of either 30% intensity or 100% intensity and were of the following six emotions, happiness, sadness, fearful, anger, disgust and surprise. Vocal stimuli consisted of six different sentences each portraying a different emotion (happiness, sadness, disgust, fearful, angry and surprise). These sentences were spoken by an undergraduate student who is active in theatre and were recorded by a 2 Edirol R-09 24-bit Wave/mp3 recorders. A script for each emotion was designed by the investigator for the student to recite into the recorder. Each

sentence was neutral and did not suggest any particular type of emotion. Then, an mp3 file of each sentence was incorporated into the PowerPoint that included visual stimuli.

Results

Experiment 3 used a 2x2 experimental design, including children's level of anxiety (high or low anxiety) and type of facial emotion expression (negative or positive). Participants were exposed to one condition in which type of facial expression and vocal inflection were the independent variable. They viewed facial expressions of 100% intensity paired with a 30% intensity facial expression that corresponded to a vocalized sentence. In regards to the dependent variable, the participants were divided into two groups based on whether they demonstrated a high level of anxiety or a low level of anxiety. All participants were exposed to this condition and were assigned to anxiety group based on their RCMAS-2 total score.

Results were examined using an independent-samples t test, comparing means of amount of time spent focusing on the most intense facial emotional cue versus the less intense facial emotional cue paired with a vocalized sentence inflecting the less intense face's emotion in regards to level of anxiety. The alpha was set at .05. Cohen's d was used in order to determine effect size. Once again, as with Experiment 2, an ANOVA was not used because of a correlation between negative and positive facial emotion expressions in the length of time spent attending to a particular facial expression. For instance, if a participant spent more time focusing on one type of facial emotion expression then they would have to spend less time focusing on the other type of facial emotion expression because participants had a fixed amount of time in which they could view facial images.

The analysis for Experiment 3 examined the difference in attention towards an intense facial expression versus a different facial expression of a lower intensity paired with a

corresponding vocal expression. This relationship was analyzed including and excluding the factor of anxiety. In other words, the study examined whether children in general (regardless of anxiety level) focused more frequently on an intense facial expression versus a facial expression of a lower intensity paired with a corresponding vocal expression and also if level of trait-anxiety predicts which type of emotion stimuli a child will attend more frequently. The present study hypothesized that children experiencing high levels of trait-anxiety attend more frequently towards less intense visual stimuli paired with corresponding vocal stimuli and children experiencing low levels of trait-anxiety will attend more frequently towards intense visual stimuli. Furthermore, the present study also hypothesized that, in general, children will attend more frequently towards vocal stimuli rather than visual stimuli.

An independent-samples t test shows that a difference in attention towards visual stimuli between children experiencing high levels of anxiety (N = 20, M = 123.17, SD = 30.52) and children experiencing low levels of anxiety (N = 17, M = 132.45, SD = 30.96) is not statistically significant, t (35) = 0.91, p = .366, d = 0.31. However, results show a slight difference between the two anxiety groups; children with low anxiety spent slightly more time focusing on the more intense visual stimuli rather than the less intense visual stimuli paired with a corresponding vocal stimuli. Therefore, looking at statistical trends, results support the present study's hypothesis that children with low levels of anxiety will attend more frequently towards more intense visual stimuli. Regardless, the results also show a low effect size, indicating that anxiety may not play a role in whether or not a child attends to facial emotional information or vocal information.

On the other hand, the analysis shows that a difference in attention towards vocal stimuli between children with high levels of anxiety (N = 20, M = 74.99, SD = 34.86) and children with low levels of anxiety (N = 17, M = 54.15, SD = 27.88) is statistically significant and shows a

large effect size, t (35) = -1.98, p = .05, d = 0.67. Thus, these results support the study's hypothesis that children with high levels of anxiety will attend more frequently towards intense facial expressions paired with a corresponding vocal stimulus. Furthermore, the moderate effect size offers more support by indicating that anxiety plays a role in a child's likelihood to focus more frequently on vocal stimuli.

When not considering each child's level of anxiety, an independent-samples t test shows that a difference in children's focus towards more intense facial stimuli (N = 37, M = 127.43, SD = 30.65) versus focus towards a less intense facial stimuli paired with a corresponding vocal stimuli (N = 37, M = 65.41, SD = 33.13) is statistically significant, t (36) = 12.01, p = .000, d = 4.00; t (36) = 25.28, p = .000, d = 8.43. Therefore, the preceding results do not support the study's hypothesis that children will attend more frequently towards vocal stimuli rather than facial stimuli but rather, children focused more on the visual stimuli.

Discussion

Experiment 3 examined whether or not children attended more to visual emotional stimuli or vocal emotional stimuli. Furthermore, it also looked at the effects of trait-anxiety on children's attention towards either vocal or visual stimuli. It was hypothesized that, in general, children focus their attention more on vocal rather than visual emotional stimuli. However, results do not support the previous hypothesis. In general, all participants focused their attention more on facial emotion stimuli rather than vocal emotion stimuli. In addition, when comparing the two anxiety groups, children experiencing a high level of trait-anxiety spent significantly more time attending to vocal stimuli rather than visual facial stimuli. On the other hand, even though not statistically significant, children experiencing a low level of trait anxiety spent a longer time focusing on facial stimuli rather than vocal stimuli.

Research shows that both vocal and visual stimuli are helpful when deciphering emotional information (Massaro & Egan, 1996). In fact, both visual and vocal emotional information have shown to aid a person in their ability to understand speech. Therefore, participants experiencing higher levels of trait-anxiety may have focused their attention towards the less intense visual stimuli paired with a corresponding vocal stimulus rather than a more intense visual stimuli because of the additional emotional information that was able to be gathered from two different types of emotional stimuli. It is likely that paying attention to both kinds of stimuli allowed an individual to more accurately and rapidly gain a better understanding of an emotion being expressed.

Furthermore, if a highly anxious person is able to detect visual emotional stimuli at lower intensities, then it would not be detrimental for them to pay more attention to a differing and more intense facial emotional stimuli placed next to a less extreme visual emotional stimulus that corresponds to a vocal stimulus in order to perceive a specific emotion. If fact, it may be argued that an individual who is able to detect emotions at low intensities would be presented with more emotional information when ignoring a more intense visual stimuli and focusing on the visual and vocal stimuli pairing. Thus evolutionarily, it would be more effective for an individual to focus on emotional information that enabled them to have the best understanding of potential environmental threats.

Massaro and Egan's (1996) results support the present study showing that visual stimuli were more influential than vocal stimuli when determining an emotion. Thus, this may explain why participants paid more attention towards visual emotional stimuli rather than vocal stimuli. However, Fenster, Blake and Goldstein (1977) explain that the majority of emotional expression is understood most accurately when presented visually, with the exceptions being fear and

anxiety. Thus, it may be that highly anxious children included in the present study may have attended more towards vocal stimuli because of the mood congruency theory. This theory explains that an individual may attend more readily towards emotional stimuli that are similar to the emotions they commonly experience. Thus, if fear and anxiety are more easily understood by vocal stimuli, then it is possible that highly anxious individuals have, from experience, learned this association and therefore are more likely to respond to vocal stimuli.

In summary, it is not certain whether visual or vocal stimuli offer the most information regarding emotion; however, it is known that both are significantly important in perceiving emotion. Thus, it may be argued that visual and vocal emotional information may be utilized differently by individuals of various anxiety groups. As shown by the present study, highly anxious children more frequently utilized vocal stimuli, while children experiencing less anxiety more frequently utilized visual stimuli. The previous finding cannot be certain and inconsistencies shown by various studies suggestions that this area needs to be further investigated, focusing to develop a method by which investigators are easily and precisely able to draw conclusions about the relationship between levels of trait-anxiety and visual versus vocal emotional stimuli.

General Discussion

The experiments reported previously offer some support to the idea that a child's level of trait-anxiety effects their recognition and attention towards visual and auditory emotional stimuli. Experiment 1 did not show a significant effect of trait-anxiety on a child's ability to recognize facial emotion expressions at various intensities. In fact, the analysis shows that anger was the only emotion in which a statistical significance was approached. However, even if significance had been reached it would not have supported the study's hypothesis that children experiencing a

high level of trait-anxiety recognize facial emotion expressions at lower intensities. It fact, it would support the opposite, inferring that children experiencing low levels of trait-anxiety recognize facial emotion expressions at lower intensities. In Experiment 2, a child's experience of high trait-anxiety showed a significant effect of their attention towards a particular type of facial emotion expression (positive or negative). However, results demonstrate the opposite trend of Experiment 2's hypothesis that children with high levels of trait-anxiety will attend more frequently to negative facial emotion expressions. Children experiencing high levels of trait-anxiety spend more time looking at positive facial expressions than negative facial expressions. Furthermore, low levels of trait-anxiety did not show a significant effect on children attention towards a particular facial emotion expression type. However, results approached significance, suggesting that children experiencing low levels of trait-anxiety spend more time looking at negative facial emotion expressions. Experiment 3 supported the hypothesis that children experiencing high levels of trait-anxiety attend more frequently to vocal emotion expression rather than visual emotion expression. On the other hand, Experiment 3 did not support the hypothesis that children, in general, attend more regularly to vocal emotion stimuli.

The results of the previous three experiments are not entirely what were expected; however, they are also not surprising when referring to the numerous inconsistent results presented in literature. Based on specific theories that are mentioned previously, it is difficult to know for certain why results turned out the way they did. For instance, the hypervigilant theory is quite convincing in its explanation of why people experiencing high levels of anxiety may show an enhanced ability to recognize facial emotion expressions. Furthermore, the emotion congruency theory explains that individuals experiencing a certain emotion such as anxiety will be more likely to attend to negative facial emotion expressions that demonstrate similar

characteristics to anxiety. Then, in regards to vocal versus visual stimuli one may assume that, in general, children would attend to the less intense facial image paired with a corresponding vocal intonation because this condition provided more information for emotion processing. However, this was not the case. So, why did the present study find these results? What factors play a role in children's visual and vocal emotion recognition and attention? For these questions to be answer, future research must be conducted that examines factors that have not already been studied prevalently. It is likely that research continues to present inconsistent results because the factors that are being studied may not be the actual cause of impairment or enhancement in an individual's emotion perception. However, it is important to note that across all experiments of the present study, there is some evidence supporting that anxiety plays a role in emotion perception.

The area of psychology dealing with emotion would benefit from further research dealing with children's anxiety and their ability to recognize and attend to vocal and visual emotional information. Due to limited funding and resources, many of the results reported in the present study are not precise. This research would benefit from the use of eye-tracking devices, making accurate and precise measurements of where a child is orienting their attention. Furthermore, the present study would also benefit from an incorporation of more participants. Based on the context of this research, gaining a large sample of child participants was difficult and therefore, caused statistical power to be jeopardized. Furthermore, the present study does not include a diverse sample of individuals, including children of similar ethnical, racial and socioeconomically backgrounds. By including a more diverse sample, the study's application to the general population would increase.

The previous research could be used in the development of new methods for detecting children's anxiety symptoms and also in the development of programs that help anxious children learn appropriate social skills. Social training programs could help children learn how to cope with their symptoms of anxiety and also increase the level of confidence during social interactions. It may be that social dysfunction caused by anxiety may be easily avoided and thus hold significant relevance in child development. The prevention of social dysfunction caused by emotion recognition and attention impairment has the potential to save children from living a life revolved around social avoidance and ridicule.

The ability to process emotional information, whether it is vocal or visual, may be commonly taken for granted. It is likely that few individuals frequently spend several minutes or hours wondering about the formation of their friend's lips that they observed moments ago or wonder why a passing stranger's mouth corners were pointing down. This emotional processing is all done by miraculously complex brain systems that work automatically and, at times, in our subconscious. From the time a human is born, their brain will form a close relationship with the emotional stimuli that radiates from numerous sources. This relationship, if functioning adequately, will aid a person in their development; specifically, their social development.

With adequate functioning, a child will learn to interact with peers, friends, and family, teachers and etc. They will be able to gain an understanding of another individual's emotional or psychological state, making it possible for them to act appropriately within social situations. When a child experiences various types of brain trauma, physical or mental, their social functioning will likely deteriorate. However, less severe trauma such as daily stress (trait-anxiety) may, in some ways, hold more of a significant influence on a person's daily functioning because trait-anxiety is experienced by all human beings. It is likely that many individuals

suffering from high levels of trait-anxiety go unnoticed. This phenomenon may be particularly evident among young children due to a common belief that children experience minimal stress. Furthermore, how easy is it for a 4-year-old child to express to an adult that they are feeling anxious? In fact, many children are unaware of the meaning of anxiety. Thus, it is up to empirical evidence to gain awareness of child anxiety and prevent permanent developmental deficiencies in children.

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Appendix A

Revised Children's Manifest Anxiety Scale: Second Edition (RCMAS-2) (Reynolds & Richmond, 2008).

Questions 12, 15, 27, 31, 44, 45, 47 and 49 were omitted

Children were instructed to respond with "yes" or "no"

1. Often I feel sick to my stomach.
2. I am nervous.
3. I often worry about something bad happening to me.
4. I fear other kids will laugh at me in class.
5. I have too many headaches.
6. I worry that others do not like me.
7. I wake up scared sometimes.
8. I get nervous around people.
9. I feel someone will tell me I do things the wrong way.
10. I fear other people will laugh at me.
11. I have trouble making up my mind.
12. I get nervous when things do not go the right way for me.
13. Others seem to do things easier than I can.
14. I like everyone I know.
15. Often I have trouble catching my breath.
16. I worry a lot of the time.
17. I feel bad if people laugh at me.
18. I am afraid of a lot of things.

19. I am always kind.

20. I get mad easily.

21. I worry about what my parents will say to me.

22. I feel that others do not like the way I do things.

23. I am afraid to give a talk to my class.

24. I always have good manners.

25. It is hard for me to get to sleep at night.

26. I worry about what other people think about me.

27. I feel alone even when there are people with me.

28. I get teased at school.

29. I am always good.

30. My feelings get hurt easily.

31. My hands feel sweaty

32. I worry about making mistakes in front of people.

33. I am always nice to everyone.

34. I am tired a lot.

35. I worry about what is going to happen.

36. Other people are happier than I am.

37. I am afraid to speak up in a group.

38. I tell the truth every single time.

39. I have bad dreams.

40. I get angry sometimes.

41. I worry about being called on in class.

42. I worry when I go to bed at night.

43. It is hard for me to keep my mind on my schoolwork.

44. I sometimes say things I should not say.

45. I worry about someone beating me up.

46. I wiggle in my seat a lot.

47. A lot of people are against me.

48. I have told a lie.

49. I worry about saying something dumb.

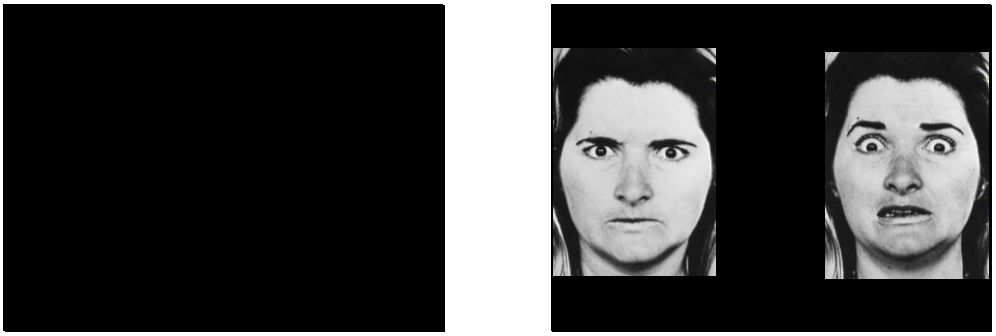
Appendix B

Positive versus Negative Facial Emotion Attention

PowerPoint Sample (Slides 1-10, out of 1-42)

(Young, Perrett, Calder, Sprengelmyer & Ekman, 2002)

Slide 1

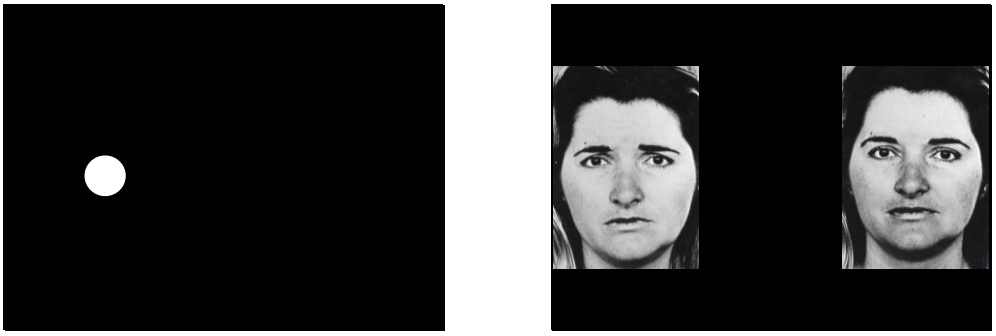


Slide 3

Slide 5

Slide 7

Slide 9



Appendix C

Facial Emotion Recognition

PowerPoint Sample (Slides 1-10, out of 1-55)

(Young, Perrett, Calder, Sprengelmyer & Ekman, 2002)

Slide 1

Slide 3

Slide 5

Slide 7

Slide 9

Appendix D

Facial versus Vocal Emotion Attention

PowerPoint Sample (Slides 1-9, out of 1-62)

(Young, Perrett, Calder, Sprengelmyer & Ekman, 2002)

Slide 1

Slide 3

Slide 5

Slide 7

Slide 9