Emotion Recognition in Children with Anxiety Disorders:
Effects of Age, Subtype, and Gender

By

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Abstract

Objectives: It is unclear whether anxiety disorders are associated with children’s ability to recognize emotions. To elucidate this relationship, the effects of age, subtype, and gender were examined, which have been neglected in past studies. Methods: Sixty-three anxious children and 59 non-anxious children identified various emotions displayed by an animated character. Children also completed questionnaires measuring state anxiety and depressive/anxiety symptoms. Results: Anxious children generally did not have difficulty identifying emotions compared with non-anxious children. However, children with separation anxiety disorder (SAD) and young children with generalized anxiety disorder (GAD) showed difficulty. Gender played a minimal role in emotion recognition, but anxious girls were less accurate in recognizing disgust when compared with anxious boys and non-anxious girls. Conclusion: Anxious children as a group may not exhibit difficulty in emotion recognition. When age and subtype factors are considered, however, children with SAD and young children with GAD exhibit some deficits.
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Chapter One

General Introduction
General Organization of Thesis

My thesis begins with a chapter of general introduction (Chapter 1). In this chapter, published scholarly articles and textbook chapters are reviewed to frame my thesis with reference to the history of the present research questions, while explaining important terminology, concepts, and gaps in knowledge in this area of research. This chapter further describes the importance of investigating the ability to correctly recognize others’ emotional states in children with anxiety disorders, and addresses some of the methodological issues in measuring emotion recognition skill in young children. Lastly, the chapter ends with the main study aims and hypotheses.

Chapters 2 and 3 are the main studies of my thesis, and are presented as scientific journal manuscripts for submission. Chapter 2 is based on my first journal manuscript “Effects of Age and Subtype on Emotional Recognition in Children with Anxiety Disorders”, which was accepted in November of 2012 for publication in Canadian Journal of Psychiatry. This chapter examines if children with anxiety disorders are impaired in their ability to identify others’ emotional states, and if children with certain types of primary anxiety disorder are more impaired than children with other types of anxiety disorder or without anxiety disorder.

Chapter 3 is my second journal manuscript “Effect of Gender on Emotion Recognition Accuracy in Children with Anxiety Disorders: Disgust Recognition Implicated”, which was prepared as a brief report. This chapter examines if gender significantly predicts emotion recognition accuracy in children with anxiety disorders.
Chapter 4 contains additional exploratory analyses that delve into the potential effects of state anxiety, task completion time, depressive symptoms, and anxiety symptoms on emotion recognition accuracy in children with and without anxiety disorders.

Chapter 5 is a general discussion section that summarizes significant findings of the present study, while comparing them to the original hypotheses. Then, the chapter discusses clinical implications and the limitations of the present study. A general conclusion is briefly stated, and finally, my thesis ends with Chapter 6, a description of future directions for this research.

Because my thesis work is organized as a set of self-contained chapters that all examine emotion recognition accuracy in children with anxiety disorders using common methods, some degree of repetition was inevitable. Tables and figures are displayed at the end of each chapter, and all references are placed at the end of this thesis.
Introduction

The ability to correctly identify the emotional states of others plays a pivotal role in interpersonal relationships. Proficiency in this emotional skill may have also served as an adaptive trait in human evolution. For example, accurate recognition of others’ anger or disgust would allow the observer to avoid confrontation or poisons/contaminants, leading to better chance of survival. On the other hand, impairment in this skill may diminish experiences in everyday lives. Not surprisingly, impaired recognition of emotions is reported in various mental disorders.

Children with anxiety disorders have difficulties in social and emotional functioning. These observations raise the question of whether these children are impaired in the ability to recognize the emotional states of others. However, there is a paucity of research on this issue, and the available past studies have shown inconsistent results. Answering this question may allow scientists to better understand the nature of anxious children’s emotional development and social difficulties.

Further, investigating emotion recognition in anxious children may have implications for current psychotherapies for childhood anxiety disorders. For example, the traditional anxiety-focused psychotherapy focuses on the reduction of anxiety symptoms via changing thinking and behavioural patterns, and regulation of emotions. However, efficacy of the psychotherapy might improve if equal emphasis were placed on improving emotion-related skills in children with anxiety disorders. For this reason, researchers developed a new emotion-focused psychotherapy which involves more sessions to discuss emotions that anxious children may have difficulty understanding and regulating. Examining emotion
recognition in anxious children would inform psychotherapy and elucidate when and whether emotion-focused psychotherapy may be more beneficial.

The present study aims to elucidate the relationship between anxiety disorders and children’s ability to recognize others’ emotions. In this thesis, I highlight the effects of age, subtype, and gender on emotion recognition in anxious children. Paying attention to these factors may lead to novel findings in this field of research, relevant to better understanding and treating anxious children’s emotional development.

**Non-pathological Anxiety in Children**

Anxiety or worry is characterized by a diffuse sense of apprehension and unpleasant thoughts (e.g. anticipation of harm) that are accompanied by autonomic symptoms (e.g. heart palpitations, muscle tension, stomach pain) and avoidance behaviour (Barlow, 1988; Lang, 1968). Transient anxiety is a normal response to threats or dangerous situations, and this fleeting condition effectively triggers defensive fight-or-flight responses (Ohman, 1993). These defensive reactions help individuals protect themselves from the negative emotional states or physical dangers associated with the acute stressors (Ohman, 1993). Further, this passing, non-pathological anxiety also motivates individuals to be vigilant about potential threats and to avoid confrontation of these aversive stimuli by anticipating them (Barlow, 2000).

According to social-cognitive theory, the state of anxiety transpires when a person’s perception of threat or danger outweighs self-efficacy of coping such that lower perceived self-efficacy compared with harmful aspects of an aversive event will result in anxiety arousal (Barlow, 2000; Bandura, 1986; 1988, Marks, 1977). In this sense, the same
potentially harmful stimulus or event may cause anxiety arousal in some individuals, but may not in others based on their perception of self-efficacy of coping.

Non-pathological anxiety or worry is very common in school-age children. For example, about 70% of school-age children are mildly anxious or worried about everyday life (Muris, Meesters, Merckelbach, Sermon, & Zwakhalen, 1998; Silverman et al., 1995). Mothers of approximately 43% of school-age children report that their children undergo seven or more mild worries and fears, often including separation concerns (Bell-Dolan, Last, & Strauss, 1990; Lapouse & Monk, 1964).

Although the theme of anxiety or worry in school-age children often changes during the course of development (Albano, Chorpita, & Barlow, 2003; Bauer, 1976), the most common themes of anxiety in children relate to academic performance, physical health, dying, and interpersonal relationships (Muris et al., 1998). Such anxiety-generating thoughts can occur as early as five years, and these thoughts tend to be more frequent and more complex in content at 8 years or above (Vasey, 1993). The age-related increase in the frequency and complexity of anxious thoughts in school-age children may reflect their development in cognitive skills, such as their ability to anticipate threatening outcomes and to elaborate negative implications from these outcomes (Magnusson, 1985; Vasey, Crnic, & Carter, 1994). In most cases, anxiety or worry in children is seen as non-pathological because their anxious feelings do not lead to significant impairment and distress and subside when the anxiety-provoking stimulus is no longer present or out of sight. Further, the amount of anxiety children experience is reasonable to the circumstances and in proportion to the actual threat (Wagner, 2002, pp. 22).

Pathological Anxiety in Children
Non-pathological anxiety or worry can become pathological and maladaptive when a child’s anxiety or worry is excessive (i.e. out of proportion to the actual threats), pervasive, recurrent or chronic, and if anxiety interferes with normal functioning, learning and concentration. In such case, a child may be diagnosed with an anxiety disorder (American Psychiatric Association, 2000). The onset of anxiety disorder may be sudden, sometimes within a few hours, or gradual, often taking weeks, months, or years (Angst & Vollrath, 1991).

Anxiety disorders are among the most prevalent psychiatric disorders of childhood and adolescence (Anderson, 1994; Bernstein & Borchardt, 1991). However, the exact prevalence rate of childhood anxiety disorders is unclear as the number varies significantly across different epidemiologic studies (Cartwright-Hatton, McNicol, & Doubleday, 2006). It is estimated that approximately 5-15% of the general population has some type of anxiety disorder during childhood (Klein & Pine, 2002). The most conservative point prevalence in the literature indicates that at least 3% of children and adolescents are affected (Ford, Goodman, & Meltzer, 2003), attesting to the high prevalence of childhood anxiety disorders.

Pathological symptoms of anxiety disorders can be a salient feature in a multitude of psychiatric and mood disorders in children. For example, about 16% to 62% of children and adolescents with depression have comorbid anxiety disorders (Brady & Kendall, 1992). Anxiety disorders in children and adolescents also tend to be highly comorbid with each other (Craske & Waters, 2005), implying that a child diagnosed with one type of anxiety disorder is at increased risk for another type of anxiety disorder.

Types of Childhood Anxiety Disorders
Anxiety disorder in children and adolescents, similar to those in adults, may manifest in a number of distinct forms, including separation anxiety disorder (SAD), generalized anxiety disorder (GAD), social phobia (SP), specific phobia, obsessive-compulsive disorder (OCD), post-traumatic stress disorder (PTSD), and panic disorder (PD) (American Psychiatric Association, 2000). Among these different types of anxiety disorders in children, SAD is the only type that is specific to childhood (Ollendick & Schroeder, 2003, pp. 34).

**Separation anxiety disorder (SAD).**

SAD is among the most common types of anxiety disorders of childhood, affecting approximately 4.1% of school-age children (Shear, Jin, Ruscio, Walters, & Kessler, 2006). Children diagnosed with SAD are abnormally reactive to real or imagined separation from their parents or other attachment figures, and their distress is severe enough to interfere with normal functioning and development (Masi, Mucci, & Millepied, 2001). Childhood SAD is strongly associated with school-refusal behavior (Last & Strauss, 1990), which in turn significantly predicts inadequate relationships with peers and poor academic performance (Berg, Marks, McGuire & Lipsedge, 1974; Hersov, 1972). The onset of school-refusal in children diagnosed with SAD can begin as early as 8-9 years, and their age at psychiatric assessment is around 11-12 years (Last & Strauss, 1990).

Childhood SAD has been proposed as a major risk factor for the development of major depression (Lewinsohn et al., 2008) and certain types of anxiety disorders in adults, such as panic disorder (Battaglia et al., 1995; Lewinsohn et al., 2008) and agoraphobia in women (Zitrin & Ross, 1988). However, some recent longitudinal studies have argued against the link between childhood SAD and panic disorder in adults (Aschenbrand, Kendall, Webb, Safford, & Flannery-Schroeder, 2003), warranting further investigation in this regard.
**Generalized anxiety disorder (GAD).**

According to DSM-IV, a diagnosis of GAD can be made when a child is excessively anxious for more than six months, but the focus of anxiety is not on a specific event or stimulus (2000). These children tend to worry about a variety of issues (e.g. relationships, physical health, keeping schedules), and often exaggerate their concerns and the risks of situations (Hudson, Deveney, & Taylor, 2005). Symptomatology of GAD in children includes feelings of tension, apprehension, need for reassurance, irritability, negative self-perception (Masi, Mucci, Favilla, Romano, & Poli, 1999), and one or more chronic physiological symptoms (e.g. stomach ache, sleep disturbance, restless, impaired concentration on tasks) (Kendall & Pimentel, 2003). Children with GAD present a more frequent need for reassurance than adolescents with GAD, whereas adolescents with GAD tend to brood more frequently than children with GAD (Masi et al., 1999). The prevalence rate of GAD in school-age children is estimated to be 5% (Shear et al., 2006), and the onset is about 9 to 10 years (Last, Perrin, Hersen, & Kazdin, 1992). GAD in children is usually comorbid with other type(s) of anxiety disorders or mood disorders, and this comorbidity often limits our understanding of pure childhood GAD (Hudson et al., 2005).

**Social phobia (SP).**

Children living with SP (or social anxiety disorder) experience persistent and extreme fear of being judged negatively in social situations, and are often concerned that others will notice their anxiety symptoms in social settings (American Psychiatric Association, 2000; Heckelman & Schneier, 1995, pp. 3). As a result, SP presents as the second most frequent anxiety subtype in children and adolescents who refuse to go to school (Last & Strauss,
1990), and is also often comorbid with other types of anxiety disorder, such as GAD (Francis, Last, & Strauss, 1992).

The SP syndrome can be diagnosed in school-age children (Biedel & Turner, 1998), and symptoms resemble those in adults (e.g. fear of speaking/reading/writing in public, informal social activities) (Beidel, Turner, & Morris, 1999). Psychopathologies of SP in children manifest as heightened emotional responsiveness, social inhibition or shyness, dysphoria, loneliness, distress, and maladaptive coping (Beidel et al., 1999).

**Obsessive-compulsive disorder (OCD).**

The concept of OCD involves both the cognitive feature of obsessions and the behavioural feature of compulsions. An obsession is “an intrusive, repetitive thought, image, or impulse that is unacceptable or unwanted and gives rise to subjective resistance” (Rachman & Shafran, 1998, pp. 51), whereas a compulsion is “a repetitive, stereotyped, intentional act” with an “experienced sense of pressure to act, and the attribution of this pressure to internal sources” (Rachman & Shafran, 1998, pp. 53-54). Compulsive behaviours and cognition are thought to help temporarily relieve or suppress obsessions, and these behaviours can be either overt (e.g. washing) or covert (e.g. counting, praying, neutralizing) in nature (March & Friesen, 1998, pp. 5).

The diagnostic criteria for OCD include obsessions or compulsions that cause significant distress, time consumption (spending more than an hour per day), or marked interference with the individual’s functioning (American Psychiatric Association, 2000). The most common themes of obsessions in children are fear of contamination, fear of harming self or others, and an excessive urge for symmetry or exactness, whereas the most common compulsions are excessive washing, checking, counting, repeating, touching and
straightening (March & Friesen, 1998, pp. 6; Swedo et al., 1989). The prevalence rates of OCD in children and adolescents have been found to be approximately 2-3% (Valleni-Basile, Garrison, Jackson, & Waller, 1994). About a half of adult OCD patients acquired their OCD during childhood (Rasmussen & Eisen, 1990)

**Post-traumatic stress disorder (PTSD).**

When a child directly experiences or observes a catastrophic event, which is life-threatening or involves serious injury, he/she may develop ongoing emotional and physical difficulties known as PTSD (American Academy of Child and Adolescent Psychiatry, 2010). Children experience PTSD through (1) repeated, persistent re-experiencing of the traumatic event (e.g. distressing memories, dreams, flashbacks), (2) emotional numbing and detachment (e.g. avoidance of thoughts and feelings about the traumatic event), and (3) hypervigilance and/or chronic arousal (e.g. always being on guard for the event to recur) (American Psychiatric Association, 2000). Additionally, children may express post-traumatic stress through hyperactivity, excessive fear, helplessness, horror, disorganized or agitated behaviour for more than one month (Fletcher, 2003, pp. 332; Kaminer, Seedat, & Stein, 2005). If these symptoms last for less than four weeks in duration, however, the child may be diagnosed with acute stress disorder instead of PTSD (Nolen-Hoeksema, 2007, pp. 193).

Due to the unpredictability of catastrophic or traumatic events, it is difficult to determine the range of prevalence of PTSD. In Canada, the lifetime prevalence of PTSD and current (one month) PTSD are estimated to be about 9.2% and 2.4%, respectively (Van Ameringen, Mancini, Patterson, & Boyle, 2008); however, there is a lack of systematic epidemiologic review in childhood PTSD. It is generally agreed that school-age children are
more susceptible to PTSD than adults exposed to a traumatic event as about 36% of traumatized children are diagnosed with PTSD, whereas about 24% of adults are diagnosed with PTSD following such events (Fletcher, 2003, pp. 332). Also, it seems evident that certain familial factors contribute to the risk of developing PTSD in children. For example, there is a strong correlation between parental PTSD and the likelihood of PTSD in offspring (Yehuda, Halligan, & Bierer, 2001).

**Specific phobia.**

Specific phobia refers to a pathological fear of specific objects or situations that are unrelated to social phobia or panic disorder (Albano et al., 2003, pp. 289-290). The DSM-IV lists four distinct subtypes of specific phobia: blood-injection-injury type (e.g. seeing blood), animal type (e.g. spiders), natural environmental type (e.g. heights), and situational type (e.g. closed spaces) (American Psychiatric Association, 2000). In childhood specific phobia, children’s anxiety symptoms are present for at least six months, and their phobic reactions are expressed as tantrums, crying, freezing, and clinging (Muris, Schmidt, & Merckelbach, 1999). Specific phobias in children are as common as 5% (lifetime prevalence), making them the most prevalent type of anxiety disorders in children (Costello & Angold, 1995, pp. 115).

**Panic disorder (PD).**

It is highly controversial whether panic attacks or panic disorder (PD) exist in children (Nelles & Barlow, 1988). One study used retrospective reports of adults diagnosed with panic disorder, and found a few cases of childhood PD (Klein, Mannuzza, Chapman, & Fyer, 1992). However, Abelson and Alessi (1992) questioned whether retrospectively
reviewed psychiatric status should be regarded as valid evidence for childhood PD (Abelson & Alessi, 1992), and the controversy seems to continue in the literature.

PD becomes more common during adolescence. According to a longitudinal epidemiologic study of psychiatric disorders within a representative sample of children and adolescents (Costello, Mustillo, Erkanli, Keeler, & Angold, 2003), prevalence of PD begins to increase at a moderate rate during adolescence and the disorder eventually becomes one of the most prevalent anxiety problems by middle adolescence.

Changes in Classification and Diagnostic Criteria for Childhood Anxiety Disorders in DSM-5

According to recent revisions in DSM-5 (American Psychiatric Association, 2012), one of the major changes in the classification of anxiety disorders is that OCD has been removed from the anxiety disorders category because the key feature of OCD is not often anxiety but rather the repertoire of intrusive obsessions and compulsive rituals (Stein et al., 2010). Alternatively, it is unknown to what extent anxiety is linked to obsessions and compulsions, and some researchers therefore argue that OCD should be included in a new category of OC-spectrum disorders or obsessive-compulsive-related disorders (OCRD), consistent with the classification system of the International Classification of Mental Disorders (ICD) (Hollander, Kim, & Zohar, 2007). It is expected that the new specification may allow clinicians to make more targeted diagnoses and screening.

There are also other minor changes within the category of anxiety disorders in DSM-5. First, the age of onset requirement has been dropped for the diagnosis of SAD, recognizing that SAD may occur in adulthood (American Psychiatric Association, 2013) and making the disorder no longer specific to childhood. In fact, an epidemiologic study (Shear,
Jin, Ruscio, Walters, & Kessler, 2006) showed that SAD in adults is very common condition, and that the majority of them have their first onsets in adulthood. Second, the ‘generalized’ specifier for social anxiety disorder (or SP) has disappeared, whereas the ‘performance only’ specifier has remained (American Psychiatric Association, 2013). Third selective mutism has been included in the anxiety disorders category because “a large majority of children with selective mutism are anxious” (American Psychiatric Association, 2013).

Scrutiny is mandated in the future for the effects of revised diagnostic criteria of GAD in DSM-5. For example, the test-retest reliability (i.e. extent to which clinicians agree on the same diagnosis) of the GAD diagnosis in DSM-5 is in the questionable range. This reliability has not improved from the field trial results based on the DSM-IV criteria for GAD (Regier et al., 2013).

**Consequences of Childhood Anxiety Disorders**

Anxiety disorders of childhood can cause various debilitating social and academic problems for affected children and their families (Donovan & Spence, 2000). Evidence shows that children with anxiety disorders have difficulty with social adjustment (Wood, 2006), peer relationships (Ginsberg, La Greca, & Silverman, 1998), academic performance (Van Ameringen, Mancini, & Farvolden, 2003; Wood, 2006), and school attendance (i.e. school refusal) (Atkinson, Quarrington, Cyr, & Atkinson, 1989; Last & Strauss, 1990).

These mental disorders of childhood often persist into later life, resulting in adult diagnoses of anxiety disorder (Last, Philips, & Statfield, 1987; Shear et al., 2006). The persistent pathological symptoms of anxiety disorders in adolescence or adulthood significantly predict a range of social and psychological/psychiatric long-term complications, including comorbid depression (Kovacs, Gatsonis, Paulauskas, & Richards, 1989),
vocational impairment (Koran, 2000), marital problems (McLeod, 1994), and substance abuse (Kushner, Sher, & Beitman, 1990; Woodward & Fergusson, 2001).

Given the high prevalence, a significantly increased risk for comorbid psychiatric disorders or conditions, and their emergence as a significant public health concern, early intervention for anxiety disorders in children is essential.

**Evidence-based Treatments for Childhood Anxiety Disorders**

Cognitive behavioral therapy (CBT) and serotonin-specific medication are the evidence-based treatment options for anxiety disorders in children. In terms of clinical outcomes, a combination of CBT with medication therapy is significantly superior to CBT or medication alone; however, each type of monotherapy is significantly more effective than placebo (Walkup et al., 2008). CBT is equally effective as medication therapy for reducing the anxiety symptoms, but generally causes significantly fewer adverse side effects than medication therapy in clinically anxious school-age children (Walkup et al., 2008). Consequently, many clinicians prefer CBT to medication as the first-line treatment in children with anxiety disorders.

**What is cognitive behavioural therapy?**

CBT is an evidence-informed psychotherapeutic approach that is used to treat symptoms of a range of mental health disorders by reducing dysfunctional emotions and behaviour through modifying cognitive patterns and contents (Sheldon, 1995, pp. 3). The primary goals of CBT for anxiety disorders in children are suppression and management of anxiety symptoms. However, recent clinical applications have broadened, emphasizing the need of improving their social and emotional skills (Mash, 2006, pp. 12).
The systematic procedures implicated in CBT integrate two distinct models of psychological/psychiatric disorders: the cognitive model and the behavioural model. These models are based on the shared assumption that prior learning may cause maladaptive consequences, and that intervention reduces dysfunctional emotions and behaviour by reversing the prior learning (Brewin, 1996). The cognitive model assumes that we react to life events via a combination of cognitive, emotional, motivational, and behavioural responses (Brewin, 1996; Corsini & Wedding, 2000, pp. 276), and a cognitive therapist would evaluate an individual’s irrational thinking patterns of causal attribution and treat them as the main target of treatment (Beck, 1976). On the other hand, behavioural modification focuses on extinguishing an undesirable behaviour by replacing with a desirable behaviour through contingency learning (Brewin, 1996), visualized or real exposure to anxiety-generating objects or situations (i.e. gradual desensitization), and relaxation training (Suveg, Kendall, Comer, & Robin, 2006).

**Cognitive behavioural therapy for childhood anxiety disorders and its efficacy.**

CBT is effective in the treatment of all types of anxiety disorders in adults (Hoffman & Smits, 2008). Although CBT is also effective for anxiety disorders in children aged 6 years and older when compared with wait-list controls, reviews of CBT for specific anxiety disorders in children (e.g. SAD, SP) are absent in the literature (Cartwright-Hatton, Roberts, Chitsabesan, Fothergill, & Harrington, 2004). Most trials grouped children with specific anxiety disorders into a unitary anxiety group due to high comorbidity, without assessing the relative effect of CBT on each type of anxiety disorders. Such specification in research, however, may help optimize clinical outcomes of CBT for anxious children, as evident in the
treatment of specific anxiety disorders in adults that benefit from different approaches (Cartwright-Hatton et al., 2004).

Kendall’s ‘Coping Cat’ (2006) is unquestionably among the most-widely-used, evidence-based CBT protocols for treating anxiety disorders of childhood, especially for SAD, GAD or SP (Macklem, 2011, pp. 34). Some strategies applied in Coping Cat, however, can also be applied in the treatment of childhood PTSD, OCD, and specific phobia (Kendall, Furr, & Podell, 2003, pp. 45). This manualized CBT program was first developed at the Child and Adolescent Anxiety Disorders Clinic at Temple University (Philadelphia, USA). The program requires the therapist to follow the therapist’s treatment manual (Kendall & Hedtke, 2006a) and child to use his or her workbook during treatment (Kendall & Hedtke, 2006b). The Coping Cat protocol has been adapted internationally and modified for populations in different countries: Coping Bear in Canada (Scapillato & Mendlowitz, 1993) and Coping Koala in Australia (Barrett, Dadds, & Rapee, 1991).

The main goal of the Coping Cat CBT is to help children with anxiety disorders recognize their anxiety-related physiological, cognitive, and behavioural symptoms in order to effectively apply coping strategies in anxiety-generating situations (Velting et al., 2004; Wood, 2006). This protocol is composed of sixteen sessions in which the first eight sessions are devoted to psychoeducation (e.g. learning how to recognize cues for their anxiety, cues for feelings of one’s own or others, coping skills), and the second eight sessions focus on behavioural desensitization and modification (e.g. facing their fears in a graded hierarchy) (Beidas, Benjamin, Puleo, Edmunds, & Kendall, 2010). During the psychoeducation period, emotion-related concepts are addressed to some extent with more emphasis on emotion.
regulation than emotion understanding. However, the largest focus of this traditional CBT is on anxiety symptoms (Suveg, et al., 2006).

In the first randomized controlled trial (RCT) by the developer of Coping Cat, the anxiety symptoms were markedly reduced at post-treatment in about two thirds of anxious children with primary diagnoses of SAD, GAD, and SP; however, the remaining one third still met the full criteria for anxiety disorders following the treatment (Kendall, 1994). The second RCT also replicated the initial findings of Kendall (1994), and nearly half of treated children with anxiety disorders no longer met the diagnostic criteria for any anxiety disorder at post-treatment (Kendall et al., 1997). Many further RCT’s of Coping Cat or programs very similar to it have been done internationally with similar results. Finally, a recent meta-analysis on the efficacy of CBT on anxiety disorders in children and adolescents strongly supported the effectiveness of anxiety-focused CBT and suggested that its effects could be maintained for up to two years (Ishikawa, Okajima, Matsuoka, & Sakano, 2007).

Despite the evidence for short-term and long-term efficacy of CBT for children with anxiety disorders, at least one third of treated children remain unresponsive to CBT, thereby categorizing the treatment as a “probably efficacious” (Silverman, Pina, & Viswesvaran, 2008). Given this clinical limitation of anxiety-focused CBT, researchers must further examine potential areas of difficulty beyond cognitive or behavioral domains in children with anxiety disorders. One promising area of research is emotion.

**Emotion-focused cognitive behavioural therapy.**

There has been growing emphasis in CBT on assessing emotion-related difficulties that children with anxiety disorders may experience, especially in those unresponsive to traditional CBT. One example of such an effort is emotion-focused CBT (ECBT), which
closely follows the standard procedures of traditional anxiety-focused CBT. Although ECBT is consistent with anxiety-focused CBT, it places equal weight on ameliorating emotional deficits and anxiety symptoms (Jablonka, Sarubbi, Rapp, & Albano, 2012, pp. 546; Suveg et al., 2006). Specifically, whereas the traditional anxiety-focused CBT spends only 1-2 session(s) on emotion recognition or understanding, ECBT integrates the same emotional content throughout the entire eight sessions of psychoeducation (Suveg et al., 2006). In each session of ECBT, both clinician and child work as a team to identify emotion(s) that the child has difficulty regulating and understanding (Suveg et al., 2006). However, the emotion understanding component in ECBT focuses on understanding or recognizing one’s own emotional experiences, with less emphasis on others’ emotional states (Beidas et al., 2010; Suveg, Sood, Comer, & Kendall, 2009; Rynn, Vidair, & Blackford, 2012, pp. 546).

**Emotion Understanding**

Emotion understanding refers to the “conscious knowledge about emotion” and related processes (Southam-Gerow & Kendall, 2002, pp. 200; Thompson, 1990). In research, the construct of emotion understanding comprises emotion recognition and other emotional knowledge (e.g. causes of emotion, multiple emotions, emotion display or hiding, knowledge about emotion regulation) (Southam-Gerow & Kendall, 2002). Emotion understanding facilitates a child’s social functioning, (Hubbard & Coie, 1994), and impairment in this conscious knowledge is associated with some types of psychopathologies of childhood. For example, impaired emotion understanding is reported in school-age children with attention-deficit hyperactivity disorder (ADHD) (Da Fonseca, Seguier, Santos, Poinso, & Deruelle, 2009).
Research on emotion understanding in children with anxiety disorders is very scant in the literature. Only one study by Southam-Gerow and Kendall (2000) examined four distinct facets of the emotion understanding construct in anxious children: knowledge about emotional cues, multiple or simultaneous emotions, changing or hiding emotions, and knowledge about emotion regulation and coping. The study found that children with anxiety disorders are less able to hide or change their emotions than non-anxious children; however, the study did not assess the children’s ability to recognize emotions, although emotion recognition is another crucial element of emotion understanding.

Emotion Recognition

Emotion recognition refers to the perceptual and cognitive capacity to identify others’ or one’s own emotional states through facial, postural, and contextual cues (Buitelaar, Van der Wees, Swaab-Barnesveld, & Van der Gaag, 1999). The ability to recognize others’ emotions may manifest as early as in newborns and infants, albeit in immature form, and infants begin to heed facial expressions for appraisal of emotions (Field, Woodson, Greenberg, & Cohen, 1983). According to the theory of natural selection by Darwin (1898), this biological predisposition in humans to pay attention to facial expressions and to correctly discriminate emotions may have been a favoured trait for survival (Fridlund, 1997, pp. 109-111). More specifically, accurate recognition of others’ emotional states allows receivers to appropriately change their behaviour based on the sender’s emotional expressions (e.g. acting submissively after seeing an angry face), and such adaptive behaviour may facilitate cooperation and prevent aggression and energy expenditure (Elfenbein, March, & Ambady, 2002, pp. 38-39). Furthermore, proficiency in emotion recognition may allow individuals to
effectively manage their emotional states (e.g. hiding their feelings or deceiving others) in the presence of others (Ekman, 1973).

There is another theory relating to emotion recognition and its potential importance for survival, the ‘subordination hypothesis’ (Henley, 1973). According to this hypothesis, women are generally more accurate than men in emotion recognition based on the historically lower social status of women relative to men. This subordinate or oppressed status made emotion recognition an important skill for women’s survival. However, some researchers have opposed this view with empirical evidence that men can recognize certain emotions, such as anger, more accurately than women (Elfenbein et al., 2002; Mandal & Palchoudhury, 1985; Wagner, MacDonald, & Manstead, 1986).

**Neural mechanisms of emotion recognition.**

In terms of neuroanatomical correlates of emotion recognition, the process takes place predominantly in the right hemisphere in most people when judging negative or positive emotions (DeKosky, Heilman, Bowers, & Valenstein, 1990; Ley & Bryden, 1979). However, this tendency seems less apparent when judging neutral or mild emotions (Ley & Bryden, 1979). Further, some lesion studies (Blonder, Bowers, & Heilman, 1991) also provide evidence for the right hemisphere playing a major role in emotion recognition, especially when appraising emotions through facial and bodily expressions. On the other hand, some variations seem to exist across studies in locating discrete sectors for processing emotions. For example, one study (Adolphs, Damasio, Tranel, & Damasio, 1996) found that the right inferior parietal cortex and mesial anterior infracalcarine cortex are the main cortical systems for the processes involved in emotion recognition, whereas other studies
have located this function in the right inferior frontal cortex (Nakamura et al., 2000) or exclusively in the right temporoparietal cortex (Bowers, Bauer, Coslett, & Heilman, 1985).

There is converging evidence, however, that such differential activation of the discrete cortical areas may reflect emotion-specific processes during emotion recognition (Adolphs et al., 1996). For example, although perceiving some negative basic emotions (anger, disgust, and fear) all equally activates Brodmann area 47 in the left inferior-frontal cortex, ‘anger’ seems to distinctively activate right gyrus cinguli, whereas ‘disgust’ and ‘fear’ may predominantly activate right putamen and amygdala, respectively (Adolphs et al., 1996). Following this perceptual processing, amygdala and orbitofrontal cortices communicate with other parts of the neocortex and hippocampal formation in order to retrieve emotional knowledge. Then, the conscious recognition of the emotional states of others ensues (Adolphs, 2002).

**Social correlates and psychopathologies.**

The ability to correctly recognize others’ emotional states is an important emotional skill in social communication and interpersonal relationships. For example, emotion recognition is significantly associated with children’s social competence (Mueser et al., 1996), which helps children to adapt successfully in various social settings (Semrud-Clikeman, 2007). Further, emotion recognition is one of the most reliably validated elements of emotional intelligence (Elfenbein et al., 2002, pp. 45), which in turn predicts leadership competencies (George, 2000) as well as satisfaction with interpersonal relationships (Lopes, Salovey, & Straus, 2003). By the same logic, however, any deficit in emotion recognition may presage social difficulties in everyday life. In fact, impairment in emotion recognition
seems to be significantly related to various types of psychopathologies (Collin, Bindra, Raju, Gillberg, & Minnis, 2013) that cause social and behavioural problems in affected individuals.

Impaired ability to recognize others’ emotional states has been reported in adults and children suffering from a wide range of mental health disorders. For example, a deficit in this ability is seen in adults with alexithymia (Lane, Sechrest, Reidel, Weldon, Kaszniak, & Schwartz, 1996), dementia (Keane, Calder, Hodges, & Young, 2002), bipolar disorder (Getz, Shear, & Strakowski, 2003), depression (Demenescu, Kortekaas, Den Boer, & Aleman, 2010), eating disorders (Kucharska-Pietura, Nikolaou, Masiak, & Treasure, 2003), mania (Lembke & Ketter, 2002), panic disorder (Kessler, Roth, von Wietersheim, Deighton, & Traue, 2006), and schizophrenia (Johnston, Stojanov, Devir, & Schall, 2005; Kohler et al, 2003; Mandal, Jain, Haque-Nizamie, Weiss, & Schneider, 1999; Namiki et al., 2007; Sachs, Steger-Wuchse, Kryspin-Exner, Gur, & Katsching, 2004). Impaired emotion recognition has also been found in children and adolescents with autism spectrum disorders (Kuusikko et al., 2009), ADHD (Singh, Ellis, Winton, Singh, Leung, & Oswald, 1998), bipolar disorder (McClure, Pope, Hoberman, Pine, & Leibenluft, 2003), and abuse and neglect (Camras, Grow, & Ribordy, 1983; Pollak, Cicchetti, Hornung, & Reed, 2000).

Despite the strong evidence that children with anxiety disorders have a broad range of social deficits (e.g. social shyness/withdrawal, inappropriate social skills, social maladjustment) (Strauss, Lease, Kazdin, Dulcan, & Last, 1989), current treatments, including both CBT and ECBT, for anxiety disorders of childhood are mostly focused on the child’s ability to recognize his/her own emotions. They do not carefully address and treat the child’s potential difficulty in recognizing others’ emotions. This is unfortunate because a deficit in decoding others’ emotional information is an important correlate of interpersonal problems.
(Kornreich et al., 2002), and such a deficit, if it exists, could potentially contribute to exacerbation of anxiety symptoms during social interactions in children with anxiety disorders.

**Previous findings on emotion recognition in children with anxiety disorders.**

Research on the relationship between anxiety disorders and emotion recognition in children is scarce and inconsistent. One study by Easter et al. (2005) found that children with anxiety disorders are more impaired in recognizing emotions than children without anxiety disorder. In this study, researchers compared emotion recognition accuracy in a relatively small number of child participants, 15 clinically anxious children and adolescents and 11 non-anxious controls, using a set of posed pictures of facial expressions. By convention, SAD, GAD, and SP types of anxiety disorders were considered as a single experimental group in this study. This is commonly done because these types are highly comorbid, but neglects the distinct clinical features associated with each of the anxiety types. Furthermore, the effect of other highly comorbid conditions, such as conduct or oppositional disorder, has not been examined in children with anxiety disorders.

With the same conventional research design and with the same set of facial emotion cues, however, other studies produced results that are different from the finding by Easter et al. (2005). For example, Manassis and Young (2000) found that children with anxiety disorders can identify others’ facial emotions as accurately as children without anxiety disorder. Only children with learning disabilities without anxiety were significantly impaired in this study. Similarly, McClure et al. (2003) found that children and adolescents with anxiety disorders could recognize others’ emotional states as accurately as their non-anxious counterparts, but only children and adolescents with bipolar disorder showed a deficit in
emotion recognition. Lastly, Guyer et al. (2007) compared emotion recognition accuracy among children and adolescents from various clinical groups, and reported that children with anxiety disorders and children with depression as a group were not impaired in emotion recognition. In this particular study, however, different pediatric mood and psychiatric disorders were arbitrarily combined into single groups (e.g. combining the depression group with the anxiety group. Thus, their findings may be limited in telling a clear story about anxious children’s ability to recognize emotions. As illustrated above, there seems to be little agreement on emotion recognition in children with anxiety disorders.

What Are the Factors Potentially Contributing to Inconsistent Results of Past Studies?

Measurement limitations in assessing emotion recognition in young children with anxiety disorders.

Previous studies relied on static pictures of adult and child facial emotions for assessing emotion recognition in children with anxiety disorders. However, there may be some measurement issues in using these pictorial cues for measuring young children’s ability to recognize emotions. First, the use of static photographs of facial expressions in traditional lab settings may not adequately capture the emotional tenor in real social interactions because emotional messages in real-life settings are often conveyed via a combination of different types of emotional cues (e.g. facial cues, bodily cues, contextual/situational cues). Contextual cues in particular are known to provide additional crucial information when appraising others’ emotional states (Carroll & Russell, 1996). In other words, if past studies had provided more emotional information, while making the lab settings more generalizable, findings might have been more consistent.
Second, most of these instruments require verbal labelling of emotions based on choices for each item, and responses are scored as dichotomous outcomes (i.e. right or wrong). This dichotomous scoring method may cause statistical distortions, especially with small sample sizes (Comrey, 1988), and can skew the interpretation of the results. Because previous studies typically involved small sample sizes, this type of forced-choice format and dichotomous scoring may have contributed to inconsistent past results.

Third, some of these instruments, such the Diagnostic Analysis of Nonverbal Accuracy (DANVA), do not assess recognition accuracy for some basic and complex emotions that young children may gradually learn to understand during the course of development. Examples include some neutral emotions (relaxed, tired, exhausted) as well as disgust, guilt, pride, and jealousy. Of particular interest, assessing the recognition of ‘disgust’ seems to have some clinical implications in CBT for certain types of anxiety disorders, such as OCD (Rector, Daros, Bradbury, & Richter, 2012). Failing to provide a wider array of complex and clinically relevant emotions may have hindered attainment of developmentally meaningful and reliable outcome data, potentially leading to the mixed findings in this area of research.

Lastly, emotional cues used in previous studies are motionless. During social interactions, however, we perceive emotional expressions as dynamic and spontaneous processes rather than perceiving them as static or motionless in time. Research suggests that providing even a little dynamic information when presenting emotional cues allows more accurate emotion recognition compared to using exclusively static information (Elfenbein & Ambady, 2002; Wehrle, Kaiser, Schmidt, & Scherer, 2000). Although a very recent study argues that young children may not have any significant advantage in emotion recognition
using dynamic expressions than using static expressions (Nelson & Russell, 2012), the children in this study were limited to 4-7 years of age. Participants in past studies in this area of research ranged from 7 to 17.

New research, therefore, needs to assess emotion recognition ability in children with anxiety disorders using a developmentally sensitive tool that is well-validated in children of varying ages, while addressing the above shortcomings of traditional experimental designs.

**Other limitations of previous studies.**

There are other limitations within the experimental design of previous studies. First, sample sizes were generally small in previous studies. Only two previous studies are exceptions to this observation; however, even these studies had some flaws in sampling. For example, one study (Manassis & Young, 2000) had an anxiety group size similar to the present study, but this study included preschool children with limited emotional vocabulary, which may have affected results. The other one, by Guyer et al. (2007), had a much larger total number of child and adolescent participants than the present study, involving various clinical groups. However, there were only 14 children diagnosed with anxiety disorders, and these children were mixed with children with depression to form a single experimental group. Thus, results could not be clearly attributed to the presence of anxiety disorders.

Second, the effect of age on emotion recognition accuracy has not been examined in children with anxiety disorders. However, age seems to have major impacts on emotion recognition accuracy in children without anxiety disorder (Durand, Gallay, Seigneuric, Robichon, & Baudouin, 2007; Feldman & Philippot, 1990). Careful control of this variable in children with anxiety disorders might have yielded more meaningful and reliable outcome data in past studies. For example, in some past studies, the age range was large despite a
small number of participants, so results may have been largely due to age effects. Therefore, it may be important to scrutinize the effect of this developmental proxy in order to explain the inconsistent results of past studies.

Third, diverse types of anxiety disorders of childhood were often combined into one experimental group without assessing the relative impact of distinct primary diagnoses on emotion recognition accuracy. This conventional design is often used because anxiety disorder types are highly comorbid with each other. However, since each anxiety disorder has unique clinical features and symptoms, this variability in characteristics may have differentially influenced emotion recognition accuracy in child participants of past studies. Therefore, it is imperative to examine the effect of anxiety type on emotion recognition in children.

Lastly, previous studies neglected to carefully assess gender effects on emotion recognition accuracy in children with anxiety disorders. It is well-established, however, that gender effects on emotion recognition accuracy exist in non-anxious individuals. Women are generally more accurate than men in recognizing emotions (Hall, 1978; Kirouac & Dore, 1985; Rotter & Rotter, 1988). Therefore, gender difference may have interacted with clinical status, affecting the results of previous studies.

**Merits of the Present Study and General Aims**

In contrast to previous studies bearing the limitations above, the present study examines a substantial sample of child participants who are old enough to verbally express a range of simple and complex emotions.

Age effects on emotion recognition accuracy are also scrutinized and controlled for when comparing anxiety diagnoses for accurate statistical analyses. The present research is
the first study to assess the effect of different types, comparing SAD, GAD, and SP types, on children’s ability to recognize emotions. Furthermore, the present study aims to examine the effect of gender on emotion recognition accuracy in children with and without anxiety disorders.

Lastly, the present study utilizes Mood Assessment via Animated Characters (MAAC; Manassis et al., 2009) a computerized instrument that displays an animated character’s dynamic facial, bodily, and situational cues in order to measure sixteen specific feelings in young children with anxiety disorders (Appendix A). There are some key advantages of using MAAC over static facial photographs for young anxious children’s ability to recognize emotions. First, MAAC was specifically designed for and validated in young children with anxiety disorders. Second, MAAC displays dynamic and subtle types of emotional cues (facial, bodily, and situational cues) using an animated character. These animations may provide more accurate and clear emotional messages to the child for appraisal than do still facial photographs removed from context. Third, MAAC’s displays of a child-friendly animated character may help reduce participants’ anxiety during assessment, minimizing the effect of confounding factors such as state anxiety. Fourth, the standard scoring of responses on MAAC introduces three-level ordinal scores (incorrect, close to correct, correct), allowing researchers to capture the developmental patterns or ‘growth’ of emotion recognition ability in children with anxiety disorders, while mitigating the statistical bias associated with dichotomous scoring. All of these advantages justify the use of MAAC in the present study. More details on this instrument are explained in Chapter 2.

This thesis has four main aims: (a) to compare children with anxiety disorders and children without anxiety disorder in their accuracy of recognizing the emotional states
expressed by an animated character on MAAC, (b) to examine age-related changes in emotion recognition accuracy in children with anxiety disorders in comparison with that in children without any anxiety disorder, (c) to determine how the most documented types of anxiety disorders for anxious youth, namely SAD, GAD, and SP, are related to children’s ability to recognize emotions, and (d) to assess any gender effect on emotion recognition accuracy in children with anxiety disorders.

In addition to these main research questions, this thesis also reports secondary analyses in a separate chapter (Chapter 4) that explores the effects of other potential confounding factors (e.g. state anxiety, task completion time, depressive/anxiety symptoms) on emotion recognition accuracy in children with and without anxiety disorders.

**Hypotheses**

**Objective #1: to determine emotion recognition accuracy in children with and without anxiety disorder (examined in Chapter 2).**

For this objective, I predict that children with anxiety disorders will show lower emotion recognition accuracy than non-anxious children. A recent meta-analysis (Demenescu et al., 2010) on emotion recognition accuracy in children with anxiety disorders has suggested that presence of anxiety disorders is not associated with children’s ability to recognize various emotions. In this review, however, the sampling criterion was based on the presence of any type of anxiety disorder, without specifying types of anxiety disorders. Some included studies only contained children with SP, excluding children with SAD or GAD as primary diagnosis. Such sampling design may not accurately represent the proportion of different anxiety groups in a treatment setting or in the general population, and fails to consider unique clinical features of each type of anxiety disorders. By studying a
diverse anxiety group in a treatment setting with careful attention to anxiety types, differences between anxious and non-anxious children may be elucidated.

**Objective #2: to determine the effect of age on emotion recognition accuracy in children with and without anxiety disorder (examined in Chapter 2).**

This second objective examines the effect of age on emotion recognition accuracy in children with and without anxiety disorders. It is predicted that there will be a positive correlation between age and overall emotion recognition accuracy in both children with and without anxiety disorders because age represents a conventional proxy for development. This prediction is based on the previous literature on the effect of age on emotion recognition in children without anxiety disorder. In previous studies, age had a positive correlation with emotion recognition accuracy in children and adolescents (Durand et al., 2007; Feldman & Philippot, 1990). Furthermore, it is predicted that the rate of age-related improvement in emotion recognition accuracy will be significantly lower in children with anxiety disorders than in children without anxiety disorder because clinically anxious children tend to have more problems in social and emotional domains than non-anxious children. However, this particular prediction has not been previously tested, so the results will be preliminary.

**Objective #3: to determine the effects of anxiety subtypes on emotion recognition accuracy in children with anxiety disorders (examined in Chapter 2).**

The third objective examines the effect of primary type of anxiety disorders on emotion recognition accuracy in children. It is hypothesized that children with SP will be significantly more impaired in recognizing others’ emotional states than children with other types of anxiety disorder or children without anxiety disorder because the primary symptoms of SP pertain to social features. However, there has been no study that evaluates the relative
effects of anxiety subtype on children’s emotion recognition accuracy, so the findings of this objective will be preliminary.

**Objective #4: to determine effect of gender on emotion recognition accuracy in children with and without anxiety disorders (examined in Chapter 3).**

For the fourth objective, examining the effect of gender on emotion recognition accuracy in children with and without anxiety disorder, it is predicted that girls, regardless of clinical status, will be significantly more accurate in recognizing emotions than boys. This prediction is based on the finding of a systematic review on emotion recognition accuracy in children and adolescents (McClure, 2000). This systematic review indicates that girls without any clinical diagnosis are more accurate than boys without a clinical diagnosis in recognizing basic emotions when facial emotion cues are presented (McClure, 2000).

As these gender differences exist in predicting emotion recognition accuracy in children without anxiety disorder (McClure, 2000), the gender factor may also influence emotion recognition accuracy in children with anxiety disorders. Therefore, it is predicted in this study that girls with anxiety disorders will be more accurate than boys with anxiety disorders in emotion recognition. Further, non-anxious girls will be more accurate in emotion recognition than non-anxious boys. The present study is the first attempt to comprehensively examine potential gender effects on emotion recognition accuracy in children with anxiety disorders, so findings will be preliminary.
Chapter Two

Effects of Age and Subtype on Emotion Recognition in Children with Anxiety Disorders

Contents of this chapter have been published in Canadian Journal of Psychiatry:
Abstract

This study examined whether an anxiety diagnosis, age, and subtype are associated with emotion recognition accuracy in school-age children. Children with anxiety disorders performed comparably with children without anxiety disorder in emotion identification. In both groups, accuracy for disgust increased significantly each year of age. When age and primary anxiety types were considered, however, children with separation anxiety disorder (SAD) showed a deficit in overall emotion recognition, compared with children with other subtypes or without anxiety disorder. Further regression analyses showed that children with generalized anxiety disorder (GAD) presented significantly lower accuracy than control children at a young age, but this deficit disappeared with increased age. Children with anxiety disorders as a group may not appear to be impaired in emotion recognition. However, when age and subtypes are considered, children with SAD and young children with GAD appear to have difficulty, compared with children without anxiety disorder.
Introduction

Childhood anxiety disorders, especially separation anxiety disorder (SAD), generalized anxiety disorder (GAD), and social phobia (SP), are most effectively treated with a combination of medication and cognitive behavioural therapy (CBT) (Walkup et al., 2008). CBT or medication (for example, sertraline) alone is more effective than placebo, however, CBT tends to cause fewer side effects than medication (Walkup et al., 2008).

For some clinicians, therefore, CBT may be preferred as a first-line treatment for anxiety disorders in children. In an evidence-based, manualized CBT for anxiety disorders in children (such as, Coping Cat CBT; Kendall & Hedtke, 2006), clinicians include activities that may help clinically anxious children facilitate emotion recognition (for example, discussion of nonverbal cues for feelings or pictorial representations of feelings) (Kendall & Hedtke, 2006). However, there is a lack of consistent empirical evidence for these children’s deficits in recognizing others’ emotions (Easter et al., 2005; Manassis & Young, 2000; McClure et al., 2003; Guyer et al., 2007; Melfsen & Florin, 2002; Simonian et al., 2001). Rather, recent research has identified deficits in other emotional domains in children with anxiety disorders, such as emotion regulation skills (Suveg & Zeman, 2004) and identifying their own emotional states (Zeman, Shipman, & Suveg, 2002).

Therefore, a new emotion-focused CBT for children with anxiety disorders has been developed. This program adds sessions to existing CBT protocols (Suveg et al., 2006) focusing on improving emotion regulation and identifying one’s own emotional states. The emphasis is less clearly placed on training children with anxiety disorders to identify others’ emotions. As the ability to recognize others’ emotions is crucial for social interactions (Ciarrochi, Heaven, & Supavadeeprasit, 2008), and is postulated to help children with
anxiety disorders adaptively regulate their emotional experiences (Suveg et al., 2009), scrutinizing the developmental trajectory of this conscious ability informs both anxiety- and emotion-focused CBT for children with anxiety disorders.

**Emotion Recognition in Children with Anxiety Disorders**

It remains unclear whether children with anxiety disorders are impaired in identifying the emotional states of others (Easter et al., 2005; Manassis & Young, 2000; McClure et al., 2003; Guyer et al., 2007; Melfsen & Florin, 2002; Simonian et al., 2001). Findings for children with SP are particularly inconsistent (Melfsen & Florin, 2002; Simonian et al., 2001), and emotion recognition accuracy in children with SAD or GAD (commonly treated with CBT) has not been examined to date.

Conflicting results may relate to study limitations. First, previous studies generally had small sample sizes. Only one study (Manassis & Young, 2000) had an anxiety group size comparable to that of the present study, but this study contained few control subjects without anxiety disorders and included preschool children whose emotional vocabulary is generally limited (Aldridge & Wood, 1997). Another study (Guyer et al., 2007) included a much larger total number of participants aged between 7 and 18 years, but there were only 14 children with anxiety disorders, and they were mixed with children with depression into a single experimental group. Second, there was a lack of well-validated, developmentally sensitive tools to measure the ability to identify both simple and complex emotions in young children with anxiety disorders. Past research relied on facial pictures, which have not been well-validated for use with children younger than 8 years. Also, greyscale facial pictures may be unappealing to children. Further, these stimuli cannot provide some types of emotional cues that children often use. For example, preschool children with anxiety
disorders can use both facial and bodily cues for identifying emotions (Nelson & Russell, 2011), and with increased age, school-age children rely more on situational cues than facial cues (Hoffner & Badzinski, 1989). Third, age effects on emotion recognition ability have not been examined in children with anxiety disorders, although age significantly predicts the ability to recognize emotions in children without anxiety disorders (Durand et al., 2007; Feldman & Philippot, 1990). The effect of this developmental proxy may explain the inconsistent results of past studies. Finally, past studies have lumped diverse anxiety disorders into one proband group without assessing the relative impact of distinct anxiety types on emotion recognition.

By contrast, our study examines a large sample of children old enough to express a range of feelings using a developmentally sensitive tool that displays facial, bodily, and situational cues. We pursued three main objectives: to compare the accuracy in identifying others’ emotions in children with and without anxiety disorders, to examine age effects on the emotion recognition accuracy in children with anxiety disorders, and to determine how the anxiety disorders commonly treated with CBT in youth with anxiety disorders (SAD, GAD, and SP) are related to children’s emotion recognition accuracy.
Methods

Participants

A total of 130 participants between 6 and 11 years of age were initially recruited, including 65 referred patients with anxiety from an outpatient anxiety clinic in the Hospital for Sick Children in Toronto and 65 volunteer control participants via community advertisement in the Toronto area. In terms of demographics, children in both case and control groups were predominantly from well-educated Caucasian families. The institutional review board (IRB) of the hospital reviewed the research protocols and approved this study. Children were excluded from the sampling if they were: (a) taking psychoactive medication (e.g. selective serotonin reuptake inhibitor) or receiving any type of psychological treatment (e.g. CBT); (b) suffering from any psychosis or intellectual disability; or (c) presenting with the primary diagnosis of a mood disorder or developmental disorder. All the included participants and their parents completed informed assent and consent, respectively.

All participants completed a semi-structured diagnostic interview (Anxiety Disorders Interview Schedule or ‘ADIS’) (Silverman & Albano, 1996) as part of clinical assessment, administered by trained psychiatrists with at least three years of experience using this instrument. After this screening process, the sample was reduced to 122 participants because six children from the control group had marked difficulties understanding instructions in English, and two children from the anxiety group had only subclinical levels of anxiety.

The anxiety group of 63 children mainly had primary diagnoses of SAD (n = 13), GAD (n = 35), and SP (n = 10), and a few children had specific phobia (n = 3), and post-traumatic stress disorder (PTSD; n = 2). Among the 63 clinically anxious children in the final sample, 38.1% had a secondary comorbid anxiety diagnosis, and 8.0% had a comorbid
non-anxiety diagnosis (e.g. attention-deficit hyperactivity disorder). The control group of 59 children in the final sample was screened for psychopathology and did not meet full criteria for any non-anxiety DSM diagnosis (e.g. attention-deficit hyperactivity disorder, major depressive disorder, oppositional defiant disorder, learning disability).

**Instruments**

**Mood Assessment via Animated Characters (MAAC).**

The Manassis Lab developed and validated a computer-based self-report instrument, MAAC, which was specifically designed for young anxious children to elicit feeling states associated with their psychopathology. MAAC displays a female teenage animated character ("Teena") expressing 16 different types of feeling states (relaxed, bored, exhausted, surprised, sad, guilty, ashamed, angry, irritable, jealous, scared, nervous, disgusted, happy, elated, and pleased) in animation for about three to four seconds (Manassis et al., 2009). Using the child-friendly animated character, instead of plain text and scale, MAAC measures a young child’s ability to recognize feelings of others (i.e. emotion of Teena) and self (by comparing himself/herself to animated emotions expressed by Teena). The interface of MAAC displays a tableau of sixteen still facial expressions of Teena’s simple and complex emotions. If a child presses the emotion representation on the tablet screen with a PC stylus pen, the selected emotion picture becomes a short animated cartoon. These animations show Teena’s dynamic and engaging facial, bodily, and situational cues that capture the character’s current emotional state. The child can play and/or replay the emotion-related clips in any order of his or her preference.

**State-trait Anxiety Inventory for Children (STAIC).**
The STAIC contains two sets of 20 items using a 3-point scale that measures the intensity of both long-term trait anxiety (i.e. how children usually feel or their general tendency to be anxious) and transitory state anxiety (i.e. how children feel right now or a temporary state of anxiety specific to situations) (Spielberger, Edwards, Lushene, Montuori, & Platzar, 1973). Therefore, the STAIC state anxiety scores represent changes in transient anxiety that children experience during psychological testing or treatment, whereas the STAIC trait anxiety scores are used to identify children with “high levels of neurotic anxiety” (Spielberger et al., 1973). The STAIC can be administered to children between the ages of 6 and 14. Participants in this study completed the STAIC at the time of MAAC administration to determine if the children were feeling anxious during the testing, which could potentially be a confounding variable in the relation between a diagnosis of anxiety disorder and emotion recognition.

**Procedures**

A graduate student with a master’s degree introduced MAAC to a child based on standardized protocols (“On this computer is a cartoon character named Teena who has a number of different feelings.”). The child was first allowed to freely explore pictorial representations of the animated character, selecting any picture(s) to view the emotion-specific animations and gaining familiarity with MAAC (“Right now, she is just sort of hanging out. If you press a button at the bottom of the screen, she will act out one of her feelings”). Following the introduction, the child was asked to pick the emotion(s) that he/she was feeling at the moment and rate intensity (“Pick the button where Teena seems to feel the way you’re feeling right now. How can you tell? If 5 checkmarks is a perfect match between how you feel right now and how Teena feels and “X” means you don’t feel that way at all...
right now, show how much you feel like Teena right now on the scale”). Then, the graduate student and child visited each animated emotion together in order from top to bottom, left to right, asking the child to identify the emotional state of Teena (“Tell me how Teena is feeling”). The same instruction was repeated until all sixteen emotions on MAAC were viewed (“Let’s have a look at Teena’s other feelings.”), selecting all the buttons not previously selected. All verbal responses of the child were tape-recorded for scoring of his/her emotion identification accuracy.

For scoring, each response was converted to a numerical score based on how accurately the child identified the emotion: 0 (incorrect), 1 (close but not exactly correct), and 2 (correct). The child's overall or general ability to identify the emotional states of others was defined by a total accuracy score, obtained by adding the individual scores across the sixteen emotions presented on MAAC. Therefore, the maximum total score is 32 points (2 points multiplied by 16 items). To establish inter-rater reliability, two graduate students blindly and independently scored the responses endorsed by participants, and the Kappa statistic was computed.

**Statistical Analyses**

For the first main analysis, comparing the emotion recognition accuracy between clinically anxious children and non-anxious children, both a Wilcoxon Rank Sum test and an independent t-test were used to compare total accuracy scores between the two groups. The parametric t-test was conducted because the residual distributions of the total accuracy scores were normally distributed for both anxiety and control groups (the findings on the normality assumption will be reported in the results section). However, the dependent variable (total accuracy score) was defined as the sum of sixteen ordinal scores in this study, and such
restricted ordinal score range could also justify the use of the non-parametric rank sum comparison. Therefore, the present study reported both parametric and non-parametric results. Further, ordinal regression analyses were conducted to compare these two groups’ ability to identify each of sixteen specific emotions.

For the second main analysis, examining age effects on emotion recognition, linear regression analyses were conducted in the anxiety and control groups for modeling the relationship between age (predictor) and total accuracy score (outcome). Then, ANCOVA was conducted for comparing the slopes and intercepts of these two regression lines in order to determine if the general ability to identify emotions in anxious children differentially correlates with age in comparison with that of non-anxious children. Additionally, ordinal logistic regression analyses were conducted to determine if clinically anxious children’s and non-anxious children’s ability to identify specific types of emotions differentially changes with age.

For the third main analysis, comparing the emotion recognition accuracy as a function of the primary anxiety diagnosis, children with specific phobia or PTSD were dropped because these samples were too small for this analysis. An ANCOVA was conducted to contrast differences in mean total accuracy scores among the anxiety groups of SAD, GAD, and SP, while age was controlled for. Then, Bonferroni-adjusted pairwise comparisons were conducted with the two-tailed alpha level set at 0.05 for statistical significance. Furthermore, linear regression analyses were used to model the association between age and total accuracy score in each primary anxiety diagnosis group to examine the developmental trajectory of the general ability to recognize others’ emotions in these groups. Using ANCOVA, the slopes and intercepts of these regression lines were compared with
those of the non-anxious control group by checking for the presence of any interaction between the lines.
Results

Mean ages of the anxiety group (M = 8.7, SD = 1.2) and non-anxious control group (M = 8.3, SD = 1.4) were similar, t (120) = -1.60, p = 0.11. A one-way ANOVA indicated that SAD (M = 8.5, SD = 1.3), GAD (M = 8.8, SD = 1.1), SP (M = 8.4, SD = 1.3), and control groups were also comparable in mean age, F (3, 113) = 1.18, p = 0.32. The normality assumption was tested for age and total accuracy score variables and found that the data of these variables were normally distributed within each comparison group. The state anxiety scores did not differ among the SAD, GAD, SP, and control groups, F (3, 86) = 0.79, p = 0.50.

Objective #1: Emotion Recognition Accuracy in Children with and without Anxiety Disorder

Total accuracy score in anxious children was not significantly different from non-anxious children when a t-test was conducted, t (120) = 0.73, p = 0.68. The restricted, ordinal total accuracy score range could also justify the use of the nonparametric test. However, the result was unchanged when a non-parametric test of a Wilcoxon Rank Sum test was conducted, z = -0.72, p = 0.47, as the mean of the ranks of total accuracy score in the anxiety group was 59.27 and that of the control group was 63.88.

Ordinal logistic regression analyses failed to reveal any significant difference in recognition accuracy for any specific types of emotions on MAAC between children with anxiety disorders and children without anxiety disorder (Table 2). It is noteworthy that children with anxiety disorders as a group performed exceptionally well on correctly identifying certain basic emotions, such as happy, angry, and scared.
Objective #2: Effect of Age on Emotion Recognition Accuracy in Children with and without Anxiety Disorder

Age was positively correlated with total accuracy score received on MAAC (i.e. age was correlated with the general ability to identify emotions) for both anxious children ($r = 0.52$, $p = 0.001$) and non-anxious children ($r = 0.36$, $p = 0.005$). Linear regression analyses were conducted to model the linear relationship between age (predictor) for total accuracy score (outcome) in both anxiety and control groups: (1) Predicted total accuracy score in the anxiety group = $7.79 + 1.49$ Age (years); (2) Predicted total accuracy score in the control group = $14.35 + 0.81$ Age (years). An ANCOVA indicated that these slopes were similar, $\Delta B_1 (ANX-CONT) = 0.68$, 95% CI $-0.13$ to $1.52$, $p = 0.10$, and their intercepts were also comparable, $\Delta B_0 (ANX-CONT), = -6.56$, 95% CI $-13.87$ to $0.39$, $p = 0.06$.

Ordinal logistic regression analyses revealed that non-anxious children’s recognition accuracy for ‘disgusted’, ‘jealous’, and ‘proud’ emotions increased significantly each year (Table 3). Similarly, clinically anxious children’s recognition for ‘disgusted’ and ‘jealous’ emotions also increased significantly during this period; however, their identification accuracy for ‘tired’ and ‘nervous’ emotions was also found to increase significantly.

Objective #3: Effects of Anxiety Subtypes on Emotion Recognition Accuracy in Children with Anxiety Disorders

A Kruskal-Wallis test was initially conducted to examine the effect of subtypes on anxious children’s emotion recognition accuracy, due to the small SP group size with a bi-modal data distribution. This non-parametric test did not take into account age effect on emotion recognition, and the results revealed that there was a significant group difference in emotion recognition accuracy, $X^2 (3) = 9.49$, $p = 0.02$. A post-hoc test using a series of
Mann-Whitney tests with Bonferroni adjustment and the alpha level set at 0.008 (0.05 / 6) showed significant differences in total accuracy score received on MAAC between the SAD and control groups ($U = 191.50$, $Z = -2.83$, $p = 0.005$, $r = 0.33$) and between the SAD and GAD groups ($U = 104.50$, $Z = -2.87$, $p = 0.004$, $r = 0.41$).

A parametric test of ANCOVA was also conducted to compare the mean total accuracy scores across different anxiety disorder groups, while controlling for possible age effects. In this type of analysis, the assumption of homogeneity of regression slopes must be met as it relates to how the covariate and the dependent variable are associated with each other for every comparison group (Field, Miles, & Field, 2012, pp. 466). If this assumption is violated, the results and conclusions will be misleading.

The assumption of homogeneity of regression slopes was met for the ANCOVA, $F (3, 109) = 2.28$, $p = 0.08$. The result of ANCOVA indicated that group differences by primary anxiety diagnosis (covarying for age) were significant, $F (3, 112) = 4.47$, $p = 0.004$, eta-squared = 0.11 (Figure 1). Pairwise comparisons between SAD ($M = 18.27$, $SD = 0.75$) and all other groups were significant with Bonferroni corrections (GAD [$M = 21.05$, $SD = 0.46$, $p = 0.01$]; SP [$M = 21.42$, $SD = 0.86$, $p = 0.04$]; control [$M = 21.28$, $SD = 0.35$, $p = 0.003$]), but those among GAD, SP, and control groups were not. However, interpreting this result required caution because age was significantly correlated only with the total accuracy score in the SAD ($r = 0.60$, $p = 0.03$) and GAD groups ($r = 0.68$, $p < 0.001$), but not in the SP group ($r = 0.20$, $p = 0.59$).

Therefore, we repeated an ANCOVA without the SP group, while age was controlled for. The ANCOVA for group differences by primary diagnosis was still significant, $F (2, 103) = 7.06$, $p = 0.001$, eta-squared = 0.12, but very close to violating the homogeneity of
regression slopes assumption, F (2, 101) = 2.90, p = 0.05. Bonferroni-corrected pairwise comparisons showed that the SAD group was still significantly lower on total accuracy score than the GAD (p = 0.001) and control groups (p = 0.006). However, the GAD and control groups were not significantly different from each other (p > 0.99).

Linear regression equations of age predicting total accuracy score in both SAD and GAD groups were: (1) Predicted total accuracy score in the SAD group = 6.64 + 1.36 Age (years); (2) Predicted total accuracy score in the GAD group = 3.90 + 1.99 Age (years). Both of these regression lines had an intercept lower than that for the control group, but only one for the GAD group was statistically significant (SAD [Delta B0 (SAD-CONT) = -7.71, 95% CI - 19.19 to - 3.77, p = 0.18; GAD [Delta B0 (GAD-CONT) = -10.45, 95% CI - 19.04 to - 1.87, p = 0.02). The slope of the SAD group line was not significantly different from that for the control group, Delta B1 (SAD-CONT) = 0.55, 95% CI - 0.79 to 1.89, p = 0.42, whereas the slope of the GAD group line was significantly steeper than that for the control group, Delta B1 (GAD-CONT) = 1.18, 95% CI 0.20 to 2.16, p = 0.02 (Figure 2).

To compare emotion recognition accuracy of specific emotions between the SAD group and the control group, an ordinal regression analysis was performed for each of sixteen specific emotions. However, the analyses did not detect any deficit in recognition of a specific type of emotion (Table 2).
Discussion

The present study was the first to examine age effects on anxious children’s emotion recognition and the first to examine how some of the most documented anxiety disorders for anxious children, SAD and GAD, are related to the ability to recognize others’ emotions. Children in our study ranged from 6 to 11 years, when children’s verbal skills are not correlated with the ability to identify emotions (Steele, Steele, & Croft, 2008). With these considerations, we revisited the question of whether anxiety diagnosis is associated with children’s ability to recognize the emotional states of others, illuminating explanations for contradictory findings in the past.

Emotion Recognition Accuracy in Children with and without Anxiety Disorder

Because the prevalence of specific anxiety disorders in children varies across epidemiologic studies (Cartwright-Hatton et al., 2006), our anxiety group may not show the same diagnostic distributions as children with anxiety disorders in the general population. Initially, we placed different anxiety types into one proband group to replicate conventional research designs that neglected to examine various types of primary diagnosis.

When children with and without anxiety disorders are compared with non-anxious children on emotion recognition abilities, our results show that children with anxiety disorders can identify the emotional states of others as accurately as children without anxiety disorder. This finding is consistent with a recent meta-analysis of emotion recognition in children with anxiety disorders (Demenescu et al., 2010) and with the findings of McClure et al., (2003) Manassis and Young (2000), and Guyer et al. (2007). Moreover, we failed to detect any difficulty in children with anxiety disorders in recognizing any specific type of emotion compared with children without any anxiety disorder. Rather, children with anxiety
disorders seem proficient in recognizing basic emotions when various types of emotion-related cues are available.

**Effects of Age and Anxiety Subtypes on Emotion Recognition Accuracy**

Our findings indicate that, as in children without anxiety disorder, the general ability to recognize others’ emotions in children with anxiety disorders increases significantly with age, and the rate of improvement is comparable with that of children without anxiety disorder. In both children with and without anxiety disorders, recognition of ‘disgust’ improves significantly between 6 and 11 years of age. Furthermore, in both groups, identification accuracy of some complex emotions increases significantly each year, especially emotions conveyed via bodily or contextual cues (e.g. ‘jealous’, ‘pleased/proud’, ‘tired’ and ‘nervous’). On the other hand, the recognition of ‘nervous’ appears to improve significantly each year during the elementary years in children with anxiety disorders, whereas the recognition of ‘proud’ improves significantly each year in children without anxiety disorders.

When age effects were controlled, children with SAD demonstrated a significantly lower overall ability to recognize the emotional states of others, compared with children without anxiety disorder and children with the primary diagnosis GAD or SP. Like children with GAD or children without anxiety disorder, children with SAD demonstrated age-dependent improvement in emotion recognition accuracy. On the other hand, children with GAD also showed difficulty at a young age, but their ability to identify others’ emotions improved with age at a faster rate to catch up with that of children without anxiety disorder during school years.

**Limitations and Clinical Implications**
Our study has limitations. First, the present findings are limited to children ages 6 through 11 years. Second, our findings do not address whether children with anxiety disorders have problems recognizing their own emotional states, but the scope of our research is limited to recognizing others’ emotional states through a female animated character. Third, including more participants with SAD or SP would have much improved statistical confidence/power, especially regarding age effects on emotion recognition accuracy in these subgroups. Fourth, we did not measure general intelligence or verbal skills of our participants as a covariate. Fifth, children with anxiety disorders in our study were not more state anxious than their non-anxious counterparts at the time of testing. Therefore, our findings do not capture these children’s ability to recognize emotions during anxiety-provoking situations (for example, social activities for children with SP). Sixth, there may have been ceiling effects in the measure as participants generally made few errors on recognizing basic emotions. Lastly, MAAC does not measure processing time for emotion recognition.

Our findings suggest that augmenting emotion recognition skills may help children with SAD and early school-age children with GAD, as they appear to have difficulty identifying various emotions, compared with their non-anxious counterparts. However, the treatment may be more effective if clinicians discuss various types of cues for both basic and complex feelings, not limited to facial cues for basic emotions only, with these children. Finally, our findings support the flexible use of anxiety-focused CBT, allowing for increased emphasis on understanding emotions in children with anxiety disorders with deficits in social or emotional understanding. However, such flexibility may be less crucial in children with GAD, whose impaired emotion recognition seems transitory at a young age.
Future Directions

First, future directions include a comparison of emotion recognition deficits with other clinical groups using a developmentally sensitive tool in school-age children with SAD. Second, as the ability to identify others’ emotions in children with SP was not linearly commensurate with age, this clinical subgroup needs to be re-examined with a larger sample size of varying ages. Third, emotion recognition ability of children with anxiety disorders needs to be measured during anxious states to determine if their recognition is distorted in such situations, and in relation to gender. Lastly, longitudinal studies will be required to confirm the developmental trajectory of emotion recognition ability in children with anxiety disorders.
### Table 1. Characteristics of the Anxiety Group and the Control Group

<table>
<thead>
<tr>
<th></th>
<th>Anxiety (n=63)</th>
<th>Control (N=59)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N</td>
<td>%</td>
</tr>
<tr>
<td><strong>Primary Anxiety Diagnosis</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SAD</td>
<td>13</td>
<td>20.6</td>
</tr>
<tr>
<td>GAD</td>
<td>35</td>
<td>55.6</td>
</tr>
<tr>
<td>SP</td>
<td>10</td>
<td>15.9</td>
</tr>
<tr>
<td>Specific Phobia</td>
<td>3</td>
<td>4.8</td>
</tr>
<tr>
<td>PTSD</td>
<td>2</td>
<td>3.2</td>
</tr>
<tr>
<td><strong>Secondary Anxiety Diagnosis</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>None</td>
<td>34</td>
<td>54.0</td>
</tr>
<tr>
<td>SAD</td>
<td>3</td>
<td>4.8</td>
</tr>
<tr>
<td>GAD</td>
<td>13</td>
<td>20.6</td>
</tr>
<tr>
<td>Social Phobia</td>
<td>5</td>
<td>7.9</td>
</tr>
<tr>
<td>Specific Phobia</td>
<td>3</td>
<td>4.8</td>
</tr>
<tr>
<td><strong>Secondary Non-anxiety Diagnosis</strong></td>
<td></td>
<td></td>
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<tr>
<td>ADHD</td>
<td>1</td>
<td>1.6</td>
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<tr>
<td>ODD</td>
<td>1</td>
<td>1.6</td>
</tr>
<tr>
<td>LD</td>
<td>3</td>
<td>4.8</td>
</tr>
<tr>
<td>Boys</td>
<td>28</td>
<td>44.4</td>
</tr>
<tr>
<td>Age &lt;8</td>
<td>19</td>
<td>30.2</td>
</tr>
<tr>
<td><strong>Age – mean (SD)</strong></td>
<td>8.7</td>
<td>1.2</td>
</tr>
</tbody>
</table>

*Note: N and % refer to the number of individuals and their percentage relative to the total group size, respectively.*
<table>
<thead>
<tr>
<th>Emotion</th>
<th>Anxiety, Compared with Control Group</th>
<th>SAD, Compared with Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Odds Ratio</td>
<td>(95% CI)</td>
</tr>
<tr>
<td>Relaxed</td>
<td>1.0</td>
<td>(0.5, 2.0)</td>
</tr>
<tr>
<td>Bored</td>
<td>1.2</td>
<td>(0.6, 2.5)</td>
</tr>
<tr>
<td>Tired</td>
<td>0.7</td>
<td>(0.3, 1.4)</td>
</tr>
<tr>
<td>Surprised</td>
<td>0.6</td>
<td>(0.2, 1.3)</td>
</tr>
<tr>
<td>Sad</td>
<td>0.9</td>
<td>(0.4, 1.8)</td>
</tr>
<tr>
<td>Guilty</td>
<td>0.9</td>
<td>(0.5, 1.9)</td>
</tr>
<tr>
<td>Ashamed</td>
<td>0.7</td>
<td>(0.3, 1.5)</td>
</tr>
<tr>
<td>Angry</td>
<td>1.5</td>
<td>(0.3, 6.9)</td>
</tr>
<tr>
<td>Irritable</td>
<td>0.9</td>
<td>(0.5, 1.8)</td>
</tr>
<tr>
<td>Jealous</td>
<td>1.2</td>
<td>(0.6, 2.3)</td>
</tr>
<tr>
<td>Scared</td>
<td>1.0</td>
<td>(0.4, 2.5)</td>
</tr>
<tr>
<td>Nervous</td>
<td>1.5</td>
<td>(0.8, 3.0)</td>
</tr>
<tr>
<td>Disgusted</td>
<td>0.9</td>
<td>(0.4, 1.7)</td>
</tr>
</tbody>
</table>
Table 2. Ordinal Regression Analyses of Anxiety Diagnosis and Separation Anxiety Disorder Predicting Emotion Recognition Accuracy in Comparison with the Control Group (Continued)

<table>
<thead>
<tr>
<th>Emotion</th>
<th>Anxiety, Compared with Control Group</th>
<th>SAD, Compared with Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Odds Ratio  (95% CI)  P</td>
<td>Odds Ratio  (95% CI)  P</td>
</tr>
<tr>
<td>Happy</td>
<td>1.6  (0.5, 4.9)  0.4</td>
<td>2.0  (0.2, 16.2)  0.5</td>
</tr>
<tr>
<td>Elated</td>
<td>1.1  (0.5, 2.1)  0.9</td>
<td>0.6  (0.2, 2.3)  0.5</td>
</tr>
<tr>
<td>Proud</td>
<td>1.1  (0.5, 2.5)  0.7</td>
<td>0.4  (0.09, 1.9)  0.3</td>
</tr>
<tr>
<td>Emotion</td>
<td>Control Odds Ratio</td>
<td>Control (95% CI)</td>
</tr>
<tr>
<td>-----------</td>
<td>--------------------</td>
<td>------------------</td>
</tr>
<tr>
<td>Disgusted</td>
<td>2.1</td>
<td>(1.3, 3.3)</td>
</tr>
<tr>
<td>Jealous</td>
<td>1.8</td>
<td>(1.2, 2.7)</td>
</tr>
<tr>
<td>Proud</td>
<td>2.0</td>
<td>(1.2, 3.3)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bored</td>
<td>1.5</td>
<td>(1.0, 2.5)</td>
</tr>
<tr>
<td>Ashamed</td>
<td>1.4</td>
<td>(1.0, 2.2)</td>
</tr>
<tr>
<td>Relaxed</td>
<td>1.4</td>
<td>(1.0, 2.0)</td>
</tr>
<tr>
<td>Happy</td>
<td>1.6</td>
<td>(0.9, 3.0)</td>
</tr>
<tr>
<td>Guilty</td>
<td>0.8</td>
<td>(0.5, 1.1)</td>
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<tr>
<td>Nervous</td>
<td>1.3</td>
<td>(0.9, 1.8)</td>
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<tr>
<td>Irritable</td>
<td>1.2</td>
<td>(0.8, 1.8)</td>
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<tr>
<td>Angry</td>
<td>0.7</td>
<td>(0.3, 1.5)</td>
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<tr>
<td>Surprised</td>
<td>1.2</td>
<td>(0.8, 1.8)</td>
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Table 3. Ordinal Regression Analyses of Age Predicting Emotion Recognition Accuracy for Children with and without Anxiety Disorder (continued)

<table>
<thead>
<tr>
<th>Emotion</th>
<th>Control</th>
<th>Anxiety</th>
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<tr>
<td></td>
<td>Odds Ratio (95% CI)</td>
<td>P</td>
</tr>
<tr>
<td>Sad</td>
<td>0.9 (0.6, 1.3)</td>
<td>0.6</td>
</tr>
<tr>
<td>Elated</td>
<td>1.1 (0.7, 1.6)</td>
<td>0.7</td>
</tr>
<tr>
<td>Tired</td>
<td>0.9 (0.6, 1.3)</td>
<td>0.7</td>
</tr>
<tr>
<td>Scared</td>
<td>1.0 (0.6, 1.6)</td>
<td>0.9</td>
</tr>
</tbody>
</table>
Figures

Figure 1. Total Accuracy Score by Anxiety Types: SAD, GAD, SP, and Control Groups

- Significant difference among test groups, $F(3,112)=4.47, p=0.004$, eta-squared=0.11
Figure 2. Regression Lines for Age and Total Accuracy Score on MAAC in the SAD and GAD Groups, Comparison with the Control Group

- Compared to the control group, the y-intercept of the SAD group was not significantly lower ($p = 0.18$), and the slope was not significantly different ($p = 0.4$).
- Compared to the control group, the y-intercept of the GAD group was significantly lower ($p=0.02$), and its slope was significantly steeper ($p=0.02$)
Chapter Three

Effect of Gender on Emotion Recognition Accuracy in Children with Anxiety Disorders

This chapter was prepared as a brief report for journal submission
Abstract

The present study examined the link between gender and emotion recognition accuracy in school-age children with and without anxiety disorders. Gender failed to predict overall emotion recognition accuracy. However, disgust recognition was significantly less accurate in clinically anxious girls than in clinically anxious boys, and was also less accurate, albeit not significantly so, than in age-matched non-anxious girls.
Introduction

The ability to accurately recognize emotions through nonverbal cues mediates children’s social and academic outcomes (Izard et al., 2001). This ability may be associated with anxious children’s social difficulties and hence requires scrutiny. There is a lack of theoretical model that explains for gender differences in emotion recognition patterns. Nevertheless, in non-anxious children, girls are significantly more accurate than boys in recognition of emotions via facial cues (McClure, 2000), and this female advantage is also consistent across different cultures (Elfenbein et al., 2002).

In children with anxiety disorders, gender differences have not been extensively examined in relation to emotion recognition accuracy. To elucidate the nature of their emotional difficulties, however, it may be important to characterize gender differences in emotion recognition accuracy in this clinical population. More specifically, gender-specific patterns of emotion recognition accuracy in anxious children may reveal a novel biobehavioral marker for anxiety disorders of childhood. Therefore, we examined gender effects on emotion recognition accuracy in clinically anxious children, using developmentally sensitive, dynamic displays of emotions. Then, we compared the result with that for non-anxious, age-matched counterparts.
Methods

Data were obtained from a previous study by Lee et al. (2013), which included 122 school-aged children (57 boys and 65 girls) 6-11 years of age, consisting of 63 clinic-referred children with an anxiety disorder at the Hospital for Sick Children in Toronto and 59 non-anxious volunteers. Diagnostic interviews were conducted by experienced clinicians, using the Anxiety Disorders Interview Schedule. Any child with ongoing treatments or with a presentation of psychosis or intellectual disability was not included in this study. The anxiety group mainly consisted of children with separation anxiety disorder (n=13), generalized anxiety disorder (n=35), and social phobia (n=10), with a few participants with specific phobia (n=3) and post-traumatic stress disorder (n=2). The control group did not contain any anxiety or non-anxiety DSM diagnoses.

Emotion recognition accuracy was measured with Mood Assessment via Animated Characters (MAAC), a computerized self-report instrument, specifically designed for anxious children (Manassis et al., 2013). MAAC presents a child-friendly character expressing sixteen types of emotions (relaxed, bored, tired, surprised, sad, guilty, ashamed, angry, irritable, jealous, scared, nervous, disgusted, happy, elated, and proud) via facial, bodily, and contextual cues in dynamic motion.

All children viewed each of sixteen emotion-specific animations, and were asked to identify the character’s emotional state. The child’s response for each emotion was scored for accuracy (0=incorrect, 1=close to correct, 2=correct), and individual scores were summed for the total accuracy score. Inter-rater agreement on scoring was previously computed (Lee, Dupuis, Jones, Guberman, Herbert, & Manassis, 2013), and was excellent (kappa=0.92, p < 0.001).
**Statistical Analysis**

The total accuracy score was compared between anxious boys and anxious girls using an independent t-test. Then, ordinal regression analyses were used to compare emotion recognition accuracy between the gender groups on each of sixteen emotions. Using the same method, accuracy was also compared between genders in non-anxious children and between anxious girls and non-anxious girls. Further, we measured state anxiety (T-score on the State-Trait Anxiety Inventory for Children) and depressive symptoms (T-score on the Children’s Depression Inventory) to control for potential confounding factors.
Results

Boys with Anxiety Disorders vs. Girls with Anxiety Disorders

Boys with anxiety disorders (n = 28, M = 8.83, SD = 0.97) and girls with anxiety disorders (n = 35, M = 8.51, SD = 1.25) were matched for age, \( t (61) = 1.09, p = 0.28 \), state anxiety (\( p = 0.67 \)), and depressive symptoms (\( p = 0.06 \)). The normality assumption was satisfied for total accuracy score within both groups.

When an independent t-test was conducted, there was no significant difference between boys with anxiety disorders (M = 21.46, SD = 2.50) and girls with anxiety disorders (M = 19.94, SD = 3.54) in the overall recognition accuracy (i.e. total score), \( t (61) = 1.89, p = 0.06 \). Ordinal regression analyses revealed that clinically anxious boys and clinically anxious girls were not significantly different in recognition accuracy on most of the specific emotions (Table 1). However, girls with anxiety disorders performed significantly worse than boys with anxiety disorders on recognition of disgust (\( p = 0.03 \)), boredom (\( p = 0.02 \)), and surprise (\( p = 0.02 \)).

Boys without Anxiety Disorder vs. Girls without Anxiety Disorder

Boys without anxiety disorder (n = 29, M = 8.25, SD = 1.36) and girls without anxiety disorder (n = 30, M = 8.34, SD = 1.38) were comparable for mean age, \( t (57) = -0.25, p = 0.80 \), state anxiety (\( p = 0.59 \)), and depressive symptoms (\( p = 0.53 \)). The normality assumption was satisfied within both non-anxiety groups.

Gender did not have any significant effect on the outcome of the overall emotion recognition accuracy, \( t (57) = -1.07, p = 0.29 \). The results of ordinal regression analyses indicated that there was no significant gender effect on recognition accuracy for most specific emotions; however, girls without anxiety disorder recognized the ‘relaxed/calm’ emotion more accurately than boys without anxiety disorder (\( p = 0.02 \)).
Girls with Anxiety Disorders vs. Girls without Anxiety Disorder

Girls with anxiety disorders and girls without anxiety disorders were matched for age, \( t(63) = -0.55, p = 0.59 \), and state anxiety \((p = 0.14)\), but depressive symptoms were significantly higher in clinically anxious girls \( (p = 0.006) \). However, depressive symptoms did not significantly predict total accuracy score in clinically anxious girls \( (r = 0.09, p = 0.64) \) or non-anxious girls \( (r = 0.21, p = 0.34) \). The result indicated that clinically anxious girls \( (M = 19.94, SD = 3.54) \) and non-anxious girls \( (M = 21.08, SD = 3.02) \) did not differ in recognition accuracy for overall, \( t(63) = 1.87, p = 0.07 \), and specific emotions (Table 1). Accuracy in disgust recognition between groups did not differ significantly, but came close to significance level with ordinal regression analysis \( (p = 0.06) \) in which misidentifying disgust as anger was given the score of one (i.e. close to correct). The partial score for the response of anger for disgust is justified by the fact that anger and disgust share the same emotional valence (negative) and that in the disgust animation the character looks somewhat angry when she throws down her lunch bag after sticking out her tongue. However, one may also argue that previous studies in this field consistently used a dichotomous scoring method (correct vs. incorrect), and that the response of anger should not be given a partial credit. Therefore, a 2x2 contingency table was also generated in which misidentifying disgust as anger was not given a score, and in this analysis girls with anxiety disorders showed significantly lower accuracy in recognition of disgust than girls with anxiety disorders \( (p = 0.04) \). However, no significant difference was detected on all other specific emotions with the 2x2 contingency table.
Discussion

Although limited by modest sample size, our findings suggest that gender plays a minimal role in overall emotion recognition accuracy in children with anxiety disorders. The finding regarding children without anxiety disorder in this study is inconsistent with the result of a meta-analysis by McClure (2002), and suggests that school-age girls are not more proficient than boys in emotion recognition when a combination of various dynamic, non-verbal cues for emotion are available. This inconsistency may suggest that non-anxious boys make effective use of contextual cues to compensate their difficulty with facial emotion recognition compared with girls. If so, the present results may be generalizable to real world social settings where various non-verbal channels of expression and contextual cues are available to children.

Interestingly, girls with anxiety disorders in our study are particularly less accurate in disgust recognition, often misidentifying disgust as anger. In children without anxiety disorder, however, boys and girls can recognize disgust at a comparable level when dynamic facial, bodily, and contextual cues are presented. Based on this evidence, inaccurate disgust recognition in girls with anxiety disorder may be a characteristic of anxiety disorders of childhood. Impaired disgust recognition has also been reported in individuals with certain types of OCD (Sprengelmeyer et al., 1997; Rector et al., 2012) or with severe OCD (Parker, McNally, Nakayama, & Wilhelm, 2004). Thus, the present finding on disgust recognition may be implicated in identifying a shared characteristic of anxiety disorders and OCD.

Due to sample size constraints, it was not possible to examine gender effects on emotion recognition in children with each specific type of anxiety disorders. Because types of anxiety disorders may have an effect on emotion recognition accuracy (Lee et al., 2013), future study of this issue is indicated. Further, a deficit in disgust recognition in girls with anxiety disorders in
comparison with girls without anxiety disorder was only apparent when one type of
scoring/analysis was used. Therefore, replication of our study is required. Including OCD
participants in future studies may clarify if deficit is a potential marker for childhood anxiety.
Lastly, use of vocal cues as well as visual emotion cues in future studies may further increase
generalizability of the findings of this study.
### Table 1: Ordinal Regression Analyses of Gender and Clinical Status Predicting Emotion Recognition Accuracy on Specific Emotions

<table>
<thead>
<tr>
<th>Emotion</th>
<th>Anxious Girls vs. Anxious Boys</th>
<th>Anxious Girls vs. Non-anxious Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Odds Ratio (95% CI)</td>
<td>P</td>
</tr>
<tr>
<td>Relaxed</td>
<td>1.1 (0.4, 2.7)</td>
<td>0.9</td>
</tr>
<tr>
<td>Bored</td>
<td>0.2* (0.07, 0.7)</td>
<td>0.02</td>
</tr>
<tr>
<td>Tired</td>
<td>0.8 (0.3, 2.2)</td>
<td>0.7</td>
</tr>
<tr>
<td>Surprised</td>
<td>0.2* (0.07, 0.9)</td>
<td>0.02</td>
</tr>
<tr>
<td>Sad</td>
<td>0.6 (0.2, 1.6)</td>
<td>0.3</td>
</tr>
<tr>
<td>Guilty</td>
<td>1.4 (0.5, 3.7)</td>
<td>0.5</td>
</tr>
<tr>
<td>Ashamed</td>
<td>0.8 (0.3, 2.5)</td>
<td>0.7</td>
</tr>
<tr>
<td>Angry</td>
<td>- - -</td>
<td>-</td>
</tr>
<tr>
<td>Irritable</td>
<td>1.0 (0.4, 2.5)</td>
<td>&gt;0.9</td>
</tr>
<tr>
<td>Jealous</td>
<td>1.1 (0.4, 2.7)</td>
<td>0.9</td>
</tr>
<tr>
<td>Scared</td>
<td>0.7 (0.2, 2.5)</td>
<td>0.5</td>
</tr>
<tr>
<td>Nervous</td>
<td>0.7 (0.2, 1.8)</td>
<td>0.4</td>
</tr>
</tbody>
</table>
Table 1 Ordinal Regression Analyses of Gender and Clinical Status Predicting Emotion Recognition Accuracy on Specific Emotions (Continued)

<table>
<thead>
<tr>
<th>Emotion</th>
<th>Anxious Girls vs. Anxious Boys</th>
<th>Anxious Girls vs. Non-anxious Girls</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Odds Ratio (95% CI) P</td>
<td>Odds Ratio (95% CI) P</td>
</tr>
<tr>
<td>Disgusted</td>
<td>0.3* (0.1, 0.9) 0.03</td>
<td>0.4 (0.1, 1.6) 0.06</td>
</tr>
<tr>
<td>Happy</td>
<td>0.6 (0.09, 3.3) 0.5</td>
<td>1.4 (0.3, 6.0) 0.6</td>
</tr>
<tr>
<td>Elated</td>
<td>1.8 (0.7, 5.0) 0.2</td>
<td>0.9 (0.4, 2.5) 0.9</td>
</tr>
<tr>
<td>Proud</td>
<td>1.7 (0.5, 5.0) 0.4</td>
<td>1.2 (0.4, 3.3) 0.7</td>
</tr>
</tbody>
</table>

- The asterisk (*) represents a significant result
- None of the anxious boys misidentified ‘angry’, resulting in an empty cell
Chapter Four

Additional Analyses: Effects of State Anxiety, Depressive Symptoms, and Anxiety Symptoms on Emotion Recognition Accuracy in Children with Anxiety Disorders
Abstract

This additional analysis examined the effects of state anxiety, severity of depressive symptoms and anxiety symptoms on emotion recognition accuracy in children with and without anxiety disorders. We found that state anxiety, task completion time, and depressive/anxiety symptoms do not significantly predict overall emotion recognition accuracy in children with and without anxiety disorders. Thus, these factors may not play a decisive role in emotion recognition in children with anxiety and without anxiety disorders.
Introduction

The secondary analyses investigated possible effects of state anxiety, depressive symptoms, anxiety symptoms, and time elapsed for MAAC completion on emotion recognition accuracy in children with and without anxiety disorders. Based on previous research, state anxiety does not seem to be associated with emotion recognition accuracy in children without anxiety disorders. For example, Surcinelli et al. (2006) reports that state anxiety generally failed to predict emotion recognition accuracy. On the other hand, the effect of state anxiety on emotion recognition accuracy is still unknown for children with anxiety disorders, and this study is the first attempt to examine the link between state anxiety and emotion recognition accuracy in clinically anxious children. Moreover, the effects of task completion time, depressive symptoms, and anxiety symptoms on emotion recognition accuracy have not been reported for this clinical population. Therefore, this chapter examines the effects of these variables, and any finding will be preliminary to the literature.

Aims and Hypotheses

Objective #1: to determine the effect of state anxiety on emotion recognition accuracy in children with and without anxiety disorders.

According to previous research, state anxiety seems to have a significant effect on recognition accuracy in fear-related emotions in children without anxiety disorder (Surcinelli et al., 2006). It is therefore predicted that state anxiety will significantly affect recognition accuracy on fear-related emotions in children with anxiety disorders in this study.

Objective #2: to investigate the effect of depressive symptoms on emotion recognition accuracy in children with and without anxiety disorders.
Since the literature suggests that anxiety disorders often lead to depression in children and adolescents (Cole, Peeke, Martin, Truglio, & Seroczynski, 1998), it is predicted that depressive symptoms indicated by the CDI total T-score will be higher in children with anxiety disorders compared with children without anxiety disorder. It is also predicted that depressive symptoms will be negatively correlated with the overall total accuracy score received on MAAC regardless of the clinical status since adults with depression have a deficit in recognizing emotional expressions (Demenescu et al., 2010).

**Objective #3: to characterize the effect of anxiety symptoms on emotion recognition accuracy in children with and without anxiety disorders.**

Since the anxiety group in the present study consists of children characterized by clinically high levels of anxiety diagnosed by experienced clinicians, it is predicted that anxiety symptoms will be significantly more elevated (indicated by T-score on MASC and SCARED) in clinically anxious children than in non-anxious children.

We have further predicted that anxiety symptoms in children with and without anxiety disorders will be negatively correlated with total accuracy score on MAAC (i.e. the overall emotion recognition accuracy), but will be positively related to recognition accuracy for fear related emotions (e.g. scared, nervous).

**Objective #4: to determine the effect of time elapsed for completing MAAC on emotion recognition accuracy in children with and without anxiety disorders.**

For examining the effect of time elapsed for MAAC completion on emotion recognition accuracy, there is no specific hypothesis as children with anxiety disorders might make hasty and biased judgment on identifying the emotional states of others, or might work
more slowly as a result of excessive worry about answering correctly or worrying about what
the examiner might think.
Methods

Participants, procedures, and statistical analysis are consistent with those described in the Methods section in Chapter 2. Additional instruments used are described in this section. These additional surveys were completed either before or after the MAAC assessment to measure their level of state anxiety, depressive symptoms, and anxiety symptoms since such factors may cause confounding effects on research outcomes. Administration of measures was counterbalanced to minimize order effects.

Additional Instruments Used

Children’s Depression Inventory (CDI).

The Children’s Depression Inventory (CDI) is a paper-and-pencil self-report survey that measures the presence and severity of depression in children and adolescents (Kovacs & Beck, 1977). It is used as a screening instrument and to monitor changes in depressive symptoms over the course of treatment (Kovacs & Beck, 1977). The long form of the CDI consists of 27 questions, whereas the short form consists of 10 questions, each with a 3-point scale indicating severity of the symptoms (0 = symptoms absent, 1 = symptoms mild, 2 = symptoms definite). The present study used the long form of the CDI. The subscales include negative mood, interpersonal problems, ineffectiveness, anhedonia, and negative self-esteem, and the sum of these subscale scores yield the CDI total score whose T-score of 65 is interpreted as clinically significant. Reliability of the CDI in children and adolescents computed by coefficient alpha, item-total score product-moment correlation, and test-retest coefficients has been proven acceptable (Smucker, Craighead, Craighead, & Green, 1986).

Multidimensional Anxiety Scale for Children (MASC).
The Multidimensional Anxiety Scale for Children (MASC) instrument is a self-report questionnaire targeted for children and youth from the ages of 8 to 19 years. The measure contains 39 items, and addresses four distinct dimensions of children’s anxiety, including physical symptoms (tense/restless and somatic/autonomic), harm avoidance (perfectionism and anxious coping), social anxiety (humiliation/rejection and public performance fears), and separation anxiety/panic (March, Parker, Sullivan, Stallings, & Conners, 1997). The administration time of MASC is about 5-15 minutes, and the measure has an inconsistency index that detects the presence of reckless responses. MASC is equipped with Profile Sheets which allow the conversion of raw scores to standardized T-scores. Test-retest reliability ranges from satisfactory to excellent, whereas the parent-child agreement on ratings of anxiety is poor to moderate (March et al., 1997).

**The Screen for Child Anxiety Related Emotional Disorders (SCARED).**

The Screen for Child Anxiety Related Emotional Disorders (SCARED) consists of parent and self-report versions for screening anxiety disorders in children (Birmaher et al., 1997). This instrument provides information regarding children’s symptoms of somatic/panic disorder, general anxiety, separation anxiety, social phobia, and school phobia (Birmaher et al., 1997), and contains 41 items pertinent to these symptoms, each with a three-point scale (0 = not true, 1 = somewhat true, 2 = often true) (Birmaher et al., 1999).

Both the child and parent versions of SCARED show good internal consistency (alpha = .74 to .93), test-retest reliability (intra-class correlation coefficients = .70 to .90), and discriminative validity (from other non-anxiety disorders as well as within anxiety disorders) (Birmaher et al., 1997).
Results

Objective #1: To determine the Effect of State Anxiety on Emotion Recognition Accuracy in Children with and without Anxiety Disorders

The normality assumption was checked to determine if the dependent variable (i.e. total accuracy score) were normally distributed for each level of the independent variable. The histograms showed normally distributed data in the total sample, in the anxiety group, and in the control group; however, Kolmogorov-Smirnov (KS) and Shapiro-Wilk (SW) tests of normality assumed a normal distribution only for the control group.

When a one-way ANOVA was conducted, there was no significant group difference among the SAD, GAD, SP, and control groups, $F(3, 86) = 0.79, p = 0.50$.

A correlation analysis revealed that state anxiety was not significantly correlated with the average total accuracy score received in the total sample ($p = 0.64$). The correlation analysis was also conducted in the anxiety group and the control group, but no significant correlation was detected between state anxiety and total accuracy score in either anxious children ($p = 0.81$) or non-anxious controls ($p = 0.84$). Therefore, the ANCOVA analysis for the objective #3 of the present study excluded state anxiety as a covariate since the variable failed to show any significant association with the total accuracy score.

Ordinal regression analyses were performed to predict a relationship between state anxiety and recognition accuracy for specific emotions in both the anxiety and control groups. The result revealed that in clinically anxious children, an increase in state anxiety significantly decreased the accuracy for recognizing ‘surprised’, while significantly increasing the recognition accuracy for ‘irritable’ emotion (Table 1). However, in non-
anxious controls there was no significant association between state anxiety and recognition accuracy for any specific emotions (Table 1).

**Objective #2: The Effect of Depressive Symptoms on Emotion Recognition Accuracy in Children with and without Anxiety Disorders.**

The normality assumption for the CDI T-score was satisfied within the anxiety and control groups, but the GAD group showed a positively skewed distribution shown by a histogram and tests of normality: KS ($p = 0.03$) and SW ($p = 0.03$). However, the ratios of skewness and kurtosis statistics by standard error for the GAD group were both below the value of 2, thus correlation analyses were pursued.

The average T-score for the total score on CDI was compared between the anxiety and control groups using an independent t-test. The Levine’s test showed that the variances were unequal between the two groups ($p = 0.02$). The t-test result indicated that the t-scores were significantly different between the anxiety group ($M = 48.57, SD = 7.50$) and the control group ($M = 44.63, SD = 5.82$), $t(95.87) = -3.94$, $p = 0.005$. A one-way ANOVA detected a significant difference among the groups of SAD, GAD, SP, and control groups, $F(3, 90) = 3.42$, $p = 0.02$). A post-hoc test revealed that the GAD group and the control group were significantly different, such that CDI total t-score was higher in the GAD group ($M = 49.66, SD = 8.16$) than the control group ($M = 44.63, SD = 5.82$). However, no significant difference was detected between the SAD ($M = 47.60, SD = 7.53$) and control groups or between the SP ($M = 45.22, SD = 5.93$) and control groups.

Correlation analyses indicated that the T-score for the total CDI score was not significantly correlated with total accuracy score either in the anxiety group ($r = -0.07$, $p =$
0.61) or in the control group (r = - 0.10, p = 0.50). Further, no significant correlation between the variable and total accuracy score was reported within any of the subtype groups.

Ordinal logistic regression analyses in the anxiety group revealed that the T-score for the total CDI score was not significantly associated with accurate recognition of any specific type of emotions (p > 0.05) (Table 2). The variable was also not significantly associated with any of the specific emotions in the control group (Table 2).

**Objective #3: The Effect of Anxiety Symptoms on Emotion Recognition Accuracy in Children with and without Anxiety Disorders.**

The normality assumption for both the SCARED and MASC t-scores was satisfied within the anxiety and control groups. The same assumption was met for both t-scores within all of the different groups of anxiety disorders indicated by non-significant KS and SW test results (p > 0.05). Correlation analyses showed that T-score for the SCARED and MASC total score was not significantly related to total accuracy score in anxious children ([SCARED] r = - 0.06, p = 0.65; [MASC] r = 0.06, p = 0.73) and in non-anxious children ([SCARED] r = - 0.25, p = 0.06; [MASC] r = 0.10, p = 0.59).

The average T-scores for SCARED total score (M = 33.28, SD = 11.28), t (115) = - 5.16, p < 0.001, and MASC total score (M = 59.54, SD = 8.42), t (70) = - 4.23, p < 0.001, were significantly higher in the anxiety group than the T-scores for SCARED (M = 22.46, SD = 11.38) and MASC (M = 50.65, SD = 9.37) of the control group.

A one-way ANOVA was conducted to examine the presence of any group difference in T-score for SCARED among the different types of anxiety disorders, and detected a significant difference, F (3, 108) = 10.60, p < 0.001. A post-hoc test revealed that the SAD (M = 38.83, SD = 10.58) and GAD (M = 32.53, SD = 10.81) groups, but not the SP group
(M = 25.60, SD = 9.98), had significantly higher T-scores than the control group (M = 22.46, SD = 11.38). On the other hand, the same type of parametric analysis was not recommended for MASC T-scores because the SP group only had five scored MASC questionnaires. A non-parametric Kruskal-Wallis test was conducted instead, and found a significant group difference, chi square = 10.77, p = 0.01 with df = 3). Mann-Whitney tests using the Holm-Bonferroni adjustment indicated that only the GAD group was significantly lower on the T-score for the total MASC score (p = 0.005 with alpha level at 0.008) than the control group, but there was no significant difference among the anxiety subtypes on this measure.

Ordinal logistic regression analyses in the anxiety group showed that the T-score for the total SCARED score did not significantly predict the recognition accuracy for specific types of emotions. The ‘disgusted’ emotion was close to the significance level (chi square = 3.69, df = 1), but it was not statistically significant (p = 0.06) (Table 3). In the control group, the variable failed to significantly predict the accuracy outcome for any specific type of emotions (Table 3).

In the anxiety group, the T-score for the total MASC score also did not significantly predict the recognition accuracy for specific types of emotions. In the control group, the MASC T-score was a significant predictor for recognizing the ‘sad’ emotion (chi square = 7.75, p = 0.005, df = 1) with Cox and Snell and Nagelkerke values of 0.22 and 0.27, respectively. However, the MASC T-score failed to predict for other types of specific emotions.

**Objective #4: The Effect of Time Elapsed for Completing MAAC on Emotion Recognition Accuracy in Children with and without Anxiety Disorders.**
The normality assumption for the variable of the MAAC completion time in minutes was satisfied within the anxiety and control groups as well as within each anxiety disorder group, indicated by the ratios of skewness and kurtosis statistics / standard error, histograms, and KS and SW statistics ($p > 0.05$).

The average time elapsed for the completion of MAAC was not significantly different between clinically anxious children ($M = 14.05$, $SD = 2.36$) and non-anxious controls ($M = 13.62$, $SD = 2.32$), $t (120) = -1.03$, $p = 0.31$. A one-way ANOVA was performed to detect any significant difference among the different anxiety groups of SAD, GAD, SP, and control groups, but no significant difference was detected, $F (3, 113) = 1.43$, $p = 0.24$.

Correlation analyses showed that the elapsed time for completing MAAC was not significantly correlated with the average total accuracy score in the total sample ($r = 0.06$, $p = 0.50$), the anxiety group ($r = 0.04$, $p = 0.97$), or the control group ($r = 0.15$, $p = 0.28$). The effect of the time needed to complete MAAC on recognition accuracy for specific emotions was not examined due to missing data.
Discussion

Effects of State Anxiety and Time Elapsed for MAAC Completion on Emotion Recognition Accuracy in Children with and without Anxiety Disorder

The findings of the present study imply that state anxiety is not an important factor for emotion recognition accuracy in either children with anxiety disorders or children without anxiety disorder. In particular, the present result regarding the effect of state anxiety on emotion recognition accuracy supports the findings of previous studies. For instance, Cooper et al. (2008) found that state anxiety does not significantly influence the recognition accuracy for facial expressions of seven different types of emotions: anger, sadness, happiness, fear, surprise, disgust, and neutral. Further, the same result is also consistent with the finding of Surcinelli et al. (2006) that there is no association between state anxiety and recognition accuracy for anger, sadness, happiness, surprise, disgust, and neutral emotions. However, this previous study reported a significant association between state anxiety and recognition of fearful facial emotion, whereas state anxiety failed to predict fear recognition accuracy in the present study. Differences between this previous study and the present study may also relate to the enrollment of non-clinical participants with high- and low- state anxiety in the previous study versus our enrollment of clinical participants.

Clinically anxious children did not complete the MAAC tasks in haste or exhibited excessive worry about selecting ‘correct’ answers when compared with non-anxious children. Furthermore, task completion time (in minutes) does not seem to play a significant role in predicting emotion recognition accuracy in children with or without anxiety disorders. This finding may have some implications for MAAC administration in the future. For example, it may not be crucial to record time taken in MAAC administrations for school-aged children,
Whether clinically anxious or not, since elapsed time for MAAC task completion does not predict the child’s performance on emotion recognition tasks.

**Effects of Depressive Symptoms and Anxiety Symptoms on Emotion Recognition**

**Accuracy in Children with and without Anxiety Disorder**

Findings of this study suggest that children with anxiety disorders are significantly more depressed and anxious than children without anxiety disorder. Higher or more severe anxiety symptoms in children with anxiety disorders than without are expected. Further, the present findings are consistent with previous comorbidity research on anxiety disorders, showing that depressive symptoms are very common in this population (Anderson, Williams, McGee, & Silva, 1987; McGee et al., 1990; Seligman & Ollendick, 1998).

The findings of the present study suggest that the severity of anxiety symptoms or depressive symptoms does not seem to directly influence children’s overall emotion recognition accuracy. These findings, in conjunction with results of the main objectives in this thesis, suggest that clinical status and type of anxiety disorder in children predict their overall emotion recognition accuracy, but severity of anxiety symptoms does not.

Similarly, the severity of depressive symptoms may not play an important role in predicting emotion recognition accuracy in either clinically anxious children or non-anxious children. According to previous research, however, adult patients diagnosed with depression are significantly more impaired in emotion recognition than their non-depressed counterparts (Demenescu et al., 2010; Feinberg, Rifkin, Schaffer, & Walker, 1986; George, Huggins, McDermut, Parekh, Rubinow, & Post, 1998; Leppanen, Milders, Bell, Terriere, & Hietanen, 2004). Therefore, it may be the case that clinical status of depression, reflecting clinicians’ judgment in the diagnosis of depression, may be more important in predicting emotion
recognition accuracy than depressive symptoms in individuals measured by the CDI T-score. Another possible explanation for the non-significant effect of depressive symptoms on emotion recognition accuracy is that the effect may be gender-specific. For example, there is a report discussing the significant association between depressive feelings and impaired emotion recognition in non-anxious boys but not in non-anxious girls. Investigating this gender-specific effect of depressive symptoms on emotion recognition accuracy goes beyond the scope of the present study, but it may merit further research in the future.
### Tables

**Table 1.** Ordinal Regression Analyses of State Anxiety Predicting Recognition Accuracy for Specific Emotions in Children with and without Anxiety Disorder

<table>
<thead>
<tr>
<th>Emotion</th>
<th>Control</th>
<th>Anxiety</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Odds</td>
<td>(95% CI)</td>
</tr>
<tr>
<td>Relaxed</td>
<td>1.0</td>
<td>(0.9, 1.2)</td>
</tr>
<tr>
<td>Bored</td>
<td>0.9</td>
<td>(0.8, 1.1)</td>
</tr>
<tr>
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<td>(1.0, 1.3)</td>
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<td>(0.9, 1.2)</td>
</tr>
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<td>(0.9, 1.2)</td>
</tr>
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Table 1. Ordinal Regression Analyses of State Anxiety Predicting Recognition Accuracy for Specific Emotions in Children with and without Anxiety Disorder (Continued)

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<th>Anxiety</th>
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<tbody>
<tr>
<td></td>
<td>Odds Ratio (95% CI)</td>
<td>p-value</td>
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</tr>
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<tr>
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<tr>
<td>Proud</td>
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- The asterisk (*) denotes statistically significant result
Table 2. Ordinal Regression Analyses of CDI T-Score Predicting Recognition Accuracy for Specific Emotions in Children with and without Anxiety Disorder

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<th></th>
<th>Anxiety</th>
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<td>(95% CI)</td>
<td>p-value</td>
<td>Odds</td>
<td>(95% CI)</td>
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<td>(0.9, 1.2)</td>
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<td>(0.9, 1.1)</td>
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Table 2. Ordinal Regression Analyses of CDI T-Score Predicting Recognition Accuracy for Specific Emotions in Children with and without Anxiety Disorder (Continued)

<table>
<thead>
<tr>
<th>Emotion</th>
<th>Control</th>
<th>Anxiety</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Odds Ratio</td>
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<tr>
<td>Disgusted</td>
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<td>(0.9, 1.1)</td>
</tr>
<tr>
<td>Happy</td>
<td>1.1</td>
<td>(0.9, 1.2)</td>
</tr>
<tr>
<td>Elated</td>
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<td>(0.8, 1.0)</td>
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<td>Proud</td>
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<td>(0.9, 1.1)</td>
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<tr>
<td>Emotion</td>
<td>Control</td>
<td>Anxiety</td>
</tr>
<tr>
<td>---------</td>
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</tr>
<tr>
<td></td>
<td>Odds Ratio</td>
<td>(95% CI)</td>
</tr>
<tr>
<td></td>
<td>1.0</td>
<td>(1.0, 1.1)</td>
</tr>
<tr>
<td>Bored</td>
<td>1.0</td>
<td>(1.0, 1.1)</td>
</tr>
<tr>
<td>Tired</td>
<td>1.0</td>
<td>(1.0, 1.1)</td>
</tr>
<tr>
<td>Surprised</td>
<td>1.0</td>
<td>(1.0, 1.1)</td>
</tr>
<tr>
<td>Sad</td>
<td>1.0</td>
<td>(0.9, 1.0)</td>
</tr>
<tr>
<td>Guilty</td>
<td>1.0</td>
<td>(1.0, 1.1)</td>
</tr>
<tr>
<td>Ashamed</td>
<td>1.0</td>
<td>(1.0, 1.1)</td>
</tr>
<tr>
<td>Angry</td>
<td>1.0</td>
<td>(0.9, 1.1)</td>
</tr>
<tr>
<td>Irritable</td>
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<td>(1.0, 1.1)</td>
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<tr>
<td>Jealous</td>
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<td>(0.9, 1.1)</td>
</tr>
<tr>
<td>Scared</td>
<td>1.1</td>
<td>(1.0, 1.1)</td>
</tr>
<tr>
<td>Nervous</td>
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<td>(1.0, 1.1)</td>
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</table>
Table 3. Ordinal Regression Analyses of SCARED T-Score Predicting Recognition Accuracy for Specific Emotions in Children with and without Anxiety Disorder (Continued)

| Emotion | Control | | | Anxiety | | |
|---------|---------|------|------|---------|------|
|         | Odds Ratio | (95% CI) | p-value | Odds Ratio | (95% CI) | p-value |
| Disgusted | 1.0 | (1.0, 1.1) | 0.6 | Disgusted | 1.0 | (1.0, 1.1) | 0.07 |
| Happy   | 1.0 | (0.9, 1.1) | 0.8 | Happy | 1.0 | (0.9, 1.1) | 0.9 |
| Elated  | 1.0 | (1.0, 1.1) | 0.9 | Elated | 1.0 | (0.9, 1.0) | 0.9 |
| Proud   | 1.0 | (1.0, 1.1) | 0.2 | Proud | 1.0 | (1.0, 1.1) | 0.3 |
Chapter Five

General Discussion
General Discussion

To the author’s knowledge, the present study was the first to examine age effects on emotion recognition in children with anxiety disorders, and was the first to examine how some of the most documented types of anxiety disorders for anxious children, SAD and GAD, are related to the ability to recognize the emotional states of others. Furthermore, the study explored gender effects on emotion recognition in children with anxiety disorders, which had not been extensively studied in the past. Additionally, although not included as one of the main research manuscripts, the present study conducted secondary analyses to investigate potential impacts of state anxiety, task completion time, and depression/anxiety symptoms on emotion recognition accuracy in children with anxiety disorders, all of which had not been reported in the past. The fact that children’s age was carefully controlled to range from 6 to 11 years was a strength because at this age children’s verbal skills do not seem to be correlated with the ability to identify emotions (Steele et al., 2008). Thus, the study minimized the possible confounding effect of individual verbal ability on emotion recognition accuracy. Each of the study’s key findings will now be discussed in greater detail.

Emotion Recognition Accuracy in Children with and without Anxiety Disorder

The prevalence of specific anxiety disorders in children varies across epidemiologic studies (Cartwright-Hatton et al., 2006), and due to the high rate of comorbidity among specific disorders (Last, Strauss, & Francis, 1987) conventional research designs usually study children with anxiety disorders as a single group. Therefore, in the first objective of this study all the anxiety types of SAD, GAD, and SP (and a few children with PTSD or specific phobia) were combined into a single experimental group to explore findings of these past studies.
The result for this first objective suggested that children with anxiety disorders do not have difficulty identifying emotions accurately compared with children without anxiety disorder. Using the same conventional designs of past studies, combining various types of anxiety disorders into a single experimental group, the present study therefore produced results similar to those of previous studies of emotion recognition in children with anxiety disorders (Demenescu et al., 2010). Further, children with anxiety disorders did not seem to have any difficulty recognizing any specific type of emotions in comparison with children without anxiety disorder.

**Effects of Age on Emotion Recognition Accuracy in Children with and without Anxiety Disorders**

The result of the second objective indicated that emotion recognition accuracy linearly increases with age in children with and without anxiety disorders. Unlike the initial prediction of this study, however, the rate of improvement seemed to be comparable in the two groups. It was also suggested that the recognition accuracy for the basic emotion of disgust improves during the elementary school years in both children with and without anxiety disorders. Improvement in recognition of disgust may be a common feature of emotional development in children between 6 and 11 years of age. On the other hand, the same children did not show age-related improvement in recognition accuracy for other basic emotions (happy, sad, angry, and scared). This was the case because children with and without anxiety disorder were highly accurate in recognizing these emotions at 6 years of age, and statistical analyses could not detect any significant improvement beyond this age.

In both groups of children, recognition accuracy for some complex emotions increased significantly each year, especially those that were conveyed via bodily or
contextual cues (e.g. ‘jealous’, ‘proud/pleased’, ‘tired/exhausted’, ‘nervous’). This finding seems to be consistent with the trend shown in children without anxiety disorder that with increased age, representing wider social experiences and improved verbal ability to express complex emotions, they can recognize others’ complex feelings more accurately (Gross & Ballif, 1991).

Effects of Age and Anxiety Subtypes on Emotion Recognition Accuracy in Children with Anxiety Disorders

When the age effects were included as a covariate, the present study indicated that children with SAD have significantly lower overall emotion recognition accuracy, compared with non-anxious children and children with the primary diagnosis GAD or SP.

Although children with SAD demonstrated age-dependent improvement in emotion recognition accuracy in the present study, their recognition accuracy seems to be significantly lower than that of children without anxiety disorder at an early school age, and this deficit seems to continue throughout 6 to 11 years of age. By contrast, children with GAD also showed a deficit in emotion recognition accuracy at a young school age, but accuracy improved at a faster rate than that of SAD children to catch up with the accuracy of children without anxiety disorder at later school years. These findings are only discernible when age and different types of anxiety disorders are considered together. Conclusions for the SP group are limited by small sample size, but children with SP failed to display significant age effects on their overall emotion recognition accuracy.

The developmental delay in emotion recognition ability shown in children with SAD may relate to the observation that children with SAD tend to lack early social experiences due to their reluctance to leave their parents or attachment figures (Ollendick, King, & Yule,
1994, pp. 146). The rationale for this hypothesis is based on evidence that recognition of facial emotions can be influenced by children’s early social experiences (Pollak, Messner, Kistler, & Cohn, 2008). Learning or expertise in emotion recognition seems to develop with practice. On the other hand, children with GAD or SP may be more concerned than children with SAD about others’ perceptions, as (in GAD) they may worry about being bullied or scapegoated by peers and (in SP) they may worry about embarrassment and negative evaluation by others (Albano et al., 2003, pp. 285-292). These concerns all involve the children’s learning and inspection of others’ thoughts and feelings, potentially fostering development of emotion recognition skills.

Effects of Gender on Emotion Recognition Accuracy in Children with and without Anxiety Disorder

The findings on gender effects on emotion recognition accuracy in the present study imply that gender plays a minimal role in emotion recognition accuracy children with and without anxiety disorders. However, the present study found that gender is significantly related to disgust recognition accuracy such that girls with anxiety disorders are more impaired in recognizing disgust than boys with anxiety disorders or their non-anxious counterparts.

It is noteworthy that gender was not associated with emotion recognition accuracy in children without anxiety disorder in the present study. This is inconsistent with a previous meta-analysis on gender effects in emotion recognition accuracy, which suggested that non-anxious girls are more accurate than non-anxious boys on emotion recognition tasks (McClure, 2000). One possible explanation relates to the fact that children in the present study were shown various types of cues in dynamic motion. It is possible that boys in this
study may have effectively used contextual cues or dynamic bodily motion of the character to compensate for their delay, compared with girls, in facial emotion recognition. In real-life social settings, however, children assess others’ emotional states based on a combination of facial expressions, bodily gestures, and situational contexts. Therefore, findings of the present study (which used all of these cues) may be more generalizable than previous studies in the anxiety literature.

**Limitations**

The present study has a number of limitations. First, although participants were mainly from well-educated Caucasian families, detailed data for children’s cultural or ethnic background were not available for statistical analyses in this study. However, evidence suggests that cultural background may modulate amygdala activation during emotion processing, influencing emotion recognition accuracy. For instance, Asians tend to exhibit a significantly more robust amygdala response upon perceiving angry faces in comparison with Europeans, paralleled by decreased recognition accuracy (Durntl et al., 2012). Another example of culture-specificity is provided by a meta-analysis on cross-cultural universality and cultural specificity of emotion recognition. This study revealed that emotion recognition accuracy tends to increase when emotions are expressed and identified by individuals of the same national or ethnic group, reflecting in-group familiarity (Elfenbein & Ambady, 2002). In the present study, however, the main animated character of MAAC (Teena) is a white teenage girl. Although this character captures the local majority group status in terms of culture and ethnic background, her ethnicity may place children with minority status at a disadvantage with respect to emotion recognition.
Second, the analyses did not determine if the overall emotion recognition accuracy in children with anxiety disorders continues to linearly increase in relation to age after the age of eleven. Because the present research may have implications for child-focused CBT for anxiety disorders which targets children of ages up to 13 (Kendall, Gosch, Furr, & Sood, 2008), the ideal experiment would therefore have included children older than 11 (i.e. 12 and 13 year-old children) with anxiety disorders. Replication involving the full age range up to 13 years is warranted in order to better understand the development of emotion recognition accuracy in anxious children.

Third, the present findings are limited to recognition of the emotional states of a female animated character, which may or may not be generalizable to other children or other adults. Nevertheless, MAAC was used to ensure the validity of findings in young children who may have difficulty labelling emotions based on facial expressions. This limitation may be improved if both male and female characters, of varying ages, are presented in the future.

Fourth, the ability to recognize one’s own emotions or to recognize emotions using verbal cues has not been addressed in this thesis. However, a study of the roles of verbal and non-verbal cues in emotion recognition in persons with and without autism spectrum disorder (ASD) shows that individuals with ASD can use both verbal and non-verbal cues for emotions in the same way as individuals without ASD. High-functioning individuals with ASD rely more on non-verbal cues than verbal cues to recognize a speaker’s emotional states (Loveland et al., 1997). Based on this evidence from the literature of ASDs, the present study may be limited in the sense that it fails to assess if clinically anxious children rely more on non-verbal cues than verbal cues, or use both types of cues in the same manner as non-anxious children. Further, although clinically anxious children show proficiency in
recognizing basic emotions (e.g. happy, sad, angry) in the present study, it may be worthwhile investigating to what extent verbal cues contribute to these children’s recognition of complex emotions (e.g. jealous, irritable, proud). Such investigation would be relevant to the generalizability of our findings, as it is a common sense that we perceive both verbal and non-verbal cues in everyday situations.

Fifth, the present study contained moderately unequal group sizes, and increasing the sample size of certain comparison group(s) would have improved statistical confidence. For example, the numbers of participants in the SAD group and in the SP group were only 10 and 13, respectively, whereas the numbers in the GAD group and in the control group were 35 and 59, respectively. A mild to moderate degree of unequal group sizes can be expected and can sometimes reflect randomness (Schulz & Grimes, 2002). However, because all members in the present study are assumed to be equally influential, unequal sample group sizes that do not reflect the population distribution may cause a bias in the estimation of effect sizes (Kenny, Mannetti, Pierro, Livi, & Kashy, 2002). Therefore, an increase in sample size for both the SAD and SP groups could have improved the power of our analyses, especially regarding age effects on emotion recognition accuracy in these groups. This is especially true for the SP group, the only diagnostic group that failed to exhibit a significant correlation between age and emotion recognition accuracy. To resolve this limitation, the proband group in future studies must include a larger number of children with SAD or SP.

Sixth, the present study failed to investigate the effect of socioeconomic status (SES) of participating children’s families. In fact, SES appears to significantly affect emotion recognition accuracy such that persons with a higher SES tend to recognize others’ emotions better compared with those with a lower SES (Edwards, Manstead, & Macdonald, 1984; Hall
& Halberstadt, 1994). Thus, SES may have played a role in predicting emotion recognition accuracy in children with anxiety disorders in the present study, although the range of SES is generally narrow in this clinic (middle and upper middle class). Therefore, it may be more informative if future research includes children from various SES backgrounds and then examine the effects of various SES levels on emotion recognition accuracy.

Seventh, the present study did measure general intelligence of the child participants. Such information was not collected because the present study was a secondary analysis to the validation of MAAC (Manassis et al., 2013). However, the link between general intelligence and emotion recognition accuracy in anxious children is still unknown, and this may be an important factor in this analysis – ergo, this factor must be addressed in the future.

Eighth, children with anxiety disorders in the present study did not show higher state anxiety than their non-anxious counterparts at the time of the MAAC assessment. Therefore, our findings do not capture these children’s ability to recognize emotions during anxiety-provoking situations (e.g. social activities for children with SP). In the future, therefore, the present study may be repeated in anxious children when their state-anxiety is high (e.g. children with SP in anticipation of social activities or public performance).

Lastly, attentional and motivational factors may have caused a bias in the results of the present study as some scientists have argued that individual variance in emotion recognition accuracy is simply a reflection of individual differences in attention or motivation to decode emotional information from emotion-related stimuli (Buck, 1988). However, none of the existing research has assessed the effect of individual differences in attention and motivation on emotion recognition accuracy. The present study also did not assess the potential interaction between the effect of anxiety diagnosis and the effect of
attention and motivation on emotion recognition accuracy. These issues may also be addressed in later studies.

**Implications**

The present study may have some implications for CBT in the treatment of childhood anxiety disorders (e.g. Coping Cat program) as a part of the protocol guides clinicians and children with anxiety disorders to discuss cues for the emotional states of others. However, greater emphasis is still placed on recognition of one’s own emotions in these CBT programs.

Findings of the present study suggest, albeit within the limitations inherent to a cross-sectional research design, that expanded emotion recognition training may be helpful for children with anxiety disorders, especially children with the primary diagnosis of SAD. Increased emotion recognition training, however, may be more essential for younger anxious children (early school-age children) than older ones as the deficit in emotion recognition skills seems to be more prominent in the younger anxiety group in the present study. For example, both early school-age children with SAD and early school-age children with GAD appear to have difficulty identifying various emotions compared with their non-anxious counterparts in the present study. However, the deficit in emotion recognition ability remains constant throughout the elementary school years in children with the primary diagnosis of SAD, whereas the deficit seems to diminish with time in children with the primary diagnosis of GAD. Therefore, early intervention involving additional training in emotion recognition skills may lead to better social experiences for young anxious children than improving these skills during late childhood, especially in children with a primary diagnosis of GAD.
The present findings also demonstrate that children with anxiety disorders tend to be accurate in judging basic emotions (e.g. happy, sad, angry) of others (as displayed by the animated character) that can be conveyed via simple facial cues. Such findings are consistent with a meta-analysis of previous research that utilized static facial cues (Demenescu et al., 2010). In the present study, however, the deficit in emotion recognition ability in children with SAD becomes evident only when these children are tested on a range of both simple and complex emotions that are dynamically expressed via all facial, bodily, and situational cues. This observation suggests that emotion recognition training in CBT for anxious children may be more effective if clinicians facilitate discussions of various types of cues expressing a wide range of basic and complex emotions, not limited to facial cues for basic emotions only.

Another intriguing finding involves the decreased recognition accuracy for disgust in clinically anxious girls in comparison with clinically anxious boys and non-anxious girls. If replicated, it is possible that this finding may represent a marker for the presence of anxiety disorder since school-age girls without any anxiety diagnosis are not impaired in the ability recognize disgust in others in the present study. Although this idea may seem very speculative, due to the lack of supporting theoretical framework in the literature, it is not unique in the field as some reports claim that disgust recognition is impaired in individuals with OCD (Sprengelmeyer et al., 1997), and this association seems to depend on symptom severity and general functioning (Corcoran, Woody, & Tolin, 2008).

Overall, the present findings support the flexible use of anxiety-focused CBT, allowing for increased emphasis on emotion recognition in clinically anxious children with deficits in social or emotional understanding (Beidas et al., 2010). Such flexibility may be
less important, however, in children with the primary diagnosis of GAD whose impaired emotion recognition may be transitory at a young age.
Conclusion

Although the author must interpret the present findings in the context of study limitations, children with SAD showed a deficit in the recognition of others’ emotions relative to children without anxiety disorder. Young school-aged children with GAD also showed difficulty in this emotional domain. These underlying associations can be masked, however, if age and specific diagnosis factors are neglected. Lack of attention to these details in past studies may help explain their inconsistent results. Moreover, although gender plays a minimal role in emotion recognition accuracy in children with anxiety disorders, anxiety diagnosis may be related to impairment in disgust recognition in girls. This finding merits further study with the inclusion of other clinical groups. Clinically, facilitating emotion recognition skills may be a useful component of CBT for school-aged children with SAD and for younger children with GAD.
Chapter Six

Future Directions
**Future Directions**

First school-aged children with SAD (the group that showed emotion recognition deficits in this study) must be compared with other clinical groups using a developmentally sensitive tool (e.g. MAAC) to accurately assess the severity of this impairment. Although statistically significant, the difference in emotion recognition accuracy between the SAD group and the control group seems rather mild in this study, as children with SAD do not appear to have any difficulty recognizing any specific emotion in comparison to their non-anxious counterparts. Previously, McClure et al. (2003) found that children and adolescents with bipolar disorder are more severely impaired in facial emotion recognition than those with anxiety disorders or those without any psychiatric diagnosis. Therefore, comparing children with SAD with other clinical groups, such as children with bipolar disorder, may yield meaningful outcome data.

Second, emotion recognition accuracy in children with SP will need to be reassessed with a larger sample size of varying ages because the size of the SP group was small in the present study. Emotion recognition accuracy of children in this clinical group does not seem to linearly commensurate with age. With a significantly higher number of child participants with SP, however, future studies could assess the potential relationship between age and emotion recognition accuracy in this clinical subgroup. Such studies could also examine if other factors, such as certain demographic attributes (e.g. SES, ethnic/cultural background), are significantly associated with emotion recognition accuracy in this group.

Third, additional neuropsychological tests could be used in future studies to measure clinically anxious children’s general intelligence or IQ, verbal ability to express various emotions, and personality traits. Potential interactions between these neuropsychological
factors and age in predicting emotion recognition accuracy could then be investigated.

Personality traits are considered in this future direction because certain personality traits seem to predict emotion recognition accuracy in non-anxious persons. ‘Openness to experience’, for instance, is positively correlated with emotion recognition accuracy, whereas ‘neuroticism’ is negatively associated (Matsumoto et al., 2000). The latter finding is particularly relevant to anxiety disorders because ‘neuroticism’ is highly correlated with the presence of anxiety disorders in adults (Kotov, Gamez, Schmidt, & Watson, 2010).

Fourth, emotion recognition accuracy of clinically anxious children needs to be measured during anxious states to determine if their recognition is distorted in anxiety-generating situations. Reliable methods of inducing particular moods include the use of imagination, expressive behaviour, scripted/unscripted social situations, and music (Coan & Allan, 2007, pp. 9), but films or film fragments are the most conventionally and reliably used for inducing fearful mood or state anxiety in experimental conditions (Tovilovic, Novovic, Mihic, & Jovanovic, 2009). Therefore, in future research, clinically anxious children and non-anxious children could be shown film fragments validated in school-age children to increase their state anxiety, and both child groups’ emotion recognition ability could then be measured using MAAC. In the specific case of children with SP, an alternative method of inducing state anxiety might be to have them engage in public speaking (Martin, 1990). Such a method would be especially effective for inducing fear in children with SP whose primary anxiety pertains to public performance, presumably yielding results that are highly generalizable to real-life settings. Of course, anxiety induction would have to be time limited and relatively mild to ensure ethical treatment of child research subjects.
Fifth, the analysis of age effects on emotion recognition in the present study represents an exploratory analysis since a cross-sectional research design was used. Longitudinal studies will be required to confirm the developmental trajectory of emotion recognition accuracy in anxious children. This method is more suitable than the cross-sectional method for isolating the relationship between two variables without the interference of third variables based on individual differences, allowing researchers to comprehensively examine changes over time. Even with this method, however, some degree of sampling bias and inconsistency is unavoidable (Bayley, 1965; Rajulton, 2001).

Lastly, there have been recent proposed revisions in the diagnostic criteria of GAD for DSM 5 (i.e. removing the symptoms of fatigue, difficulty concentrating, irritability, and sleep disturbance). Therefore, children diagnosed with GAD based on these new diagnostic criteria must be re-examined in future studies.
References


Appendix A

Mood Assessment via Animated Characters (MAAC)

Mood Assessment via Animated Characters (MAAC) is a computerized self-report instrument designed for clinicians and researchers to effectively communicate about emotion in young children with anxiety disorders. MAAC provides various types of dynamic emotion cues (facial cues, bodily cues, and situational cues) through a teenage female animated character (“Teena”) in order to facilitate young children’s discussion of 16 types of feeling states (calm/relaxed, bored, tired, surprised, sad, guilty, ashamed, angry, irritable, jealous, scared, nervous, disgusted, happy, elated, and proud/pleased). This instrument was created by a team of clinicians who are experienced in the assessment and treatment of childhood anxiety disorders and researchers who have expertise in the clinical application of computer devices and computer animation (Manassis et al., 2009).

MAAC assesses young children’s ability to express and identify a range of both simple and complex (social) emotions of positive, negative, fearful and neutral valence. This instrument has been validated in children, 4-10 years of age, with and without anxiety disorders. The initial validation of MAAC included children younger than 8 because well-validated assessment instruments had been largely missing in this age group.

In terms of context in which MAAC is designed to be used, this instrument may be used in the clinic for screening for internalizing symptoms or anxious feelings in young anxious children who may not have fully developed the cognitive ability to verbally describe or label their feelings. However, the instrument can also be used in non-clinical settings (e.g. home, school) to discuss everyday feelings of young children.

**Administration, coding and scoring.**
The administration of MAAC takes about on average of 15 minutes. During the procedure, children are asked to express their current feelings by comparing them to those expressed by Teena, and asked to rate the intensity of these feelings on the Likert scale between 0 (not at all) and 5 (being an exact match) by selecting/tapping on the screen.

Then, the child and the interviewer together visit each of 16 emotions in order on MAAC screen, top to bottom and left to right, to view each of these emotion-specific animations. Upon viewing each clip, the child is asked to identify Teena’s feeling. Responses may be tape-recorded and scored based on how accurately the child identified each feeling state of Teena: 0 (incorrect), 1 (close to correct), 2 (correct).

To minimize the effect of verbal ability on emotion identification accuracy, any immature form of verbal responses, but with the correct emotional tenor, ought to be carefully considered. For example, young children without the verbal ability to label ‘disgusted’ may identify the emotion in a simpler term, such as ‘yucky’, and such response may be given a score of two. For this reason, it is highly recommended that multiple raters blindly score responses on MAAC and report the inter-rater agreement on scoring.

**Psychometric properties.**

Face validity: Factors on MAAC (positive, negative, fearful, and neutral groups) contain emotions of similar valence, suggesting face validity (Manassis et al., 2013).

Content validity: The content validity of each item has not been evaluated in relation to the symptoms content of anxiety disorders.

Construct validity (convergent validity, discriminant validity): The convergent validity has shown that children’s ratings of current feelings show a significant correlation with scores on the STAIC, whereas ratings of feelings for the past two weeks significantly
correlate with some of the measures of trait anxiety, such as KFQ, MASC, and SCARED. These correlations were reported in the expected direction such that ratings on negative emotions on MAAC predicted higher ratings on the anxiety measures of STAIC and SCARED, whereas those on positive emotions predicted lower ratings on STAIC and MASC. In terms of the discriminant validity for differentiating the anxiety and non-anxiety groups based on MAAC ratings, clinically anxious children identified themselves to be significantly less positive and less calm than non-anxious children (Manassis et al., 2013).

Internal consistency: Cronbach’s alpha values have been reported in four emotion factors of positive, negative, fearful, and neutral emotions. These values were 0.83, 0.76, 0.71, and 0.55, respectively.

Inter-rater reliability: Inter-rater reliability is excellent (kappa = 0.92).

Test-retest reliability and criterion validity await further investigation.