EMOTIONAL AWARENESS AND ALEXITHYMIA: EMOTIONAL PROCESSING AND REGULATION IN ADOLESCENCE

by

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Abstract

The adolescent transition involves a number of changes that for many adolescents result in increased negativity, heightened emotional reactivity, and risk for internalizing symptoms. The purpose of the present set of studies was to examine the role that emotional awareness has in relation to emotion regulation and to subsequent mood symptomatology in adolescence. The first study tested the hypothesized relationship between emotional awareness and emotion regulation, specifically, that emotional awareness is a necessary precursor to adaptive regulation efforts. This study examined the direct and indirect effects of emotional awareness on internalizing symptoms by exploring the extent to which certain emotion regulation strategies influence this relationship. The purpose of the second and third studies was to examine the association between emotional awareness and emotion regulation as measured by changes across three emotional response domains: 1) physiological arousal, 2) self-reported experience, and 3) observed expression during an ecologically valid emotion elicitation task. Participants in these studies were identified as alexithymic or non-alexithymic. Alexithymia involves difficulty identifying and describing emotions and has been used to classify individuals with extremely low emotional awareness. The second study examined the effects of alexithymia on the three emotional response domains in adolescents. Because of the high prevalence rates of alexithymia during adolescence, it could be an important vulnerability factor to help explain increases in internalizing symptoms during the adolescent transition. The purpose of the third study was to examine how patterns of decoupling between physiological arousal, self-reported experience, and observed expression were related to depressive and anxiety symptoms in alexithymic individuals. Overall, findings confirmed that emotional awareness is an important precursor to adaptive emotion regulation efforts. In addition, emotion regulation emerged as a more proximal
mechanism in the development of depressive and anxiety symptoms in individuals with low emotional awareness. At a theoretical level, this research has guided our understanding of emotional processing and regulation. At a practical level, results from this program of research will help guide intervention and treatment approaches for adolescents with low emotional awareness.
Statement of Co-Authorship

The three manuscripts included in this dissertation are the result of collaboration primarily between the doctoral candidate, Jennifer M. Eastabrook and her supervisor, Dr. Tom Hollenstein. As the principal investigator, Ms. Eastabrook was responsible for the design and conceptualization of this research, as well as data collection, analysis, and preparation of the manuscripts. Dr. Hollenstein assisted with all aspects of the research and provided editorial feedback during the preparation of these manuscripts, and appears as co-author on the three manuscripts. Part of this research was conducted in conjunction with data collection for Jessica Flynn’s Master of Science. As such, Ms. Flynn appears as co-author on the first manuscript. Data for the second study were collected in conjunction with Dianna Lanteigne’s Master of Science. Ms. Lanteigne also trained and supervised the coding teams for the second and third study. Therefore Ms. Lanteigne appears as a co-author on the second and third manuscripts.
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Chapter 1: General Introduction
General Introduction

The transition from childhood to adolescence involves a number of biological, cognitive, and social changes that result in increased negative affect, heightened emotional reactivity, and increased risk for internalizing symptoms for many adolescents (Arnett, 1999; Larson & Ham, 1993; Larson & Lampman-Petraitis, 1989; Wagner & Compas, 1990). Depression and anxiety disorders, for example, typically emerge during the adolescent transition and are two of the most common disorders to affect adolescents (Brooks-Gunn & Petersen, 1991; Cohen et al., 1993). Understanding the development of internalizing symptoms during adolescence is important as more than three quarters of adults with psychiatric disorders were originally diagnosed between the ages of 11 – 18 years (Kim-Cohen et al., 2003; Pine, Cohen, Gurley, Brook, & Ma, 1998). To examine adolescent mental health, a variety of emotional and social competence variables have been identified as important. Included in these are a number of interpersonal factors (e.g., peer, romantic, and family relationships) as well as intrapersonal factors (e.g., temperament, resilience, and coping). A number of studies have found that adolescents with poor emotional awareness have higher rates of both depressive and anxiety symptoms (Fine, Izard, Mostow, Trentacosta, & Ackerman, 2003; Lahaye, Luminet, Broeck, Bodart, & Mikolajczak, 2010; Penza-Clyve & Zeman, 2002; Sim & Zeman, 2004; Zeman, Shipman, & Suveg, 2002). Emotional awareness refers to an adolescent’s awareness of feelings and their ability to identify and describe those feelings (Ciarrochi, Heaven, & Supavadeprasit, 2008; Lane & Schwartz, 1987; Taylor, Bagby, & Parker, 1997). Across development, emotional awareness increases, beginning with a very basic understanding of emotions via physical sensations (e.g., an infant cries when hungry) and maturing into a more advanced understanding of emotions, including the ability to understand and identify mixed emotions (e.g., feeling angry and ashamed at the same
time). Therefore, while adolescents with low emotional awareness may be unable to identify the specific emotions they are feeling, they are likely still aware of the fact that they are experiencing some sort of general emotional arousal (Penza-Clyve & Zeman, 2002). Despite increasing evidence that a lack of emotional awareness is associated to internalizing symptoms in adolescence, questions remain as to what mechanisms are responsible for this relationship. The present set of studies therefore examined emotion regulation as a mechanism linking emotional awareness and internalizing symptoms in adolescence.

Emotion regulation involves a set of competencies and skills that allow an individual to modulate the intensity and quality of emotion (Gross, 1998) and is related to a number of healthy outcomes, such as positive social functioning (Eisenberg, Fabes, Guthrie, & Reiser, 2000) and subjective well-being (Larsen & Prizmic, 2004). Moreover, emotion dysregulation has been identified as a risk-factor associated with a number of mood disorders involving unregulated affect, such as anxiety and depression (Cole, Michel & Teti, 1994; Gross & Munoz, 1995). Successful emotion regulation is dependent on one’s ability to identify specific emotions, as different emotions may call for the use of different emotion regulation strategies (Schwarz & Clore, 1996; Stegge & Terwogt, 2007; Quigley & Feldman Barrett, 1999). An individual with low emotional awareness, who experiences emotions as global, undifferentiated feeling states, may therefore have a difficult time selecting an appropriate regulatory strategy. Thus, emotional awareness is a precursor for successful regulation and individual differences in emotional awareness may have important implications for regulation efforts.

The ability to be aware of and regulate one’s emotions may be particularly important during adolescence. While adolescents do not experience any new emotions that were not already present during childhood, they do experience heightened emotional arousal, increased
negative affect, and decreased positive affect (Dahl, 2001; Larson & Ham, 1993; Rosenblum & Lewis, 2003). Furthermore, adolescents are becoming more independent in their regulation efforts. Developmental and emotion theorists propose that the development of emotion dysregulation patterns in childhood and adolescence may lead to later development of psychopathology (Sheeber et al., 2009; Cole et al., 1994). Given that adolescents with emotion regulation deficits may be at risk for later psychopathology, the assessment of adolescents with low emotional awareness may prove beneficial and be of both theoretical and practical significance. At the theoretical level, this research will help to guide models of normative and pathological emotional processing as well as models of adolescent psychopathology. At the practical level, identifying mechanisms linking emotional awareness to internalizing symptoms via emotion regulation will help to guide intervention programs targeting those processes.

Embedded within these two areas of research (e.g., emotion research and adolescent development), the following three studies employed an individual differences approach to gain a better understand how a lack of emotional awareness affects regulation efforts and internalizing symptoms during adolescence. Although the relationship between emotional awareness and regulation has been identified in the literature, as of yet, little is known regarding the extent to which individual differences in emotional awareness are associated with the use of particular emotion regulation strategies and subsequent internalizing symptoms. The objective of the first study was to test the hypothesized relationship between emotional awareness and emotion regulation, specifically, that emotional awareness is a necessary precursor to adaptive regulation efforts. To test these relationships, emotional awareness, emotion regulation (reappraisal and suppression), depressive symptoms, and anxiety symptoms were measured in a group of 13-16 year old female adolescents. Female adolescents were selected for this study because gender
differences in emotional disorders emerge during the adolescent transition. While both male and female adolescents experience problems related to emotional arousal and reactivity, female adolescents in particular are at risk for internalizing problems, experiencing increases in the development of depression (Galambos, Leadbeater, & Barker, 2004; Nolen-Hoeksema & Girgus, 1994) and anxiety symptoms (Lewinsohn, Gotlib, Lewinsohn, Seeley, & Allen, 1998). It was expected that a lack of emotional awareness would be associated with less adaptive regulation strategies (suppression) while higher awareness would be associated with more adaptive regulatory strategies (reappraisal). We also expected that emotional awareness and internalizing symptoms would be negatively correlated, but that the direct relationship between awareness and internalizing symptoms would be diminished when the indirect effects of emotion regulation were included. This study expands our current understanding of the mechanisms through which emotional awareness is related to mood symptoms (via emotion regulation). This study also points to the fact that interventions focused on decreasing internalizing symptoms by improving emotion regulation strategies need to take into consideration an adolescent’s level of emotional awareness.

While the first study examined the hypothesized awareness–regulation relationship via self-report questionnaires, the second and third studies extend this research by 1) using an ecologically valid emotion elicitation task and 2) by assessing arousal and regulation as indexed by three primary emotional response domains: physiological arousal, self-reported experience, and observed expression. The purpose underlying both of these studies was to examine how a lack of emotional awareness affects emotion regulation in real-time in younger (Study 2) and older (Study 3) adolescents. By examining two age groups of adolescents we can examine patterns of responses between the two studies to see if the effects of alexithymia on emotional
responding are different as adolescents mature. Both studies employed an experimental paradigm involving an age-appropriate social stressor for adolescents: an impromptu 3-minute speech to provoke self-conscious affect. Measures of heart rate and galvanic skin response were recorded continuously before, during, and after the speech. Participants also completed self-report measures of experience before and after the speech, and video recordings of the speeches were coded for self-conscious affect. For studies two and three participant’s level of emotional awareness was assessed by the Toronto Alexithymia Scale (Bagby, Taylor, & Parker, 1994). Alexithymia characterizes individuals with extremely low emotional awareness and was originally identified in psychosomatic patients who demonstrated an inability to express emotions through the symbolic use of words (Ruesch, 1948). Today alexithymia is defined by four core deficits: 1) difficulty identifying feelings and distinguishing them from the somatic sensations of emotional arousal, 2) difficulty describing feelings, 3) externally oriented thinking, as evidenced by a preoccupation with concrete details of day-to-day life, and 4) impoverished imaginative processes, such as a lack of day dreaming. Participants in the second study consisted of a large normative sample of adolescents aged 12 – 16 years old, classified as having low, medium, or high levels of emotional awareness based on the TAS-20. Participants in the third study were older adolescents recruited specifically based on the alexithymic and non-alexithymic cut-off scores developed for the TAS-20.

Both of these studies are novel in that there are a limited number of studies that have examined the effects of emotional awareness as indexed by all three emotional response domains. While quite a few studies have included measures of physiological arousal and self-reported experience, only a limited number (Luminet, Rime, Bagby, & Taylor, 2004; Pollatos et al., 2011; Roedema & Simons, 1999) have also included measures of observed expression. This
is an important addition to the research for a number of reasons. First, each component of the emotion system can mature at a different rate across individuals (Gross, 1998; Mauss, Levenson, McCarter, Wilhelm, & Gross, 2005), thus, physiological, self-reported, and expressed responses can occur relatively independent of each other (Cacioppo, Uchino, Crites, Snydersmith, Smith, & Bernston, 1992; Frijda, Ortony, Sonnemansm & Clore, 1992; Zajonc & McIntosh, 1992). Individuals with low emotional awareness may therefore show a different pattern of responding depending on which emotional response domain is measured. Second, differences in observed expression between individuals with high vs. low emotional awareness may have important implications for socioemotional functioning. For instance, individuals with low emotional awareness may experience particular difficulties in social contexts where the quality of relationships is affected by emotional expressivity (Riggio & Friedman, 1986), emotional responsiveness (Reis & Shaver, 1988), and emotional self-disclosure (Laurenceau, Barrett & Pietromonaco, 1998). Indeed, alexithymia is related to social deficits, including less perceived social support, smaller social networks and decreased social skills (Lumley, Ovies, Stettner, Wehmer, & Lakey, 1996). Thus, these studies expand our current understanding of how deficits in observed expression may be related to mood symptomatology in individuals with low emotional awareness.

In addition to measuring all three emotional response domains, our second study is novel in that it is the first to examine the effects of alexithymia in adolescents. As a transitional period adolescents experience increased negative affect and heightened emotional reactivity (Larson, Csikszentmihalyi & Graef, 1980; Larson & Lampman-Petratis, 1989), therefore the ability to effectively regulate emotions is critical to maintaining socioemotional well-being. Unfortunately, adolescents have more difficulty managing emotions than either younger or older
individuals (Steinberg, 2007). This difficulty could be due in part to increased biological, cognitive, and social changes that occur during adolescence (Silk, Steinberg, & Sheffield Morris, 2003). For example, adolescents must deal with the physical and emotional changes associated with puberty, increasing academic stress, as well as changes in the role of family and peer relationships (Christopher, Nangle, & Hansen, 1993). Moreover, adolescence is a time of increased independence resulting in significant decreases in the amount of parental involvement and support (Collins, 1990; Collins & Russell, 1991). It is therefore important that adolescents are able to process and regulate their emotions (Papini, Farmer, Clark, Micka, & Barnett, 1990). For most adolescents, however, the hormonal, neural, and cognitive control systems necessary for successful emotion regulation develop gradually over the course of adolescence, resulting in relatively immature emotion regulation skills when they are needed most (Steinberg, 2008). Alexithymia, or low emotional awareness, may therefore be an important vulnerability factor for adolescents. Thus, this study also extends our current knowledge of the developmental implications of alexithymia.

The third study tested the “decoupling hypothesis”, which states that an alexithymic individual’s subjectively perceived arousal is decoupled from their physiological arousal (Papciak, Feuerstein, & Spiegel, 1985). This study adds a further dimension to this body of research by including observed expression in addition to physiological arousal and self-reported experience. This study also extends current research by examining how patterns of decoupling between alexithymic and non-alexithymic individuals relate to internalizing symptoms. Taken together, we expected that results from these studies would help us to understand in what ways a lack of emotional awareness interferes with emotion regulation and how this might then be related to mood symptomatology during adolescence.
References


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Chapter 2: Internalizing Symptoms in Female Adolescents: Associations with Emotional Awareness and Emotion Regulation
Abstract

The transition into adolescence involves a number of changes that for many adolescents result in increased negative affect and internalizing symptoms, especially for females. In the current study we examined the direct and indirect effects of emotional awareness on internalizing symptoms by exploring the extent to which certain emotion regulation strategies influence this relationship. Participants were 123 female adolescents aged 13 to 16 years (M=14.51 years) who completed measures of emotional awareness, emotion regulation (emotional reappraisal and expressive suppression), and symptoms of depression and social anxiety. Two multiple indirect effect models were conducted including both reappraisal and suppression (one for each of the dependent variables, depression and social anxiety) via the bootstrapping method. Results found that reappraisal accounted for the effect of emotional awareness on depressive symptoms but suppression accounted for the effect of emotional awareness on social anxiety symptoms. Results suggest that emotion regulation strategies play an important role in determining depressive and social anxiety symptoms and are associated with an adolescent's level of emotional awareness.
Internalizing Symptoms in Female Adolescents: Associations with Emotional Awareness and Emotion Regulation

The transition into adolescence involves a number of biological, cognitive, and social changes that result in increased negative affect, emotional reactivity, and risk for internalizing symptoms for many adolescents (Arnett, 1999; Larson & Ham, 1993). While both male and female adolescents experience problems related to emotional arousal and reactivity, gender differences in emotional disorders emerge during the adolescent transition. Female adolescents in particular are at risk, experiencing increases in the development of depression (Galambos, Leadbeater, & Barker, 2004; Nolen-Hoeksema & Girgus, 1994) and anxiety symptoms (Lewinsohn, Gotlib, Lewinsohn, Seeley, & Allen, 1998). With respect to depression, female adolescents are twice as likely to experience depression compared to male adolescents (Bearman, Stice, & Chase, 2003). In fact, depression is the most prevalent psychological disorder to affect adolescent females (Bearman et al., 2003; MacPhee & Andrews, 2006) with approximately 20-25% experiencing clinically significant levels of depression before the age of 19 (Kessler, Avenevoli, & Merikangas, 2001; Lewinsohn, Hops, Roberts, Seeley, & Andrews, 1993; Lewinsohn, Petit, Joiner, & Seeley, 2003). While gender differences in anxiety disorders tend to develop during childhood (Lewinsohn et al., 1998), certain anxiety symptoms, such as social phobia, show marked increases during adolescence for females but not for males (Costello, Mustillo, Erkanli, Keeler, & Angold, 2003).

A growing number of studies have shown that children and adolescents who have difficulties identifying, describing, and expressing their emotions (e.g., poor emotional awareness; Lane & Schwartz, 1987) have higher rates of both depressive and anxiety symptoms (Fine, Izard, Mostow, Trentacosta, & Ackerman, 2003; Lahaye, Luminet, Broeck, Bodart, &
Mikolajczak, 2010; Penza-Clyve & Zeman, 2002; Rieffe & De Rooij, 2012; Sim & Zeman, 2004; Zeman, Shipman, & Suveg, 2002). Several theoretical models posit increases in emotional awareness across development (Buckley & Saarni, 2006; Halberstadt, Denham, & Dunsmore, 2001; Lane & Schwartz, 1987; Mayer & Salovey, 1997; Saarni, 2000), whereby the experience of emotion is hypothesized to become more sophisticated and differentiated as individuals acquire further cognitive resources (Lane & Schwartz, 1987). Thus, individual differences in emotional awareness may be especially important during the adolescent transition when emotional arousal is high yet emotional awareness is not yet fully mature.

Being aware of one’s own emotions, however, is only one component of an emotional response. Emotion regulation strategies refer to “the processes by which individuals influence which emotions they have, when they have them, and how they experience and express these emotions” (Gross, 1998b, p. 275) and are believed to occur relatively late in the emotional responding process (Gottman, Katz, & Hooven, 1997; Lambie & Marcel, 2002). It has therefore been argued that emotion regulation efforts are dependent upon the degree of emotional awareness, with lower levels of emotional awareness leading to less adaptive regulatory strategies (Izard et al., 2011; Mayer, Salovey, Caruso, & Sitarenios, 2001; Saarni, 1999).

Emotion dysregulation, in turn, is known to be related to a number of psychosocial problems experienced during adolescence (Arnett, 1999; Larson & Ham, 1993). However, what is not known is the extent to which individual differences in emotional awareness are associated with the use of particular emotion regulation strategies and subsequent internalizing symptoms.

Emotional awareness increases across development, ranging from global feeling states to complex and differentiated emotional experiences (Lane & Schwartz, 1987). During infancy, at the most basic level of awareness, emotions are experienced as physical symptoms and are
expressed behaviorally as the infant’s needs, desires, and satisfaction. At this level of awareness, emotions are experienced as global feeling states, representing overall contentment and distress (Hesse & Cicchetti, 1982; Osofsky, 1992). Over the course of development, emotions become more differentiated and complex as children develop language and the cognitive capacity to represent emotions as abstract. At the highest level of emotional awareness, individuals are able to understand that multiple feelings can be experienced at the same time (e.g., mixed emotions) and are able to differentiate between subtle nuances of emotions in themselves and in others (Lane & Schwartz, 1987). In a large sample of girls and female adolescents aged 9-16 years, the ability to report mixed emotional states involving basic emotions (e.g., anger and fear) was equivalent in younger and older participants. However, mixed emotion reporting continued to increase for social emotions (e.g., embarrassment and guilt) across development up to the age of 16 years (Burnett, Thompson, Bird, & Blakemore, 2011). Thus, both theory and empirical findings suggest that more sophisticated forms of emotional awareness, such as being aware of mixed emotions in social contexts, continue to develop across adolescence.

Individuals with high emotional awareness understand not only personal emotional experiences, but emotional experiences of others (Lane & Schwartz, 1987). Effective emotional awareness is thus a basic constituent of many emotional processes, and is a hallmark of emotionally competent behavior (Buck, 1991; Crick & Dodge, 1994; Denham, 1998; Halberstadt et al., 2001; Hubbard & Coie, 1994; Izard, 2002; Mayer, Salovey, & Caruso, 2004; Saarni, 1999; Thompson, 1990). For instance, higher levels of emotional awareness enable individuals to interact effectively within their social environments (Greenberg, 2002). An adolescent with high emotional awareness is better able to distinguish the anger they feel at a parent for grounding them from the guilt they feel for breaking a rule, compared to an adolescent with poor emotional
awareness. Because each emotion is experienced as separate, the adolescent can understand the cause of the emotion, the particular context in which it arose, the corresponding bodily sensations, and the appropriate display rules and action tendencies unique to that emotion in that particular situation (Feldman Barrett, Gross, Christensen, & Benvenuto, 2001). Highly differentiated emotions therefore function as signals indicating the need to change or adjust appraisals, behaviors, or goals. It is not surprising, then, that individuals with poor emotional awareness have trouble determining appropriate responses to daily situational challenges. Specific emotional cues, if perceived, prepare us for danger as well as opportunity, and help us to realize short- and long-term goals (Stegge & Terwogt, 2007). Individuals with low awareness therefore have difficulty gaining information about their current situation from their emotions (Schwarz & Clore, 1996). This can be particularly costly in terms of negative emotions since the individual may be unable to take the necessary precautions to avoid potential harm (Quigley & Feldman Barrett, 1999). Thus, emotional awareness is a necessary, albeit not sufficient, precursor to effective regulatory strategies (Gottman et al., 1997; Izard et al., 2011; Mayer et al., 2001).

Adaptive emotion regulation involves a number of strategies aimed at altering the experience and/or the expression of an emotion, such as its duration and intensity (Thompson, 1990). Prior to the onset of puberty, parents play a fundamental role in assisting children in how to deal with their emotions. However, during the adolescent transition there is a decrease in parental involvement (Collins, 1990; Collins & Russell, 1991) and adolescents become more independent in their regulation efforts. With age, individuals continue to develop greater capacity to modulate emotional arousal, as cognitive and social strategies for regulating emotions mature (John & Gross, 2004). An adolescent with poor emotional awareness, however, is likely
to experience greater difficulty in determining and employing effective regulatory strategies compared to an adolescent with higher emotional awareness. For instance, the adolescent who is unaware of the fact that he/she is feeling guilty as well as angry may find it hard to select a regulatory strategy to diminish their feelings of guilt. In fact, the two feelings could likely combine into an overall feeling of “badness”, whereby the adolescent is unable to distinguish between them and as a result cannot understand the underlying cause of the “badness”. Without awareness of what they are feeling as well as why they are feeling that way, the adolescent will have difficulty employing an adaptive regulatory strategy. In the same respect, an adolescent with low emotional awareness may also experience difficulty in selecting regulatory strategies aimed at increasing or maintaining positive emotions. Effective emotion regulation is therefore associated with the ability to identify specific emotions and to understand the reason(s) behind each emotion (Mayer et al., 2001).

Difficulties with emotion regulation underlie many forms of psychopathology (Berenbaum, Raghavan, Le, Vernon, & Gomez, 2003; Cicchetti, Ackerman, & Izard, 1995; Cole, Michel, & Teti, 1994; Johnson-Laird, Mancini, & Gangemi, 2006; Kring & Bachorowski, 1999; Mennin & Farach, 2007) and are instrumental to the maintenance of these problems (Barlow, Allan, & Choate, 2004). Two regulation strategies that have received a great deal of attention and that are both present during adolescence (Gullone, Hughes, King, & Tonge, 2010) are emotional reappraisal and emotional suppression (Gross, 2007). Emotional reappraisal is an antecedent-focused strategy (Gross, 1998a, 2001; Gross & John, 2003; Gross & Thompson, 2007), in that it occurs early in the emotion generative process and involves cognitively re-framing an emotional situation. Reappraisal emerges during late childhood and by adolescence is comparable to levels of reappraisal found in young adults (Gullone et al., 2010). Reappraisal
has been associated with increased positive affect (Watson, Clark, & Tellegen, 1988), closer social relationships, and increased social support (Carver, Scheier, & Weintraub, 1989), as well as peer liking and overall well-being (Ryff & Keyes, 1995). Suppression, on the other hand, is a response-focused strategy that occurs later in the emotion generative process, once an emotion has already been activated (Gross, 2001; Gross & John, 2003; Friedman & Miller-Herringer, 1991). Suppression involves inhibiting emotion-expressive behaviors (Gross, 1998b) and has been associated with less experience and expression of positive emotions, less attention to and clarity of emotions (John & Gross, 2004), as well as greater depressive and anxiety symptoms (Gross & John, 2003; John & Gross, 2004). The use of suppression has been found to be higher during adolescence than adulthood, supporting the claim that emotion regulation efforts become healthier with age (Gullone et al., 2010). While suppression is adaptive in certain situations, (e.g., hiding one’s disappointment after receiving an undesirable gift), habitual use of this strategy has generally been thought of as maladaptive, resulting in sustained feelings of negativity in combination with decreased positive emotions (Gross & Levenson, 1997; Harris, 2001). Individuals with internalizing symptoms therefore experience difficulty processing negative affect and as a result experience more severe distress for longer periods of time (Mennin & Farach, 2007). Thus, emotion regulation is a proximal mechanism of internalizing problems and a combination of increased suppression and a lack of reappraisal may be particularly problematic for adolescents with low emotional awareness.

The goals of the present study were twofold. First, while the link between emotional awareness and emotion regulation has been established, research is limited as to the association between emotional awareness and specific regulatory strategies in adolescence. Thus, we will further explore the relationship between emotional awareness and emotion regulation by looking
at both emotional reappraisal and emotional suppression. Because reappraisal involves changing
the potential impact of an emotion-eliciting situation, an awareness of and understanding of
one’s own emotions is necessary. Suppression, however, involves “shutting down” one’s
emotions in such a way that leads to less attention to and less clarity of the emotion (Gross &
John, 2003). It was therefore predicted that emotional awareness would be positively related to
emotional reappraisal and negatively related to emotional suppression. Second, we wanted to
examine whether the association between emotional awareness and depressive and social anxiety
symptoms holds in the presence of the more proximal regulatory strategies. It was expected that
emotional awareness and internalizing symptoms would be negatively correlated, but that the
direct relationship between awareness and internalizing symptoms would be diminished when
the indirect effects of emotional reappraisal and suppression were included. We chose to include
both of these regulatory strategies in our models simultaneously because emotion regulation
strategies do not function in isolation of one another; that is, reappraisal and suppression co-
occur at different times throughout the emotion process (Gross, Richards, & John, 2006; Sheppes
& Gross, 2011). Thus, we sought to capture the use of these strategies relative to one another in
our models. Further, we examined these relationships during adolescence, as this is a
developmental period marked by drastic increases in emotional arousal and reactivity (Arnett,
1999; Larson & Ham, 1993), and females in particular experience higher rates of psychological
problems such as depression and anxiety (Costello et al., 2003; Nolen-Hoeksema & Girgus,
1994). Analyses were run separately for depressive and social anxiety symptoms because these
internalizing domains can have different etiologies and relate differently to specific emotion
regulation strategies (Aldao, Nolen-Hoeksema, & Schweizer, 2010; Clark & Watson, 1991;
Watson et al., 1995).
Method

Participants and Procedure

Participants were 123 female adolescents from a small city in Southern Ontario recruited through public advertisements and local school boards. Participants ranged in age from 13 to 16 years ($M = 14.51, SD = .89$). The majority of participants (81%) identified themselves as White, 1% as Black, 4% as Asian, 3% as Native Canadian, 9% as Other, and 2% did not indicate their ethnicity. Families with female adolescents between the ages of 13 to 16 years were contacted by a recruitment coordinator and asked if they would like to participate in a study examining changes in children’s emotions and behaviours as they move into adolescence. If they agreed, adolescents completed an on-line survey at home. Consent was provided on-line from both the parent and the adolescent. The adolescents were unable to provide consent until parent consent was granted. Ethical approval was received from both the university and the school board.

Measures

Emotional awareness. Emotional awareness was assessed with the Difficulties in Emotion Regulation Questionnaire (Gratz & Roemer, 2004). The 6-item subscale measuring “Emotional Awareness” was used to assess attention to, and awareness of, emotional responses (e.g., “When I’m upset, I take time to figure out what I’m really feeling”). Items are rated on a 5-point-Likert scale ranging from 1 (Almost Never) to 5 (Almost Always). High scores indicate higher emotional awareness. In the present study the mean score was used. Gratz and Roemer (2004) reported good internal consistency ($\alpha = .83$) in a sample of undergraduate students and Weinberg and Klonsky (2009) reported adequate internal consistency in a sample of younger adolescents ($\alpha = .77$). The alpha coefficient for the sample in the present study was good (Cronbach’s $\alpha = .83$).
Reappraisal and suppression. The Emotion Regulation Questionnaire (Gross & John, 2003) is a 10-item self-report questionnaire that assesses two different emotion regulation strategies: a 6-item cognitive reappraisal scale (e.g., “I control my emotions by changing the way I think about the situation I’m in”) and a 4-item expressive suppression scale (“I control my emotions by not expressing them”). Items are rated on a 7-point-Likert scale ranging from 1 (Strongly Disagree) to 7 (Strongly Agree) with higher scores indicating greater use of the strategy. In the present study we used mean scores in our analyses. In a large sample of adolescents in grade six, Cronbach’s alpha was .79 and .66 respectively for reappraisal and suppression and for adolescents in grade twelve Cronbach’s alpha was .86 and .83 respectively for reappraisal and suppression (Watson, 2007). In the present study the alpha coefficient was adequate (α = .74) for both reappraisal and suppression.

Depression. The Child Depression Inventory (Kovacs, 1992) is a 27-item questionnaire measuring depression in children and adolescents between the ages of 6 and 17 years. Each item consists of three self-evaluative sentences with a score of 0 to 2 with higher scores indicating greater severity of the symptom. For instance, “I am sad once in awhile,” “I am sad many times,” and “I am sad all the time.” One item regarding suicidal thoughts was excluded. In the present study the mean score was used. The CDI has excellent internal consistency, ranging from .84 to .93 in samples of children and adolescence (Craighead, Curry, & Ilardi, 1995; Kovacs, 1992; Saylor, Finch, Spirito, & Bennett, 1984; Smucker, Craighead, Wilcoxon Craighead, & Green, 1986; Weiss et al., 1991). In the present sample, Cronbach’s alpha was good (α = .91).

Social anxiety. The Social Anxiety Scale for Adolescents Revised Short Form (Myers, Stein, & Aarons, 2002) is a 13-item questionnaire that measures symptoms of social anxiety in
adolescents. Items are rated on a 5-point Likert scale according to how true the item is of the participant (e.g., “I feel shy even with peers I know well”). Responses range from 1 (Not At All) to 5 (All the time) and higher scores indicate higher levels of social anxiety. The SAS-A Revised has three subscales measuring Fear of Negative Evaluation (6 items), General Social Avoidance and Distress (3 items) and Social Avoidance and Distress in New Situations (4 items) all of which have been found to have good internal reliability (.89, .86, and .76 respectively) in adolescent samples (Myers et al., 2002). The total of the three scales are added together to give a total social anxiety score. In the present study the mean of the total score was used and Cronbach’s alpha was good (α = .93).

**Statistical Analyses**

The data analytic plan for the current study included running two multiple indirect effect models including both reappraisal and suppression (one for each of the dependent variables, depression and social anxiety) via the bootstrapping method recommended by Preacher and Hayes (2008). Age was included as a covariate because it was positively associated with emotional awareness. This approach has a number of advantages compared to single indirect effect models. This includes the ability to determine the total indirect effect of a set of variables (e.g., reappraisal and suppression simultaneously) and the specific indirect effect of each variable on its own, as well as the ability to reduce parameter bias due to omitted variables (Preacher & Hayes, 2008). Bootstrapping is a nonparametric approach to effect-size estimation that generates an empirical approximation of the sampling distribution by repeatedly resampling the data set (Preacher & Hayes, 2008). It is recommended for multiple indirect effects models because it does not assume normality of the sampling distribution (Hayes, 2009). A number of simulation studies have also found bootstrapping to be more powerful as well as more effective at
controlling Type I error than other available methods (Fritz & MacKinnon, 2007; MacKinnon, Lockwood, & Williams, 2004; Williams & MacKinnon, 2008). To determine the significance of indirect effects, 95% confidence intervals are used. If the lower and upper bounds do not include zero, then the indirect effect can be considered significant at the .05 level (Hayes, 2009).

**Results**

Table 2.1 presents the means, standard deviations, and correlations for all variables. The hypothesized model was significant for depression and accounted for 17% of the variance in symptoms. The total direct effect of emotional awareness on depressive symptoms was significant but after controlling for the two indirect effects of reappraisal and suppression, the direct effect of emotional awareness on depressive symptoms no longer reached significance (Figure 2.1). The total indirect effect of emotional awareness through suppression and reappraisal was significant ($b = .13$, CI = .04 to .24). An examination of the specific indirect effects indicates that reappraisal was significant ($b = .07$, CI = .02 to .16), but not suppression ($b = .06$, CI = -.02 to .16). The partial effect of age was not significant. Thus, low reappraisal but not high suppression was associated with depressive symptoms.

The hypothesized model was significant for social anxiety and accounted for 16% of the variance in symptoms. The total direct effect of emotional awareness on social anxiety was significant but after controlling for reappraisal and suppression, the direct effect of emotional awareness on social anxiety no longer reached significance (Figure 2.2). The total indirect effect of emotional awareness through reappraisal and suppression was significant ($b = .16$, CI = .05 to .30). An examination of the specific indirect effects indicates that suppression was significant ($b = .12$, CI = .03 to .26) but not reappraisal ($b = .04$, CI = -.00 to .12). The partial effect of age was
not significant. Thus, high suppression but not low reappraisal was associated with anxiety symptoms.

Table 2.1

*Means, Standard Deviations and Correlations Between all Variables*

<table>
<thead>
<tr>
<th>Variables</th>
<th>M</th>
<th>SD</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) Emotional Awareness</td>
<td>2.70</td>
<td>.83</td>
<td>_</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(2) Reappraisal</td>
<td>4.83</td>
<td>.81</td>
<td>.31**</td>
<td>_</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(3) Suppression</td>
<td>3.46</td>
<td>1.15</td>
<td>-.48**</td>
<td>-.19*</td>
<td>_</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(4) Age</td>
<td>14.51</td>
<td>.89</td>
<td>.18*</td>
<td>.11</td>
<td>.02</td>
<td>_</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(5) Depressive Symptoms</td>
<td>.35</td>
<td>.31</td>
<td>-.28**</td>
<td>-.40**</td>
<td>.26**</td>
<td>01</td>
<td>_</td>
<td></td>
</tr>
<tr>
<td>(6) Social Anxiety Symptoms</td>
<td>2.18</td>
<td>.74</td>
<td>-.31**</td>
<td>-.24*</td>
<td>.37**</td>
<td>.06</td>
<td>.69**</td>
<td>_</td>
</tr>
</tbody>
</table>

*Note.* **p < .01. *p < .05.
Figure 2.1. Multiple indirect effects model of emotional awareness on depressive symptoms by reappraisal and suppression. Values represent unstandardized regression coefficients; values in the parentheses represent standard error. The coefficient from emotional awareness to depression above the center horizontal path represents the total (direct) effect. The coefficient from emotional awareness to depression below the center horizontal path represents the indirect effect (controlling for reappraisal and suppression).

* p<.05. **p<.01. ***p<.001.
Figure 2.2. Multiple indirect effects model of emotional awareness on social anxiety symptoms by reappraisal and suppression. Values represent unstandardized regression coefficients; values in the parentheses represent standard error. The coefficient from emotional awareness to social anxiety above the center horizontal path represents the total (direct) effect. The coefficient from emotional awareness to social anxiety below the center horizontal path represents the indirect effect (controlling for reappraisal and suppression).

* p<.05. **p<.01. ***p<.001.
Discussion

The goal of the present study was to test the indirect effects of emotional reappraisal and suppression on the association between emotional awareness and internalizing symptoms. Results supported the hypothesized relationships. As predicted, emotional awareness was positively associated with emotional reappraisal and negatively to emotional suppression. Moreover, emotional awareness was negatively associated to both depressive and social anxiety symptoms. When emotional reappraisal and suppression were added to the models, the direct effect of emotional awareness on internalizing symptoms was indistinguishable from zero. Emotional reappraisal, but not suppression, emerged as a significant indirect effect between emotional awareness and depressive symptoms, while emotional suppression, but not reappraisal, emerged as a significant indirect effect between emotional awareness and social anxiety symptoms. These results suggest a differential effect of emotion regulation strategies, suggesting that individual differences in emotional reappraisal may be more salient for depressive symptoms while emotional suppression may be more salient for the development of social anxiety symptoms.

Because reappraisal involves cognitive re-framing of an emotional situation, it requires the understanding of specific emotional elicitors and corresponding emotions (Chen, Xu, Jing, & Chan, 2011; Swart, Kortekaas, & Aleman, 2009). Adolescents with high emotional awareness may therefore be more likely to use emotional reappraisal. Moreover, the ability to reappraise emotionally charged situations may lessen the chance that the adolescent will ruminate, a mechanism commonly associated with depression (Nolen-Hoeksema, 1991; Nolen-Hoeksema, Wisco, Lyubomirsky, 2008). Past research has found that women are more likely to ruminate than men, a gender difference that has also been confirmed in adolescents (Broderick, 1998;
Mezulis, Abramson, & Hyde, 2002; Nolen-Hoeksema, Morrow, & Fredrickson, 1993; Nolen-Hoeksema, Parker, & Larson, 1994; Peled & Moretti, 2007). During adolescence, females become extremely sensitive to negative social evaluations (Westenberg, Drewes, Goedhart, Siebelink & Treffers, 2004). In particular, adolescent females experience an increase in social comparisons (Rankin, Lane, Gibbons, & Gerrard, 2004) as well as higher fear of social evaluation (Mallet & Rodriguez-Tome, 1999) compared to male adolescents. The increase in negative social evaluations among females may be one pathway leading to increased rumination and negative affect. Because rumination inhibits adaptive strategies or actions that may decrease focus on the individual’s current mood (Joorman & D’Avanzato, 2010) emotional reappraisal may be an important emotion regulation strategy employed by adolescents with high emotional awareness that buffers against the development of depressive symptoms.

Emotional suppression, on the other hand, may be a common regulatory technique used by adolescents with low emotional awareness. Over the last decade researchers have come to agree that an emotional response can be activated without awareness (Dolan & Vuilleumier, 2003; LeDoux, 2000; Ruys, Stapel, & Aarts, 2011; Zajonc, 1980). For instance, there is a large body of research indicating that people are able to recognize and react to masked facial stimuli without any conscious experience or awareness of the specific elicitor (e.g., Dimberg, Elmehed, & Thunberg, 2000; Esteves, Dimberg, & Ohman, 1994). While this level of automatic processing may have functional significance (e.g., from an evolutionary perspective), social interactions inevitably become more complex resulting in the need for a much more sophisticated level of emotional awareness. Thus, while individuals with poor emotional awareness no doubt still experience emotion, they may have difficulty understanding the causes, contexts, and consequences of their emotions. Emotional suppression may therefore act as a way
of regulating emotions that individuals with low emotional awareness do not completely understand. In support of this, Gross and John (2003) found that adults who reported higher levels of suppression also reported less attention to and clarity of their emotions. This type of regulatory strategy is particularly costly in social contexts where the quality of relationships is affected by emotional expressivity (Riggio & Friedman, 1986), emotional responsiveness (Reis & Shaver, 1988), and emotional self-disclosure (Laurenceau, Barrett & Pietromonaco, 1998). Indeed, individuals who suppress emotions share fewer negative as well as positive emotions with others, experience greater discomfort with closeness and sharing in relationships, have less social support from social networks, and have fewer close relationships (Gross & John, 2003). This social aspect of emotional suppression may result in discomfort in social situations and in close relationships. Because of these social aspects of suppression, it may be a particularly maladaptive regulatory strategy used by adolescents with low emotional awareness that co-varies with social anxiety symptoms. Results therefore suggest that reappraisal is an emotion regulation strategy used by adolescents with high emotional awareness and is associated with depressive symptoms, while suppression is used more so by adolescents with poor emotional awareness and is related to social anxiety symptoms.

The present study was preliminary with some notable limitations. Though we would hypothesize that emotion regulation strategies such as emotional reappraisal and suppression mediate the relationship between emotional awareness and internalizing symptoms, our cross-sectional sample did not allow for a causal interpretation. A longitudinal sample would be necessary to demonstrate temporal causality of the hypothesized relationships. Moreover, the present study focused on female adolescents, therefore further research addressing different ages and including males will be necessary to reveal the generalizability of these findings.
Furthermore, the present sample was composed largely of Caucasian adolescents who may differ significantly in their reporting of and experiences of emotion. Thus, future research is necessary to examine the generalizability of these findings in different racial and ethnic groups. Lastly, our study was based solely on self-report measures. Future studies employing more ecologically valid measures of emotion regulation are necessary.

The present study suggests that emotion regulation strategies play an important role in determining depressive and social anxiety symptoms and are associated with an adolescent’s level of emotional awareness. While not all adolescents experience increased depressive and anxiety symptoms, the developmentally typical changes in emotionality (Arnett, 1999; Brooks-Gunn & Warren, 1989; Larson & Ham, 1993) may be an important contributing factor for those adolescents who do (Steinberg, 2008; Yap, Allen, & Sheeber, 2007). Adolescents with both depression and anxiety, for instance, have been found to have fewer regulatory strategies at their disposal and those that they do employ are less effective (Carthy, Hoaresh, Apter, & Gross, 2010; Garber, Braafladt, & Weiss, 1995). Therefore, teaching adolescents effective regulatory strategies to cope with increased emotional arousal would be an important factor to help decrease the risk for internalizing symptoms. However, the present study suggests that increasing adolescents’ emotional awareness and ability to identify specific emotions might be a good first step to diminish the risk of internalizing symptoms during adolescence through better emotion regulation.
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Chapter 3: Physiological, Self-Reported, and Expressed Emotional Responses in Alexithymic Adolescents During a Social Stressor Task
Abstract

Alexithymia involves difficulty identifying and describing emotions and has been associated with numerous mental and physical illnesses. To examine the underlying mechanisms of alexithymia, researchers have employed social stress or emotion elicitation paradigms to examine differences in physiological arousal, self-reported experience, and expressed emotional responses. To date, no study has examined all three emotional responses in alexithymic adolescents. The present study therefore examined the effect of alexithymia on emotional responding in adolescents. Participants were 181 adolescents (87 males, 94 females) aged 12.0 to 16.9 years (M=13.6, SD=1.1) classified as high alexithymic (HA, 19%), low alexithymic (LA, 37%), and non-alexithymic (NA, 44%). Participants gave an impromptu 3-minute speech to provoke self-conscious affect. Levels of physiological arousal and recovery were measured by heart rate and galvanic skin response before, during, and after the speech. Self-reported physical arousal as well as positive, negative, and self-conscious affect was measured before and after the speech. Observations of expressed affect were recorded during the speech and then coded later. Across the study, HA adolescents reported more negative affect while both HA and LA adolescents reported greater physical arousal symptoms compared to the NA group. HA females reported higher self-reported self-consciousness combined with lower positive affect across the study. Emotional arousal and recovery as measured by heart rate and galvanic skin response was indistinguishable between the groups as was the level of expressed (observed) self-consciousness. The present study suggests that the way in which alexithymic adolescents internalize day-to-day emotional experiences may be a mechanism of alexithymia.
Physiological, Self-Reported, and Expressed Emotional Responses in Alexithymic Adolescents During a Social Stressor Task

Alexithymia refers to a set of affective and cognitive characteristics resulting in difficulty identifying and describing emotion, impoverished imaginative processes, and an externally oriented cognitive style (Taylor, 1994; Taylor, Bagby, & Parker, 1991, 1997). Alexithymia has been identified as a vulnerability factor for numerous physical and mental health related illnesses, such as mood disorders, eating disorders, substance abuse, cardiovascular disease, respiratory illness, and chronic pain (Parker, Taylor, Bagby, & Acklin, 1993; Taylor, Parker, Bagby, & Bourke, 1996; Zeitlin & McNally, 1993). To examine the link between alexithymia and health, researchers have predominately employed social stress or emotion elicitation paradigms to examine differences in physiological arousal, self-reported experience, and expressed emotional responses. To date, no study has examined all three emotional responses in alexithymic adolescents, even though adolescence is marked by significant increases in negative affect and emotional reactivity as well as the onset of a number of internalizing problems (Arnett, 1999; Larson & Ham, 1993; Larson & Lampman-Petraitis, 1989). Moreover, many of the hormonal, neural, and cognitive mechanisms involved in regulating emotion continue to develop throughout adolescence (Spear, 2000), making emotion regulation efforts more difficult for adolescents than either younger or older individuals (Steinberg, 2007). Alexithymia may therefore be an important vulnerability factor for adolescents, especially given its high prevalence rates. Among adolescent females, rates range from 10% to 29% and from 7% to 18% among adolescent males (Horton, Gewirtz, & Kreuter, 1992; Joukamaa, Taanila, Miettunen, Karvonen, Koskinen, & Veijola, 2007). The purpose of the present study was to examine the
physiological, self-reported and expressed emotional responses of alexithmic and non-alexithmic adolescents.

One of the earliest models of alexithymia was the “stress-alexithymia hypothesis” (Martin & Pihl, 1985). According to this model, a lack of emotional awareness interferes with the ability to identify situations as stressful. This results in persistent periods of unidentified arousal and increased levels of sympathetic activation, which manifests as stress-related physical and emotional health problems. While there is some support for autonomic hyperarousal during periods of rest (e.g., Fukunishi, Sei, Morita, & Rahe, 1999; Papciack, Feurestein & Spiegel, 1985; Stone & Neilson, 2001; Newton & Contrada, 1994; Wehmer, Brejnak, Lumley, & Stettner, 1995) most studies have found either equivalent (Connelly & Denney, 2007; Fukunishi, Sei, Morita, & Rahe, 1999; Papciak, Feuerstein, & Spiegal, 1985; Stone & Nielson, 2001) or decreased (Freidlander, Lumley, Farchione, & Doyal, 1997; Linden, Lenz, & Stossel, 1996; Nemiah & Sifneos, 1977; Newton & Contrada, 1994; Wehmer, Brejnak, Lumley, & Stettner, 1995) levels of heart rate and skin conductance. Of the studies that found lower levels of physiological reactivity, most used emotion-eliciting slides (Freidlander et al., 1997; Nemiah et al., 1977; Wehmer et al., 1995). This may be too passive to elicit arousal in alexithymic individuals, given their tendency for externally oriented thinking and limited imaginative capacity. In terms of self-reported experience, most research has found alexithymic individuals to have either higher (Connelly & Denney, 2007; Friedlander et al., 1997; Pollatos et al., 2011) or comparable levels (Newton & Contrada, 1994; Franz, Schaefer, & Schneider, 2003; Hyer, Woods, & Boudewyns, 1990; Rabavilas, 1987) of negative affect compared to non-alexithymic individuals. This partially supports the notion that alexithymia involves emotion dysregulation,
in that once an emotional response is triggered, the alexithymic individual is limited in the number (and quality) of available regulation strategies (Taylor et al., 1997).

Few alexithymia studies have included measures of emotional expression, even though expression can have important implications for social competence, prosocial behaviour, and psychopathology (Bretherton, 1995; Denham, 1998, Eisenberg et al., 1993; Roberts, 1999). In three studies that examined facial expressions in response to emotion-eliciting slides (Roedema & Simons, 1999; McDonald & Prkachin, 1990) or emotion-eliciting movies (Luminet et al., 2004), two found no differences in facial expressions of emotion (Luminet et al., 2004; Roedema & Simons, 1999), while one found that alexithymic’s facial expressions of negative affect were less accurately and less intensely portrayed (McDonald & Prkachin, 1990) compared to non-alexithymics. While these studies focused on facial expressions to emotion-eliciting stimuli, Troisi, Delle Chiaie, Russo, and Russo (1996), examined whether alexithymia was associated with specific nonverbal behaviour patterns in general, during a psychiatric interview. Difficulty identifying feelings was associated with less nonverbal expressivity and more frequent displacement activity (movements focused on one’s own body, reflecting increased arousal, tension, and anxiety), while externally-oriented thinking was associated with avoidance behaviors, such as looking away and freezing. Thus, previous findings suggest that while facial expressions of emotion may not differentiate between alexithymic and non-alexithymic individuals, global non-verbal behaviours of anxiety and/or tension may.

The Present Study

Research examining alexithymia and adolescence is limited, most often relying on self-reports in relation to the prevalence of specific detrimental outcomes (Honkalampi, 2009; Zonnevylle-Bender, van Goozen, Cohne-Kettenis, van Elburg, & van Engeland, 2004; Burba et
al., 2006). Initial investigations of adolescent alexithymia have confirmed the alexithymia – health relationship. The purpose of the present study was to add to this body of research by examining emotional responding in groups of high alexithymic (HA), low alexithymic (LA) and non-alexithymic (NA) adolescents by 1) using an ecologically valid emotion elicitation task, and 2) assessing arousal and recovery as indexed by physiological reactivity, self-reported experience, and observations of expressed affect. The study employed an experimental paradigm involving an age-appropriate social stressor for adolescents: an impromptu 3-minute speech to provoke self-conscious affect. Speech tasks are well-validated social stressors, capable of eliciting robust changes in emotional responding (Dickerson & Kemeny, 2004). Levels of physiological arousal were measured by heart rate (HR – general autonomic arousal) and galvanic skin response (GSR – sympathetic arousal) before, during, and after the speech task as was self-reported experience. Observations of expressed affect were recorded during the speech task and then coded later. Based on past research that has found no differences in physiological reactivity (Connelly & Denney, 2007; Fukunishi et al., 1999; Papciak et al., 1985; Stone & Nielson, 2001) or recovery (Connelly & Denney, 2007; Papciak et al., 1985; Friedlander et al., 1997, Pollatos et al., 2011, Franz et al., 2003; Martinez-Sanchez, Ortiz-Sorai, & Ato-Garcia, 2001) between alexithymic and non-alexithymic adults, it was predicted that HA, LA, and NA adolescents would show the same pattern of increased responsivity (baseline to speech) and decreased responsivity (speech to recovery) in HR and GSR. However based on past research (e.g., Fukunishi, Sei, Morita, & Rahe, 1999; Papciack, Feurestein & Spiegel, 1985; Stone & Neilson, 2001; Newton & Contrada, 1994; Wehmer, Brejnack, Lumley, & Stettner, 1995), we predicted that there would be significant differences in baseline arousal, such that HA
adolescents would have the highest physiological arousal, followed by the LA’s and NA’s respectively.

Based on past research that has found higher levels of negative affect and somatic symptoms in alexithymic adults compared to non-alexithymic adults (Connelly & Denney, 2007; Freidlander et al., 1997; Pollatos et al., 2011), we predicted that HA adolescents would report the highest levels of negative and self-conscious affect and the lowest levels of positive affect followed by LA and NA adolescents, respectively, as a result of the speech task. We also predicted that the HA adolescents would report the greatest amount of physical symptoms during the speech followed by the LA and NA adolescents, respectively.

Lastly, based on the findings from Troisi et al. (1996), it was predicted that the HA adolescents would express the most self-conscious affect during the speech followed by the LA and NA adolescents respectively.

Method

Participants

Participants included 181 adolescents (87 males, 94 females) aged 12.0 to 16.9 years ($M=13.6$, $SD=1.1$). Participants were recruited through a pre-existing University database consisting of families who agreed to be contacted about potential studies as well as through local school boards and community events. Of this sample, 75.1% identified themselves as European-Canadian, 2.4% as Non-European Canadian (e.g., African, Chinese, Filipino, Japanese, Korean, Latin American, South Asian), and 9.4% as Other. Another 2.8% did not know their ethnicity while 10.5% did not indicate their ethnicity. Another 2.8% did not know their ethnicity while 10.5% did not indicate their ethnicity. Predetermined cut off scores from the Toronto Alexithymia Scale (Bagby, Taylor, & Parker, 1994) were used to categorize participants into HA, LA, and NA groups. There were 35 adolescents classified as HA (15 males and 20
females), 66 adolescents classified as LA (27 males and 39 females) and 80 adolescents
classified as NA (45 males and 35 females). Participants were asked to refrain from taking drugs
(e.g., caffeine and alcohol) 24 hours before coming into the lab since these variables are known
to influence physiological measures.

Procedure

Upon arrival to the lab the participant and his or her parent were seated in comfortable
tub-style chairs in an office that was decorated to resemble a living room. The experimenter
explained the study to the parent and adolescent who were each given an information sheet and a
consent form to read and sign. The room was equipped with two concealed video cameras,
monitored from an adjacent room. Once consent was granted, participants’ parents left the room.
Participants then completed a series of questionnaires on a computer assessing current mood and
alexithymia.

Sensor application.

After the questionnaires were completed a female experimenter applied the physiological
sensors. The first sensors to be applied were the electrocardiogram (ECG) sensors which
consisted of two disposable sticker electrodes in Lead II configuration; one was placed two
centimeters below the right collarbone and the second between the left hipbone and the last rib
bone. The next sensors measured GSR with an SS3 electrodermal response transducer attached
to the tips of the third and fourth finger of the non-dominant hand. All sensors were connected
to an MP150 amplifier (Biopac Systems Inc., US) via a battery pack attached to the back of the
participant’s chair and were measured continuously at 200 Hz. Incoming physiological data
were monitored and recorded using AcqKnowledge 4.1 (Biopac Systems Inc., US).
Electrocardiogram data were measured in volts and GSR was calculated as level of conductance in micromhos.

**Social stressor task.**

The experimental phase consisted of: 1) a 3-minute baseline in which participants were instructed to sit quietly and relax, 2) a 3-minute impromptu speech that participants were instructed to give as if they were in front of their class at school, 3) a 1-minute self-report where participants rated how they were feeling as they gave their speech and 4) a 3-minute recovery period. After this last task was completed all sensors were removed and parents were brought back into the room. Participants were debriefed and given a second consent form in which the opportunity to terminate participation was offered. Four participants choose to withdraw their participation, thus all data for these participants were immediately destroyed. Another three participants chose not to give a speech and therefore were not included in the analyses. All 181 remaining participants were given a $20 gift certificate to a large bookstore.

**Measures**

**Questionnaires.**

**Alexithymia.** The Toronto Alexithymia Scale (Bagby et al., 1994) is a 20-item self-report measure of alexithymia. The TAS-20 assesses three core dimensions of the alexithymia construct: difficulty identifying feelings and distinguishing them from somatic sensations, difficulty describing feelings, and externally oriented thinking. For each item, participants rate how strongly they agree or disagree based on a 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The total of the three scales are added together to give a total alexithymia score (Cronbach’s alpha = .77). High scores on the TAS-20 indicate higher levels of alexithymia. Pre-determined cut-off scores categorize participants into alexithymic (≥ 61), low
alexithymic (52-60), and non-alexithymic participants (≤ 51). Although total scores were used to classify participants into groups, mean scores for each of the groups were used in analyses and tables.

**Demographic information.** Participants completed a demographic questionnaire assessing Gender and Age. Participants also provided their body weight and height, which was used to calculate Body Mass Index (BMI). Participants also indicated the amount of caffeine they had consumed in the last 12 hours and the amount of exercise (average minutes per week).

**Emotional responding.**

**Arousal and recovery.** Physiological Arousal and Recovery were measured by changes in HR and GSR, both of which have been included in almost all of the alexithymia studies examining physiology (Luminet et al., 2004; Martin & Pihl, 1986; Connelly & Denney, 2007; Fukunishi et al., 1999; Papciak et al., 1985; Stone & Neilson, 2001; Wehmer et al., 1995; Roedema & Simons, 1999). Averages for HR and GSR were calculated for each task to examine baseline levels of HR and GSR between the HA’s, LA’s, and NA’s. Because we were interested in within-subject change, percent change scores were used to control for potential differences in HR and GSR occurring at baseline (Swan et al., 2007). Percent change in HR and GSR were calculated for changes in physiological Arousal from baseline to the speech [((Speech – Baseline)/Baseline)*100] and Recovery from speech to recovery [((Speech – Recovery)/Baseline)*100].

**Experience.** Before and after the speech participants rated their current emotions. Both positive and negative emotions were included as well as items assessing physical sensations (e.g., sweating, dry mouth) for a total of 23-items. For each item, participants indicated their current emotional or physical experience based on a 9-point Likert scale ranging from 1 (Did not
feel at all) to 9 (Feel very strongly). The experience of positive emotion (PE) was the mean of seven items (e.g., Happy, Pleased, Valuable). Negative emotion (NE) was the mean of twelve items (e.g., Nervous, Sad, Scared). Self-consciousness (SC) was the mean of seven items (e.g., Humiliated, Embarrassed, Ashamed) and physical symptoms (PS) were the mean of four items (e.g., Upset to my stomach, Sweaty). Cronbach’s alpha values for experienced emotions before the speech and during the speech, respectively, were acceptable for PE (.86, .91), NE (.83, .91), SC (.77, .86), and PS (.65, .75).

**Expression.** Videos of the speeches were coded using The Self-Conscious Affect Code II (SCAC-II) (Lanteigne & Hollenstein, 2010) which codes real-time changes in verbal and non-verbal cues of self-conscious affect (e.g., body tension, hiding, wavering voice). The SCAC-II is a 7-item binary code used to indicate the presence (coded as 1) or absence (coded as 0) of observed self-conscious affect. Therefore, every moment of the speech was given a score of either 0 or 1 for each of the seven self-conscious affect categories. This resulted in a continuous, real-time measure of the onsets and offsets of each category. A team of student coders was trained to a criterion of 80% agreement for cue duration (duration-sequence based reliability analysis), 70% agreement for the onset of a cue, and a kappa score of .65 (frequency-sequence based reliability analysis). Reliability was checked in 20% of the videos and was good (cue duration = 88%, onset of a cue = 76%, kappa = .76). The primary measure of Expression was a mean score calculated from the weighted proportional duration at each score level. A level variable was created which was the sum of the seven binary codes (corresponding to the seven self-conscious affect categories) at each coded event. Therefore at each coded event the score could range from 0-6 (although there were 7 categories, 6 is the maximum because two of the categories, Silence and Vocal Uncertain, are mutually exclusive and cannot occur together at the
same time). The proportional duration for each level was calculated by dividing the total
duration of each level by the total duration of the speech. Then, the weighted duration of each
level was calculated by multiplying the level by its proportional duration. Expression is thus the
sum of all the weighted durations. Higher values indicate greater expressed self-consciousness.

Results

Descriptive Statistics

TAS-20 total scores ranged from 25 – 86 ($M = 52.83$, $SD = 9.06$) with 19% falling in the
HA range, 37% classified as LA, and 44% as NA. To examine the relationship between
alexithymia and sample characteristics that could affect the physiological variables (age, body
mass index, caffeine consumption, and exercise) we ran a series of 3 (Alexithymia Group) x 2
(Gender) factorial ANOVAs. All sample characteristics were found to be consistent across the
groups and across gender and therefore were not included as covariates. We also found no
differences in resting HR or GSR between the groups (See Table 3.1 for descriptive statistics).

Means and standard deviations for the emotional responding variables are presented in Table 3.2.
All variables were checked for normality, skewness, kurtosis and outliers in each of the
alexithymia groups. Outliers greater than 3.5 standard deviations were winsorized to 3.5
standards deviations from the mean. Four high scores for experienced SC and one for
experienced NE during baseline were winsorized as well as one high score each for experienced
SC and NE during the speech. There were also two high scores for HR and four high GSR
scores during Arousal as well as two high scores for HR and three high scores for GSR during
Recovery that were winsorized.
Table 3.1

Means and Standard Deviations (in parentheses) for Alexithymia scores and Control Variables
by Group and Gender

<table>
<thead>
<tr>
<th></th>
<th>High Alexithymic Males</th>
<th>High Alexithymic Females</th>
<th>Low Alexithymic Males</th>
<th>Low Alexithymic Females</th>
<th>Non-Alexithymic Males</th>
<th>Non-Alexithymic Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAS-20</td>
<td>3.29 (.17)</td>
<td>3.34 (.26)</td>
<td>2.80 (.13)</td>
<td>2.76 (.14)</td>
<td>2.29 (.26)</td>
<td>2.23 (.30)</td>
</tr>
<tr>
<td>AGE</td>
<td>13.58 (1.13)</td>
<td>13.60 (.98)</td>
<td>13.49 (1.16)</td>
<td>13.52 (1.20)</td>
<td>13.73 (1.21)</td>
<td>13.45 (.96)</td>
</tr>
<tr>
<td>BMI</td>
<td>20.06 (2.93)</td>
<td>21.3 (4.08)</td>
<td>20.16 (3.32)</td>
<td>20.64 (4.87)</td>
<td>19.58 (3.50)</td>
<td>20.49 (5.33)</td>
</tr>
<tr>
<td>CAFFEINE</td>
<td>1.21 (.43)</td>
<td>1.20 (.41)</td>
<td>1.33 (.88)</td>
<td>1.18 (.45)</td>
<td>1.18 (.54)</td>
<td>1.15 (.36)</td>
</tr>
<tr>
<td>EXERCISE</td>
<td>10.96 (7.40)</td>
<td>7.10 (5.59)</td>
<td>8.32 (7.40)</td>
<td>7.83 (3.90)</td>
<td>9.70 (8.94)</td>
<td>6.30 (3.42)</td>
</tr>
</tbody>
</table>

Note. All statistics are reported for raw variables. TAS-20 = Toronto Alexithymia Scale, BMI = Body Mass Index, Caffeine = higher scores equal increased caffeine intake, Exercise = hours per week.
Table 3.2

Means and Standard Deviations for Emotional Responding Variables by Group and Gender

<table>
<thead>
<tr>
<th></th>
<th>High Alexithymic</th>
<th>Low Alexithymic</th>
<th>Non-Alexithymic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Males</td>
<td>Females</td>
<td>Males</td>
</tr>
<tr>
<td><strong>Arousal (baseline to speech)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HR % Change</td>
<td>7.97</td>
<td>15.36</td>
<td>8.72</td>
</tr>
<tr>
<td></td>
<td>(8.34)</td>
<td>(10.24)</td>
<td>(9.79)</td>
</tr>
<tr>
<td>GRS % Change</td>
<td>44.67</td>
<td>55.47</td>
<td>79.27</td>
</tr>
<tr>
<td></td>
<td>(46.75)</td>
<td>(61.43)</td>
<td>(80.89)</td>
</tr>
<tr>
<td><strong>Recovery (speech to recovery)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HR % Change</td>
<td>10.32</td>
<td>16.24</td>
<td>9.76</td>
</tr>
<tr>
<td></td>
<td>(7.62)</td>
<td>(12.73)</td>
<td>(10.44)</td>
</tr>
<tr>
<td>GSR % Change</td>
<td>10.01</td>
<td>16.41</td>
<td>19.90</td>
</tr>
<tr>
<td></td>
<td>(20.76)</td>
<td>(33.25)</td>
<td>(26.14)</td>
</tr>
<tr>
<td><strong>Experience</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PE1</td>
<td>6.51</td>
<td>4.98</td>
<td>6.01</td>
</tr>
<tr>
<td></td>
<td>(1.56)</td>
<td>(1.71)</td>
<td>(1.68)</td>
</tr>
<tr>
<td>NE1</td>
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<td>2.52</td>
<td>1.58</td>
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<td>(.62)</td>
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<td>(.60)</td>
</tr>
<tr>
<td>SC1</td>
<td>1.35</td>
<td>2.14</td>
<td>1.23</td>
</tr>
<tr>
<td></td>
<td>(.39)</td>
<td>(1.21)</td>
<td>(.38)</td>
</tr>
<tr>
<td>PS1</td>
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<td>3.24</td>
<td>2.49</td>
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<tr>
<td></td>
<td>(1.40)</td>
<td>(1.76)</td>
<td>(1.33)</td>
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<td>PE2</td>
<td>4.09</td>
<td>3.47</td>
<td>4.43</td>
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<td></td>
<td>(2.36)</td>
<td>(2.06)</td>
<td>(1.74)</td>
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<tr>
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<td>4.28</td>
<td>2.83</td>
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<tr>
<td></td>
<td>(1.63)</td>
<td>(1.49)</td>
<td>(1.69)</td>
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<td>3.75</td>
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<tr>
<td></td>
<td>(1.62)</td>
<td>(1.69)</td>
<td>(1.65)</td>
</tr>
<tr>
<td>PS2</td>
<td>3.73</td>
<td>5.04</td>
<td>3.66</td>
</tr>
<tr>
<td></td>
<td>(2.39)</td>
<td>(1.90)</td>
<td>(2.19)</td>
</tr>
<tr>
<td><strong>Expression</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCA</td>
<td>1.48</td>
<td>1.52</td>
<td>1.11</td>
</tr>
<tr>
<td></td>
<td>(.80)</td>
<td>(.69)</td>
<td>(.69)</td>
</tr>
</tbody>
</table>

Note: PE1 and PE2 = positive emotion before and after speech, NE1 and NE2 = negative emotion before and after the speech, SC1 and SC2 = self-conscious emotion before and after the speech, PS1 and PS2 = physical symptoms before and after the speech, SCA = Self-conscious affect.
Group Differences in Emotional Responding

To examine differences in Arousal and Recovery, two repeated-measures ANOVAs were computed with Alexithymia (HA, LA, and NA) and Gender as between-subject variables and Task (Arousal and Regulation) as within-subjects variables with each DV (HR and SC, run separately) measured at each time point. Experience during the speech was analyzed in the same way with Alexithymia and Gender as between-subjects variables and Task (baseline and speech) as the within-subjects variable with the DVs (PE, NE, SC, and PS) measured at each time point. Expression was examined with a 3 (Alexithymia Group) x 2 (Gender) factorial ANOVA. All ANOVA results are reported in Table 3.3.

Arousal and recovery.

There was no main effect of Alexithymia on HR or GSR nor was there an interaction between Alexithymia and Gender. There was a main effect of Gender on HR. Collapsing across Arousal and Recovery tasks, females ($M = 15.14$) had greater HR change from baseline compared to males ($M = 9.60$, $p = .00$). The Task main effect was inspected for both HR and GSR as a manipulation check and was found to be significant for both indicating that HR and GSR increased as a result of the speech and decreased during recovery. Thus, physiological Arousal and Recovery as measured by HR and GSR was comparable between HA, LA, and NA adolescents.

Experience.

There was a significant between-subjects main effect of Alexithymia for self-reported NE. Pairwise comparisons revealed that HA adolescents ($M = 2.90$) reported significantly higher levels of NE compared to both the LA ($M = 2.40$, $p = .02$) and NA ($M = 2.12$, $p = .00$) adolescents. There was also a significant main effect of Gender, with females ($M = 2.71$) scoring
significantly higher in NE compared to males \((M = 2.24, p = .00)\). Within-subjects effects indicated that there was a significant increase in self-reported NE from before the speech \((M = 1.78)\) to after the speech \((M = 3.17, p = .00)\), indicating that the speech did provoke negativity; however, there was no Alexithymia by Task interaction. Thus, the HA adolescents had higher levels of NE collapsing across the tasks.

For reported SC there was a significant interaction between Alexithymia and Gender. Pairwise comparisons revealed that, collapsing across Task, HA females \((M = 2.95)\) reported significantly higher levels of SC compared to HA males \((M = 1.95, p = .00)\). See Figure 1. As expected, results from within-subjects effects indicate that there was a significant increase in SC emotions from before the speech \((M = 1.45)\) to after the speech \((M = 2.72, p = 00)\), but there was no Alexithymia by Task interaction.

There was a significant interaction between Alexithymia and Gender for PE. Pairwise comparisons revealed that, collapsing across Task, HA females \((M = 4.23)\) had lower self-reported PE compared to HA males \((M = 5.30, p = .04)\). See Figure 2. There was also a within-subjects effect of Task on PE, which decreased significantly from baseline \((M = 5.87)\) to speech \((M = 3.89, p = .00)\), however; there was no Alexithymia by Task interaction.

In terms of PS, there was a significant main effect of Alexithymia. Pairwise comparisons revealed that both the HA \((M = 3.72, p = .00)\) and LA \((M = 3.20, p = .03)\) adolescents scored significantly higher than the NA adolescents \((M = 2.71)\) in overall PS. Within-subjects effects indicate that there was a significant effect of Task with self-reported PS being significantly higher after the speech \((M = 3.78)\) than before \((M = 2.64, p = .00)\). There was no Alexithymia by Task interaction, thus, the HA and LA adolescents experienced significantly higher PS
collapsing across Task. Alexithymic adolescents therefore reported significantly higher levels of NE and PS across the tasks, while female alexithymics reported significantly higher SC and lower PE across the tasks.

**Expression.**

There was no main effect of Alexithymia or of Gender and no interaction on Expression. Therefore HA adolescents expressed the same amount of self-conscious affect as LA and NA adolescents.
Table 3.3
ANOVA Results for the Emotional Responding Variables

<table>
<thead>
<tr>
<th></th>
<th>F</th>
<th>p</th>
<th>Effect Size</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Physiology</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arousal (baseline to speech)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>19.38</td>
<td>.00</td>
<td>.10</td>
</tr>
<tr>
<td>Alexithymia</td>
<td>.01</td>
<td>.99</td>
<td>.00</td>
</tr>
<tr>
<td>Gender</td>
<td>10.47</td>
<td>.00</td>
<td>.06</td>
</tr>
<tr>
<td>Alexithymia x Gender</td>
<td>.24</td>
<td>.79</td>
<td>.00</td>
</tr>
<tr>
<td>Time x Alexithymia</td>
<td>.01</td>
<td>.99</td>
<td>.00</td>
</tr>
<tr>
<td>Time x Gender</td>
<td>.51</td>
<td>.48</td>
<td>.00</td>
</tr>
<tr>
<td>Recovery (speech to recovery)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
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<td>.47</td>
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<tr>
<td>Alexithymia</td>
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<td>.28</td>
<td>.02</td>
</tr>
<tr>
<td>Gender</td>
<td>.00</td>
<td>.96</td>
<td>.00</td>
</tr>
<tr>
<td>Alexithymia x Gender</td>
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<td>.30</td>
<td>.02</td>
</tr>
<tr>
<td>Time x Alexithymia</td>
<td>1.90</td>
<td>.15</td>
<td>.02</td>
</tr>
<tr>
<td>Time x Gender</td>
<td>.27</td>
<td>.60</td>
<td>.00</td>
</tr>
<tr>
<td><strong>Experience</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>NE</td>
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<td></td>
</tr>
<tr>
<td>Time</td>
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<td>.45</td>
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<td>Alexithymia</td>
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<td>.08</td>
</tr>
<tr>
<td>Gender</td>
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<td>.00</td>
<td>.05</td>
</tr>
<tr>
<td>Alexithymia x Gender</td>
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<td>.06</td>
<td>.03</td>
</tr>
<tr>
<td>Time x Alexithymia</td>
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<td>.39</td>
<td>.01</td>
</tr>
<tr>
<td>Time x Gender</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>--------</td>
<td>------------</td>
<td>--------</td>
<td>--------</td>
</tr>
<tr>
<td>SC</td>
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<td></td>
<td>Alexithymia</td>
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<td></td>
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<td>Alexithymia x Gender</td>
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<td>Time x Gender</td>
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<td>.00</td>
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<td>.84</td>
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<td>.09</td>
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<td>.59</td>
</tr>
<tr>
<td></td>
<td>Time x Gender</td>
<td>1.03</td>
<td>.31</td>
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<td>PS</td>
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<td>.00</td>
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<td></td>
<td>Alexithymia</td>
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<td>.00</td>
</tr>
<tr>
<td></td>
<td>Gender</td>
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<td>.08</td>
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<td>Alexithymia x Gender</td>
<td>.94</td>
<td>.39</td>
</tr>
<tr>
<td></td>
<td>Time x Alexithymia</td>
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<td>.36</td>
</tr>
<tr>
<td></td>
<td>Time x Gender</td>
<td>1.44</td>
<td>.23</td>
</tr>
</tbody>
</table>

**Expression**

|        | Alexithymia | .71   | .50    | .01    |
|        | Gender      | 1.22  | .27    | .01    |
|        | Alexithymia x Gender | 1.24  | .29    | .01    |

Note: PE = experienced positive emotions, NE = experienced negative emotions, SC = experienced self-conscious emotions, PS = experienced physical symptoms, SCA = expressed self-consciousness.
Figure 3.1. Experienced self-consciousness by alexithymia group and gender.

Note: NA = non-alexithymic, LA = low alexithymic, HA = high alexithymic, * p < .01
Discussion

The present study examined emotional responding in HA, LA, and NA adolescents. Our goal was to develop a better understanding of the mechanisms underlying alexithymia in adolescents to help guide both prevention and intervention strategies. As predicted there were no differences in physiological Arousal or Recovery as measured by HR and GSR between the HA, LA, and NA adolescents. Results are consistent with past research with adults (Connelly & Denney, 2007; Fukunishi et al., 1999; Papciak et al., 1985; Stone & Nielson, 2001) supporting the idea that alexithymia is unrelated to physiological hyperarousal. We also examined baseline levels of HR and GSR and found no differences in resting autonomic activity between the alexithymia groups. Thus, although alexithymia has been associated with a number of somatic
and psychosomatic diseases in adults (Taylor et al., 1996) as well as adolescents (Burba et al., 2006), results from the present study suggest that autonomic hyperarousal may not be a mechanism of the alexithymia-health relationship as was once suggested (Martin & Pihl, 1985).

Despite similarities in autonomic arousal between the alexithymia groups, the HA and LA adolescents self-reported significantly higher levels of physical symptoms, such as dry mouth and sweating, compared to the NA adolescents. This is suggestive of a possible decoupling between objective physiological arousal and perceived physical arousal in alexithymic adolescents. The “decoupling hypothesis” (Papciak et al., 1985) as it is known within the alexithymia literature, states that there is a decoupling between physiological arousal and subjective emotional experiences. Our results suggest that the decoupling may also include self-reported physical symptoms. Thus, it is plausible that the link between alexithymia and somatic symptoms is due, not to actual differences in the autonomic functioning of alexithymic individuals, but rather, to the internalized experience of physical arousal symptoms.

A further examination of self-reported NE, PE, and SC provides additional support that the internalized experience of alexithymic individuals is different than non-alexithymic individuals. The present study found that 1) HA adolescents reported significantly higher levels of NE, and 2) female HA adolescents reported significantly higher levels of SC and significantly lower levels of PE. These findings partially supported the predictions. While the HA adolescents did experience increased NE, we did not find the predicted interaction between Alexithymia Group and Task. An interaction between Alexithymia Group and Task would have shown that alexithymic adolescents experienced the social stressor as significantly more negative than the non-alexithymic adolescents, due to the emotional processing deficits characteristic of alexithymia. Results from the present study, however, do support the idea that alexithymia is
associated with chronic, unregulated negative affect (Lumley, 2000) and provides further support that the subjective experience of negative emotion may be one pathway linking alexithymia to health problems, specifically those involving unregulated affect.

Finally, our findings do not support the prediction that alexithymic adolescents would express increased self-consciousness (e.g., from the coded videos). Studies examining behavioural expressions of emotion in alexithymic individuals are rare, and this is the first to examine expressed self-consciousness in adolescents. Given the potential implications of nonverbal expressions of emotion (e.g., social relational), further research is necessary to examine what, if any, effects alexithymia has on this and the development of health problems.

Although this study is unique in its contributions to the alexithymia literature, there are limitations that need to be addressed. First, adolescents in this sample were divided into three groups of high, low, and non-alexithymic participants. Although there is some debate surrounding the continuous or categorical nature of the construct, researchers continue to examine alexithymia from both perspectives (Martínez-Sánchez et al., 1998). Second, the present study utilized a relatively homogeneous community sample, composed predominately of European Canadian adolescents. Future research examining emotional responding in diverse samples of adolescents as well as clinical samples is therefore warranted. Third, although the speech is a robust stressor, and our findings indicate that it did cause significant increases in physiological and self-reported arousal, further research examining emotional responses to other emotional states, such as happiness and sadness, would be helpful to our understanding of the alexithymia construct. Lastly, we provided participants with a list of pre-determined “feelings” in which they were to indicate how much they felt each one. Given alexithymics’ difficulty
identifying and describing emotions, future research examining other methods of self-reported experience (e.g., open-ended questions) should be pursued.

The present study found that the only measure of emotional responding to differentiate the HA, LA, and NA adolescents was the subjective experience of NE, PE, SC, and PS. Emotional arousal and recovery as measured by HR and GSR was indistinguishable between the groups as was the level of expressed self-consciousness. This has particular importance for prevention and intervention strategies, specifically those aimed at alexithymic individuals with mental health disorders. Cognitive-behavioural therapy, for example, is an active treatment approach focused on identifying and changing maladaptive emotions (Freeman & Reinecke, 1995). This therapy, along with most other psychotherapeutic approaches rely on the premise that individuals have at least some awareness and understanding of their own emotions (Ogrodniczuk, Piper, & Joyce, 2005). Alexithymic individuals, therefore present a particular challenge for therapists as two of the core characteristics of alexithymia are difficulty identifying and describing emotions. However, by identifying subjective experience as a variable distinguishing alexithymic from non-alexithymic adolescents, treatments can be tailored to suit the alexithymic’s unique needs. The present study therefore suggests that the way in which alexithymic adolescents internalize day-to-day emotional experiences in combination with their inability to use adaptive regulatory strategies (Taylor et al., 1997) may be one of the underlying mechanisms of the alexithymia–health relationship.
References


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Chapter 4: Decoupling between Physiological, Self-Reported, and Expressed Emotional Responses in Alexithymia: Relationship to Internalizing Symptoms
Abstract

Alexithymia is characterized by difficulties identifying, describing, and expressing emotions and is associated with mental health problems involving emotion dysregulation. We examined how patterns of decoupling between physiological arousal, self-reported experience, and observed expression were related to depressive and anxiety symptoms in alexithymic individuals.

Participants (N=106; M=18.00 years) were classified as alexithymic (males=17, females=34) or non-alexithymic (males=23, females=32) and gave an impromptu 3-minute speech while measures of heart rate and galvanic skin response were continuously recorded. Participants also completed self-report measures of self-conscious affect and participant’s behavior was coded for self-conscious affect. Findings supported the decoupling hypothesis. Alexithymic males experienced and expressed greater self-consciousness compared to their physiological arousal. Furthermore, higher experience and expression in comparison to arousal was positively related to anxiety symptoms in non-alexithymic participants. In contrast, higher expression compared to arousal was negatively related to anxiety symptoms in alexithymic participants. Thus, different patterns of decoupling are differentially related to internalizing symptoms in alexithymia and may have important implications for the treatment of internalizing symptoms in alexithymic individuals.
Decoupling between Physiological, Self-Reported, and Expressed Emotional Responses in Alexithymia: Relationship to Internalizing Symptoms

Alexithymia is characterized by difficulties identifying, describing, and expressing emotions and is associated with psychological and physical health problems (Taylor, Bagby, & Parker, 1997). To understand the relationship between alexithymia and health, social stress and emotion-elicitation paradigms have revealed differences in emotional responding between alexithymic and non-alexithymic individuals. With some exceptions (Luminet, Rime, Bagby, & Taylor, 2004; Pollatos et al., 2011; Roedema & Simons, 1999), only two emotional response domains have been examined: physiological arousal and self-reported experience. Decoupling between these emotional response domains (e.g., high self-reported negative affect relative to autonomic responses) has been identified as a risk factor linking alexithymia to health problems (Stone & Neilson, 2001). When emotions arise, however, individuals experience change in observable expression as well as arousal and experience (Cacioppo et al., 1992). Examining observed expressions may therefore be a critical part of the socioemotional deficits of alexithymia. For instance, difficulty expressing emotion could result in interpersonal problems (e.g., lack of social support), which could be related to health problems in alexithymic individuals (Lumley, Stettner, & Wehmer, 1996). Moreover, patterns of decoupling between arousal, experience, and expression may be differentially related to internalizing disorders. The current study therefore extends prior research by examining group differences in arousal, experience, and expression between alexithymic and non-alexithymic individuals. Furthermore, we examined how decoupling between domains related to depressive and anxiety symptoms.
Alexithymia and Emotional Responding

One of the earliest models of alexithymia was the stress-alexithymia hypothesis (Martin & Pihl, 1986), which states that alexithymia is associated with high levels of autonomic reactivity during stress. While there is some support for autonomic hyperarousal during periods of rest (e.g., Fukunishi, Sei, Morita, & Rahe, 1999; Papciack, Feurestein & Spiegel, 1985; Stone & Neilson, 2001; Newton & Contrada, 1994; Wehmer, Brejnak, Lumley, & Stettner, 1995) most studies have found either lower (Linden, Lenz, & Stossel, 1996; Nemiah & Sifneos, 1977; Newton & Contrada, 1994; Wehmer et al., 1995) or comparable (Connelly & Denny, 2007; Fukunishi et al., 1999; Papciak et al., 1985; Stone & Neilson, 2001) physiological reactivity between alexithymics and non-alexithymics. Papciak et al., (1985) suggested that alexithymia is not necessarily related to autonomic hyperarousal, but that subjective experiences were “decoupled” from corresponding autonomic reactivity. Recent studies employing similar paradigms, such as speech studies have supported a decoupling, finding greater self-reported negativity relative to physiological arousal (Connelly & Denney, 2007; Newton & Contrada, 1994; Pollatos et al., 2011). Furthermore, this particular pattern of decoupling may be related to symptoms of psychopathology (Lanteigne, Flynn, Eastabrook, & Hollenstein, 2012).

To date, limited alexithymia research has included measures of observed expression (Luminet et al., 2004; Pollatos et al., 2011; Roedema & Simons, 1999). Of those using emotion eliciting slides (Roedema & Simons, 1999) or movies (Luminet et al., 2004), no relation between alexithymia and behavioural expressions of emotion have been found. However, using a public-speaking paradigm, Pollatos et al. (2011) found higher observer-rated anxiety (e.g., voice quality, gaze) in alexithymic compared to non-alexithymic participants. This is also the only study to date that has examined decoupling between all emotional response domains. While
non-alexithymics had positive associations between each domain, alexithymic participants exhibited high self- and observer-rated anxiety combined with low autonomic responses.

The present study extends previous research by examining how patterns of decoupling between all three emotional response domains are related to internalizing symptoms. To examine this objective, participants were classified as alexithymic or non-alexithymic and were instructed to give an impromptu 3-minute speech while measures of heart rate (general autonomic nervous system response) and galvanic skin response (sympathetic nervous system response) were continuously recorded. Participants also reported feelings of self-consciousness and videos were later coded for self-conscious affect. We first examined group differences in emotional responding. Alexithymics were expected to have higher levels of physiological arousal during baseline (Fukunishi et al., 1999; Papciack et al., 1985; 1987; Stone & Neilson, 2001; Newton & Contrada, 1994; Wehmer et al., 1995), but have comparable arousal levels during the speech task compared to the non-alexithymics (Connelly & Denny, 2007; Fukunishi et al., 1999; Papciak et al., 1985; Stone & Neilson, 2001). For self-reported experience, alexithymics were expected to report more self-consciousness (e.g., ashamed, embarrassed) during the speech compared to non-alexithymics (Connelly & Denney, 2007; Pollatos et al., 2011). Based on Pollatos et al., (2011) we predicted that alexithymics would express more self-consciousness compared to non-alexithymics. In terms of the decoupling hypothesis, it was predicted that alexithymics would have high experienced and expressed self-consciousness relative to their level of physiological arousal (Connelly & Denney, 2007; Newton & Contrada, 1994; Pollatos et al., 2011). It was also expected that this pattern of decoupling would be positively related to depressive and anxiety symptoms.
Method

Participants

Participants included 106 students recruited from a first-year undergraduate psychology course at a university in southern Ontario, Canada. Participants were selected using a pre-screening package during the first week of classes and were classified as either alexithymic (HA, males=14, females=31) or non-alexithymic (NA, males=26, females=35). Participants were 18.26 years ($SD=1.01$; range = 17-23) identified as European-Canadian (68.9%), Black (21.7%), Asian (2.8%), Hispanic (1.9%) and Native Canadian (4.7%).

Procedure

Questionnaire packages were distributed to students in an introductory psychology course and included the Toronto Alexithymia Scale (Bagby et al., 1994). Students who agreed to participate in studies were contacted. In the lab, participants completed a consent form and a set of questionnaires, including the TAS-20, followed by four tasks: 3-minute Baseline, 3-minute Speech task (giving an impromptu speech as if in front of a panel of judges), self-report of feelings during the speech, and 3-minute Recovery period. Participants were debriefed and given a second consent form in which the opportunity to terminate participation was offered. Four participants choose to withdraw and these data were immediately destroyed. One other participant chose not to give a speech and therefore was not included in the analyses. Participants received course credit.

Two concealed video cameras, monitored from an adjacent room, captured the video. Electrocardiogram (ECG) sensors were attached in a Lead II configuration; one sensor was placed two centimeters below the right collarbone and the second between the left hipbone and the last rib bone. Galvanic skin response (GSR) was measured with an SS3 electrodermal
response transducer attached to the tips of the third and fourth finger of the non-dominant hand. ECG and GSR were continuously measured from an MP150 amplifier (Biopac Systems Inc., US) at 200 Hz. Physiological signals were monitored and recorded using AcqKnowledge 4.1. ECG was measured in volts and GSR was calculated as level of conductance in micromhos.

**Measures**

**Questionnaires.**

*Alexithymia.* The 20-item Toronto Alexithymia Scale (TAS-20; Bagby, Taylor, & Parker, 1994) assesses difficulty identifying feelings, difficulty describing feelings, and externally oriented thinking. Items are rated on a 5-point Likert scale ranging from 1 (*Strongly Disagree*) to 5 (*Strongly Agree*). Based on a standard cut-off, participants were classified as Alexithymic (HA, n=61) or non-Alexithymic (NA, n=51). Although total (sum) scores were used to classify participants into groups, mean scores were used in analyses and tables. Cronbach’s alpha was good (α=.89).

Because the TAS-20 was completed at two time points (screening and lab) there was slight variability in group stability. There were instances where a participant recruited for one group subsequently scored on the other side of the cut-off. The time between screening and lab visit ranged from 1 to 4 months. Therefore, to determine group membership and retain maximum power, the reliable change index (RCI; Jacobson & Truax, 1991) was calculated. The RCI is based on the difference between scores and determines the magnitude of change required to be considered statistically reliable and not due to measurement error (see Jacobson & Truax, 1991; Zahra & Hedge, 2010 for details). Seven participants had scores that changed reliably from screening to lab. Of these, six switched from the HA to the NA group and were therefore grouped as NAs for the analyses. One participant’s score increased reliably but not across the
cut-off so remained in the NA group. The remaining 99 participants were classified in the same groups at both measurement points.

**Depression.** The 20-item Beck Depression Inventory (BDI-II; Beck, Steer, & Brown, 1996) measures depressive symptoms. Each item consists of four self-evaluative sentences with a score of 0 to 3 with higher scores indicating greater severity of the symptom (Cronbach’s α=.90).

**Anxiety.** The Beck Anxiety Inventory (BAI; Beck, Epstein, Brown & Steer, 1988) is a 21-item questionnaire measuring anxiety in adolescents and adults. Respondents report the extent to which they have been bothered by each of 21 symptoms during the last week (Cronbach’s α =.91). Each item has four possible choices ranging from 1 (Not at All) to 4 (Severely).

**Demographics.** Participants completed a demographic questionnaire assessing Gender, Age, caffeine consumed in the last 12 hours, minutes of exercise per week, and weight and height, which was used to calculate Body Mass Index (BMI).

**Emotional responding.**

**Arousal and recovery.**

Physiological activity was measured by changes in HR and GSR, both of which have been included in almost all of the alexithymia studies examining physiology. Averages for HR and GSR were calculated for each task. To capture within-subject change, percent change scores were calculated to control for potential differences in HR and GSR occurring at baseline (Swan et al., 2007). Percent change was calculated for Arousal [((Speech–Baseline)/Baseline)*100] and Recovery [((Speech–Recovery)/Baseline)*100].
**Experience.** Before and after the speech participants reported how annoyed, nervous, sad, embarrassed, stressed, and ashamed they felt on a 5-point Likert scale ranging from 1 (Don’t feel at all) to 5 (Feel very strongly). Cronbach’s alphas were adequate for Baseline Experience (.61) and Speech Experience (.83).

**Expression.** Videos were coded using Noldus Observer XT 7.0 software with the Self-Conscious Affect Code II (SCAC-II; Lanteigne & Hollenstein, 2010) which categorizes real-time changes in verbal and non-verbal cues of self-conscious affect (e.g., body tension, hiding, wavering voice). The SCAC-II is a 7-item binary code used to indicate the presence or absence of each self-conscious behavior to obtain a continuous, real-time measure of the onsets and offsets of each category. Observer reliability was checked in 20% of the videos and was good (cue duration=86%, onset of a cue=79%, kappa=.77). Expression was an overall mean score calculated from the weighted proportional durations of the sums across the 7 behaviors. Higher values indicated greater Expressed Self-Consciousness.

**Results**

**Descriptive Statistics**

To examine variables that could affect physiological Arousal (Age, Body mass index, Caffeine consumption, and Exercise) we ran a series of 2 (Alexithymia) x 2 (Gender) ANOVAs. Age and BMI were consistent across the groups and across gender, therefore were not included as covariates. NA adolescents consumed significantly more caffeine than HA, $F (1, 102) = 4.69, p = .03$, and males spent significantly more time exercising each week than females, $F (1, 101) = 11.33, p = .03$. Therefore Caffeine and Exercise were included as covariates in analyses involving Arousal.
To examine Baseline levels of Arousal two (Alexithymia) x 2 (Gender) ANOVA’s were run. There was a difference in baseline HR between HA’s \( (M = 75.80) \) and NA’s \( (M = 71.79) \), \( F(1, 99) = 4.10, p = .046, \eta^2_p = .04 \). There was also a main effect of Gender on Baseline GSR values, \( F(1, 99) = 7.20, p = .01, \eta^2_p = .07 \). Males \( (M = 5.49) \) had significantly higher levels of Baseline GSR compared to females \( (M = 4.21) \). See Table 4.1 for descriptive statistics.

Means and standard deviations for the emotional responding variables are presented in Table 4.2. All variables were checked for normality, skewness, kurtosis and outliers in each of the alexithymia groups. Outliers were identified as cases with z scores that were greater than 3.5 standard deviations from the mean and were winsorized to 3.5 standard deviations from the mean. One high GSR score during Arousal for the HA’s and one high GSR score during Arousal for the NA’s were winsorized.

**Group Differences in Emotional Responding**

To examine differences in Arousal and Recovery, two repeated-measures ANCOVAs were computed with Alexithymia and Gender as between-subject variables and Task (Speech and Recovery) as within-subjects variables with each DV (HR and GSR, run separately) measured at each time point. Caffeine and Exercise were included as CV’s. A repeated-measures ANOVA was computed to examine to differences in Experience during the Speech. Alexithymia and Gender were between-subjects variables and Task (Baseline and Speech) was the within-subjects variable with Experience as the DV measured at each time point. Expression was examined with a 2 (Alexithymia) x 2 (Gender) factorial ANOVA because there was no baseline measure of Expression.
Table 4.1

*Means and Standard Deviations (in parentheses) for Alexithymia scores and Control Variables*

<table>
<thead>
<tr>
<th></th>
<th>Alexithymic Males</th>
<th>Alexithymic Females</th>
<th>Non-Alexithymic Males</th>
<th>Non-Alexithymic Females</th>
</tr>
</thead>
<tbody>
<tr>
<td>TAS-20</td>
<td>3.24 (.21)</td>
<td>3.32 (.29)</td>
<td>2.28 (.53)</td>
<td>2.10 (.45)</td>
</tr>
<tr>
<td>HR AVG</td>
<td>69.79 (8.35)</td>
<td>73.52 (8.43)</td>
<td>73.21 (11.64)</td>
<td>77.56 (9.33)</td>
</tr>
<tr>
<td>GSR AVG</td>
<td>4.87 (2.19)</td>
<td>4.28 (2.12)</td>
<td>6.20 (2.53)</td>
<td>3.87 (1.39)</td>
</tr>
<tr>
<td>AGE</td>
<td>18.23 (.83)</td>
<td>18.55 (1.23)</td>
<td>18.15 (.83)</td>
<td>18.09 (.95)</td>
</tr>
<tr>
<td>BMI</td>
<td>23.45 (1.35)</td>
<td>22.54 (3.84)</td>
<td>22.97 (2.75)</td>
<td>21.81 (2.91)</td>
</tr>
<tr>
<td>CAFFEINE</td>
<td>1.08 (.29)</td>
<td>1.00 (0.0)</td>
<td>1.36 (.81)</td>
<td>1.23 (.43)</td>
</tr>
<tr>
<td>EXERCISE</td>
<td>329.17 (195.28)</td>
<td>200.00 (132.38)</td>
<td>336.40 (252.59)</td>
<td>244.57 (168.74)</td>
</tr>
</tbody>
</table>

*Note.* TAS-20 = Toronto Alexithymia Scale, BMI = Body Mass Index, Caffeine = higher scores equal increased caffeine intake, Exercise = minutes per week.
Table 4.2

Means and Standard Deviations for Emotional Responding Variables

<table>
<thead>
<tr>
<th></th>
<th>Alexithymic</th>
<th>Non-Alexithymic</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Males</td>
<td>Females</td>
</tr>
<tr>
<td><strong>Arousal (baseline to speech)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HR % Change</td>
<td>15.71 (11.66)</td>
<td>25.76 (14.17)</td>
</tr>
<tr>
<td>GRS % Change</td>
<td>67.68 (61.02)</td>
<td>64.36 (50.21)</td>
</tr>
<tr>
<td><strong>Recovery (speech to recovery)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HR % Change</td>
<td>17.32 (10.57)</td>
<td>26.64 (14.42)</td>
</tr>
<tr>
<td>GSR % Change</td>
<td>26.22 (28.15)</td>
<td>28.52 (28.92)</td>
</tr>
<tr>
<td><strong>Experience</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SC1</td>
<td>2.47 (.88)</td>
<td>2.32 (.89)</td>
</tr>
<tr>
<td>SC2</td>
<td>3.84 (1.68)</td>
<td>4.68 (1.66)</td>
</tr>
<tr>
<td><strong>Expression</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SCA</td>
<td>1.47 (.75)</td>
<td>1.25 (.78)</td>
</tr>
</tbody>
</table>

Note: SC1 = self-consciousness before the speech, SC2 = self-consciousness after the speech, SCA = self-conscious affect.
Physiological arousal and recovery.

There was a main effect of Gender on HR, $F(1, 99) = 6.30, p = .01, \eta^2_p = .07$. Collapsing across Speech and Recovery, females ($M = 24.39$) had greater overall HR change compared to males ($M = 16.33$). The Task main effect was significant for both HR, $F(1, 99) = 10.58, p = .00, \eta^2_p = .10$, and GSR, $F(1, 99) = 66.82, p = .00, \eta^2_p = .43$, indicating that HR and GSR increased as a result of the Speech and decreased during Recovery. There was no main effect of Alexithymia on HR or GSR nor was there an interaction between Alexithymia and Gender (all $p$'s $> .05$). Physiological Arousal and Recovery as measured by HR and GSR was therefore comparable between HA and NA participants.

Experience.

There was a significant between-subjects main effect of Alexithymia for Experience, $F(1, 99) = 5.85, p = .02, \eta^2_p = .06$. Follow-up analyses revealed that HA participants ($M = 3.86$) reported significantly higher levels of self-consciousness compared to NA participants ($M = 3.33$). The within-subjects effect of Task was significant, $F(1, 99) = 182.97, p = .01, \eta^2_p = .65$, indicating that there was a significant increase in self-reported Experience from before the Speech ($M = 2.58$) to after the Speech ($M = 4.61$). However, there was no Alexithymia by Task interaction. Thus, HA participants had higher levels of self-consciousness collapsing across the tasks.

Expression.

There was a significant main effect of Alexithymia on Expression, $F(1, 99) = 6.89, p = .01, \eta^2_p = .07$. HA participants ($M = 1.65$) displayed significantly higher levels of Expressed self-consciousness compared to NA participants ($M = 1.35$). There was also a significant main effect of Gender, $F(1, 99) = 6.73, p = .01, \eta^2_p = .06$, with males ($M = 1.67$) showing higher Expressed
self-consciousness than females ($M = 1.36$). There was no interaction between Alexithymia and Gender.

In summary, HA’s demonstrated higher HR compared to NA’s during Baseline, while HR and GSR during Arousal and Recovery were indistinguishable. HA’s also had higher Experienced and Expressed self-consciousness as a result of the speech.

**Decoupling Among the Three Emotional Response Domains**

To examine the decoupling hypothesis we calculated difference scores between each emotional response pairing. These scores allowed us to examine the direction and the degree to which two emotional response domains were decoupled. Scores for each domain were standardized and were then subtracted from one another. The direction of the score is conceptually meaningful, for example, a positive score for Experience-minus-Expression, means that the participant reported experiencing more self-consciousness compared to their expressed self-consciousness, a score of zero means they reported experiencing and expressing the same level of self-consciousness, and a negative score means that they experienced less than they expressed. In total there were five decoupling scores that were used as dependent variables in a series of $2$ (Alexithymia) x $2$ (Gender) factorial ANOVA’s: Experience minus Arousal (run separately for both HR and GSR), Expression minus Arousal (run separately for both HR and GSR) and Experience minus Expression. There was a significant Alexithymia by Gender interaction for Experience minus Arousal (GSR), $F (1, 89) = 5.11, p = .03, \eta^2_p = .08$. Exploratory follow-up analyses revealed that HA males were more decoupled compared to all other participants ($p = .09$). There was also a marginally significant interaction for Expression minus Arousal (GSR), $F (1, 89) = 3.74, p = .06, \eta^2_p = .04$. Follow-up analyses revealed that HA males were significantly more decoupled compared to all other participants ($p = .01$). HA males
therefore Experienced and Expressed greater self-consciousness compared to their Arousal (GSR). There was also a main effect of Gender for Expression minus Arousal (HR), \( F(1, 92) = 12.45, p = .00, \eta^2_p = .09 \) and for Experience minus Expression, \( F(1, 92) = 12.45, p = .00, \eta^2_p = .09 \). Males Expressed greater self-consciousness in comparison to both their Arousal (HR) and their Experience. There were no other significant findings.

**Correlations Between Decoupling and Internalizing Symptoms**

For the NA participants Anxiety symptoms were positively related to Experience minus Arousal (GSR) as well as to Experience minus Expression (\( r = .33 \) and \( r = .34 \), respectively). Therefore higher Experience in comparison to Arousal (GSR) and Expression was related to higher Anxiety symptoms in NA adolescents. For the HA participants Anxiety was negatively related to Expression minus Arousal (GSR; \( r = -.44 \)). Thus, higher Expression compared to Arousal (GSR) was related to lower levels of Anxiety in HA adolescents. All other correlations were non-significant (\( p’s > .05 \)).

**Discussion**

The present study examined differences in Arousal, Experience, and Expression between alexithymic and non-alexithymic participants. Moreover, we tested the decoupling hypothesis and examined how patterns between all three emotional response domains related to internalizing symptoms. Consistent with our predictions, alexithymic participants demonstrated higher Arousal during baseline (HR only), comparable levels of Arousal (HR and GSR) during the Speech, and Expressed greater self-consciousness during the speech. Our prediction that HA’ s would Experience significantly higher levels of self-consciousness as a result of the speech was not supported. Rather HA’ s reported increased levels of self-consciousness that were stable across all phases of the study. HA participants therefore Experienced and Expressed greater self-
consciousness compared to the NA’s. Alexithymia may therefore interfere with the ability to regulate the internalized experience and behavioural expression of emotion. As this is one of only a small number of studies that have examined the effects of alexithymia on Expression during a socially stressful situation, additional studies are necessary to replicate this finding and to examine how differences in Expression may affect socioemotional health.

While this between subjects approach is common within the alexithymia literature and is useful in terms of understanding group differences, it does not allow for a full examination of the decoupling hypothesis. We therefore calculated within person difference scores to better understand how individual differences in decoupling related to internalizing symptoms. We found that HA males Experienced and Expressed greater self-consciousness compared to their Arousal as measured by GSR. This finding lends support to the between group differences in Experience and Expression discussed above and is consistent with previous alexithymia research finding higher levels of Experience relative to physiological Arousal (Connelly & Denney, 2007; Newton & Contrada, 1994; Pollatos et al., 2011). This finding also extends previous research by showing that alexithymics not only report higher Experience relative to Arousal, but that they also demonstrate higher Expression relative to Arousal. Thus, the way in which alexithymic individuals internalize and express negative emotions may be an important mechanism leading to increased internalizing problems. In normative samples, this pattern of responding (higher Experience relative to Arousal) has indeed been related to psychopathology (Lanteigne et al., 2012) and was replicated in the NA participants; higher Experience relative to Arousal was positively related to anxiety symptoms. In addition, higher Experience relative to Expression was also related to anxiety symptoms in the NA participants. Therefore, NA’s who reported
higher self-consciousness compared to their levels of physiological arousal and observed self-consciousness were more likely to experience anxiety symptoms.

In the HA participants, higher Experience relative to Arousal was unrelated to internalizing symptoms, however higher Expression compared to Arousal (GSR) was negatively related to Anxiety. Thus, Expressing more self-consciousness compared to Arousal was associated with lower levels of Anxiety in alexithymics. According to the emotional discharge theory (Cacioppo et al., 1992), emotions are viewed as energy that is directly discharged through outward expression or, if this is not possible, is expressed through internal pathways. When emotion is expressed or discharged outwardly, there is an attenuation of physiological reactivity. However, when emotions are suppressed there is a subsequent increase in physiological reactivity (Gross, 1998). Thus, higher Expressed emotion may act as a protective factor for alexithymic individuals. While non-alexithymic individuals are able to discharge their emotions via verbal identification and description, these are core deficits of alexithymia. Therefore, in order to discharge emotional tension (and decrease subsequent autonomic reactivity and anxiety), alexithymic individuals may rely on outward expression. This is an interesting finding with potential implications for alexithymia, however, additional research is needed to examine this further.

The present study was unique in that we examined the patterns of decoupling across Arousal, Experience, and Expression in relation to depressive and anxiety symptoms in alexithymia. However, there are some limitations that need to be addressed. First, this was a community sample consisting of mostly European Canadian participants. Therefore, we were only able to examine subclinical levels of depressive and anxiety symptoms, not clinically diagnosed disorders. Although understanding risk factors for subclinical levels of internalizing...
symptoms is important, further research examining the decoupling hypothesis in various clinical samples is needed to extend these findings. In addition, future research should examine decoupling across a number of different elicited emotions. For instance, while we elicited self-consciousness using an impromptu speech task, future research examining the decoupling hypothesis across various emotional manifestations (e.g., anger, sadness, amusement) would greatly improve our understanding of alexithymia and emotion dysregulation.

In conclusion, the present study highlights the importance of using a multi-method approach to understanding the emotion regulation deficits associated with alexithymia. As the present study has demonstrated, different patterns of decoupling between Arousal, Experience, and Expression may be differentially related to internalizing symptoms in alexithymic and non-alexithymic individuals. By better understanding the interactions between all three emotional response domains, treatments can be tailored to suit alexithymic individuals.
References


Chapter 5: General Discussion
General Discussion

The goals of this research were 1) to examine the relationship between emotional awareness and self-reported emotion regulation strategies, 2) to determine the effects of emotional awareness on real-time emotion regulation, and 3) to explore the effects of emotional awareness and emotion regulation on internalizing symptoms in adolescents. The objectives of the first study were two-fold: to examine the association between emotional awareness and specific regulatory strategies and to test the indirect effect of emotion regulation strategies on the association between emotional awareness and internalizing symptoms. The first study confirmed that individual differences in emotional awareness were differentially related to emotion regulation strategies. Specifically, we found that emotional awareness was positively related to reappraisal and negatively related to suppression. This study also confirmed the proximal role of emotion regulation in the relationship between emotional awareness and internalizing symptoms; when reappraisal and suppression were added into the models, the direct effect of emotional awareness on internalizing symptoms was no longer significant. The second study examined the effects of emotional awareness on real-time emotion regulation in terms of physiological arousal, self-reported experience, and observed expression in a sample of adolescents. Results from this study highlight differences in the subjective experiences of high alexithymic, low alexithymic, and non-alexithymic adolescents. High alexithymic adolescents reported significantly higher levels of negative emotion compared to low and non-alexithymic adolescents. High alexithymic females also reported higher levels of self-consciousness and significantly lower levels of positive emotion compared to low and non-alexithymic adolescents. Finally, the third study replicated the second, in that it examined the effects of emotional awareness on physiological arousal, self-reported experience and observed expression in undergraduate students (See Table
5.1 for a comparison of findings between the second and third study). This study also extended the previous studies by examining the decoupling hypothesis in alexithymic participants and the relationship between decoupling and internalizing symptoms. To date, this is the first study to specifically examine the relationships between decoupling and depressive and anxiety symptoms in alexithymic participants. Patterns of decoupling between alexithymic and non-alexithymic participants were differentially related to internalizing symptoms. Taken together this program of research has a number of important implications for both emotional processing and developmental psychopathology research that will be discussed below.

First, this program of research highlights the fact that emotion regulation strategies play an important role in determining depressive and social anxiety symptoms and are associated with an adolescent’s level of emotional awareness. An interesting finding to emerge from this research was the differential effect of reappraisal and suppression on depression and social anxiety symptoms. Our results suggest that adolescents with high emotional awareness were more likely to reappraise their emotions. This was associated with lower levels of depression, but was unrelated to social anxiety. On the other hand, adolescents with low emotional awareness were more likely to suppress their emotions, which was associated with higher levels of social anxiety symptoms, but was unrelated to depressive symptoms. Individual differences in emotional awareness are therefore differentially related to emotion regulation strategies, which are themselves differentially related to internalizing symptoms. An important addition to this research would be to test the effects of different emotion regulation strategies on a variety of internalizing as well as externalizing symptoms. This could have important implications for our understanding of alexithymia and its relationship to a wide variety of mental health problems.
Table 5.1

*Comparison of Demographic Information and Emotional Responding Domains Between Studies two and three*

<table>
<thead>
<tr>
<th></th>
<th>Study 2</th>
<th>Study 3</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Demographics</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>12.0 to 16.9 years ((M=13.6, SD=1.1))</td>
<td>17.0 to 23.2 years ((M=18.26, SD=1.01))</td>
</tr>
<tr>
<td>Gender</td>
<td>males = 87, females = 94</td>
<td>males = 40, females = 66</td>
</tr>
<tr>
<td><strong>Emotional Responding</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Arousal</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Baseline HR</td>
<td>HA = LA = NA</td>
<td>HA &gt; NA in HR</td>
</tr>
<tr>
<td>Baseline GSR</td>
<td>HA = LA = NA</td>
<td>HA = NA</td>
</tr>
<tr>
<td>Speech HR</td>
<td>HA = LA = NA</td>
<td>HA = NA</td>
</tr>
<tr>
<td>Speech GSR</td>
<td>HA = LA = NA</td>
<td>HA = NA</td>
</tr>
<tr>
<td>Experience</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Self-consciousness</td>
<td>HA females &gt; LA and NA</td>
<td>HA &gt; NA</td>
</tr>
<tr>
<td>Negative affect</td>
<td>HA &gt; LA and HA &gt; NA</td>
<td></td>
</tr>
<tr>
<td>Positive affect</td>
<td>HA females &lt; LA and NA</td>
<td></td>
</tr>
<tr>
<td>Expression</td>
<td>HA = LA = NA</td>
<td>HA &gt; NA</td>
</tr>
</tbody>
</table>

Note: HA = Alexithymic, LA = low alexithymic, NA = non-alexithymic.
For instance, while we focused solely on internalizing symptoms, low emotional awareness as measured by alexithymia is associated to a host of other psychological health problems such as anorexia nervosa and bulimia (Taylor, Parker, Bagby, & Bourke, 1996; Sureda, Valdes, Jodar, & de Pablo, 1999), as well as numerous addiction related disorders, such as alcoholism (Rasheed, 2001). Because of the growing list of problems alexithymia has been associated with, some researchers have questioned its usefulness as a construct (Deary, Scott, & Wilson, 1997). The present research, however, points to the proximal role of emotion dysregulation in the development of internalizing symptoms. Moreover, emotion dysregulation has been implicated in many of the same mental health problems as alexithymia (e.g., Berenbaum, Raghavan, Le, Vernon, & Gomez, 2003; Cicchetti, Ackerman, & Izard, 1995; Cole, Michel, & Teti, 1994; Johnson-Laird, Mancini, & Gangemi, 2006; Kring & Bachorowski, 1999; Mennin & Farach, 2007). Thus, limited emotional awareness in and of itself may not be enough to result in mental health problems, but instead may affect the quality of available emotion regulation strategies. Therefore the seemingly non-differential associations between alexithymia and various health problems may be better understood by examining the effects of various emotion regulation strategies.

The second important implication from this research comes from examining the effects of emotional awareness on real-time physiological arousal, self-reported experience, and observed expression. Both studies examining differences in emotional response domains found that the alexithymic participants had higher levels of negatively valenced emotion compared to the non-alexithymic participants. Moreover, both studies found that this was not task specific; the alexithymic participants had higher levels of negative emotions both before and during the speech task. Results therefore highlight the importance of emotional awareness for the
internalized experience of emotional arousal. This finding supports past research with adults (Connelly & Denney, 2007; Pollatos et al., 2011), suggesting that difficulties identifying and describing emotions results in higher levels of negative affect and lower levels of positive affect. This difference in subjectively experienced affect could be the result of alexithymic individuals choosing more maladaptive regulatory strategies as was demonstrated in the first study.

In addition, it is interesting to note gender differences in emotional responding from Studies 2 and 3. In Study 2, female adolescents who were in the high alexithymia group reported the highest levels of self-conscious emotion as well as the lowest levels of positive emotion throughout the study. As mentioned, adolescence poses unique threats for females, who begin to show a heightened vulnerability to disorders involving emotion dysregulation (Galambos, Leadbeater, & Barker, 2004; Lewinsohn, Gotlib, Lewinsohn, Seeley, & Allen, 1998; Nolen-Hoeksema, & Girgus, 1994). In addition, female adolescents commonly have higher levels of self-conscious emotions compared to males (Bybee, 1998) due to increases in social comparisons (Rankin, Lane, Gibbons, & Gerrard, 2004) as well as higher fear of social evaluations (Mallet & Rodriguez-Tome, 1999). Results from the present study add to this body of research, suggesting that high alexithymic females in particular, who have difficulty identifying and describing their own emotions, may be at greater risk for experiencing increased levels of self-consciousness combined with decreased levels of positive affect. Thus, the ability to be aware of and describe specific emotions may act as a protective factor for females as they transition through adolescence. In support of this, female adolescents are more likely than males to engage in emotional self-revelation with friends and family (Hill & Stull, 1987; Norrell, 1984), which has been positively related to adolescent self-esteem and to overall mental health. Therefore, results from the present study point to the fact that adolescent females who are unable to discuss their
emotions due to a lack of emotional awareness may be at increased risk for socioemotional problems.

Additional gender differences were also evident in Study 3 where high alexithymic males were more decoupled in their emotional response to the speech compared to the other participants (e.g., high alexithymic males experienced and expressed greater self-consciousness compared to their physiological arousal as measured by GSR). Males typically experience increased pressure to suppress self-conscious emotions, such as sadness and embarrassment, more than females (Gullone, Hughes, King, & Tonge, 2010). Moreover, suppression (e.g., inhibiting emotion-expressive behaviours) has been associated with increased levels of alexithymia (Chen, Xu, Jing, & Chan, 2011). However, by employing an ecologically valid social stressor task and examining within-person decoupling scores, the present study found that high alexithymic males actually expressed (and experienced) increased self-consciousness in relation to their physiological arousal. Future research examining the relationship between self-reported suppression and observed expression in alexithymic males would help increase our understanding of the emotion regulation deficits associated with alexithymia.

The third implication to come from this research stems from an examination of the age-related differences in physiological arousal, self-reported experience, and observed expression between the alexithymic participants in studies 2 and 3. In terms of physiological arousal, results between the two studies are similar except that older alexithymic participants in the third study demonstrated higher levels of HR during baseline compared to the non-alexithymic participants, while younger alexithymic adolescents from the second study did not. Even within the adult literature, findings regarding hyper vs. hypo-arousal in alexithymic individuals are mixed. In recent years, however, increasing support has emerged for hyperarousal during periods of rest.
(e.g., Fukunishi, Sei, Morita, & Rahe, 1999; Papciack, Feurestein & Spiegel, 1985; Stone & Neilson, 2001; Newton & Contrada, 1994; Wehmer, Brejnak, Lumley, & Stettner, 1995).

Results from the present research therefore support the hyperarousal model of alexithymia in the older alexithymic individuals only. According to the hyperarousal model, alexithymic individuals “lack the affective awareness which would permit identification of a particular situation as stressful” (Martin & Pihl, 1985, p. 170). As a result alexithymic individuals were thought to experience stressful events longer and more frequently compared to non-alexithymic individuals, which was hypothesized to result in increased autonomic activity. Results from this research however, call into question the developmental timeframe associated with the hyperarousal model of alexithymia. For instance, the lack of higher HR during baseline in the younger alexithymic participants could be a result of differential age-related effects of alexithymia on the autonomic nervous system. Specifically, autonomic hyperarousal may not be evident in younger alexithymic participants as they have not yet experienced as many episodes of stress and unidentified arousal as older alexithymic individuals. Furthermore, while there were no differences in observed self-consciousness in the younger adolescents, older participants with alexithymia demonstrated increased levels of observed self-consciousness during the social stressor task. Thus, longitudinal studies examining the developmental trajectories of alexithymia would be useful to better understand how alexithymia interferes with regulatory efforts and how this is related to subsequent psychological health problems.

**Limitations and Future Directions**

This program of research relied exclusively on self-report measures of emotional awareness and alexithymia. Although many studies have confirmed both the discriminant and convergent (e.g., Bagby, Taylor, & Parker, 1994) validity of the TAS-20, there is still some
concern over the ability of a self-report questionnaire to properly capture a lack of emotional awareness (Lane, Quinlan, Schwartz, Walker, & Zeitlin, 1990). Therefore, understanding could be improved by using a multi-method assessment approach. There are a number of observer rated measures of alexithymia including The Observer Alexithymia Scale (OAS; Haviland, Warren, & Riggs, 2000) and The Beth Israel Hospital Psychosomatic Questionnaire (Sifneos, 1973), which have been found to be positively related to self-reported scores from the TAS-20 (Jimerson, Wolfe, Franko, Covino, & Sifnos, 1994). In clinical settings where a more extensive assessment may be required, there is also the Toronto Structured Interview for Alexithymia (TSIA; Bagby, Taylor, Parker, & Dickens, 2006).

It should also be noted that participants from each study were relatively homogeneous, therefore generalizability to diverse samples is limited. For instance, the majority of participants were Caucasian from a similar cultural background. Various studies using adult participants have examined the generalizability of the factor structure of the TAS-20 across a number of different cultures and support has been found in a number of cross-cultural studies (Bressi et al., 1996; Pandey et al., 1996; Parker, Mandal, Taylor, & Parker, 2005; Simonsson-Sarnecki et al., 2000). However, additional research examining the effects of alexithymia and low emotional awareness on emotion regulation across various cultures is still needed. Furthermore, although participants from the third study were recruited based on their TAS-20 scores, it should still be noted that the present study utilized community samples of adolescents. As such, we focused on internalizing symptoms, not clinically diagnosed levels of depression and anxiety. Although this is an important part of the research process as sub-clinical levels of internalizing symptoms can be a risk factor for more serious problems later on, the patterns of results found may not be applicable to adolescents with clinically significant levels of internalizing disorders. Research
should therefore be conducted across diverse populations of clinical participants. Past research has found high rates of alexithymia in adolescents with various eating disorders (Zonnevylle-Bender, van Goozen, Cohne-Kettenis, van Elburg, & van Engeland 2004), in adolescents with high levels of delinquency (Zimmerman, 2006), as well as depression and anxiety disorders (Sayer, Kose, Grabe, & Topbas, 2005).

Conclusion

Overall, this program of research points to the importance of emotional awareness for adaptive emotion regulation. It also highlights the differential effects of emotion regulation strategies on internalizing symptoms. At a theoretical level, this research has guided our understanding of emotional processing, confirming that emotional awareness is necessary for adaptive emotion regulation efforts. This information can then be applied at a practical level to help guide intervention and treatment approaches for adolescents with low emotional awareness. Specifically, fostering emotional awareness in everyday life, especially throughout childhood and adolescence, may go a long way to alleviate the heavy costs of internalizing psychopathologies.
References


doi:http://dx.doi.org.proxy.queensu.ca/10.1016/j.adolescence.2005.08.001


doi:http://dx.doi.org.proxy.queensu.ca/10.1007/s00787-004-0351-9
Appendix A

LAB VISIT: INITIAL CONSENT (PARENT)

Project Title: Individual differences in psychophysiological responsivity while regulating emotion in adolescence.

Background Information:

We are requesting your child’s involvement in a research project designed to explore changes in children’s emotional and behavioural patterns as they move into adolescence. You have indicated your willingness to participate in this study that involves a visit to Dr. Hollenstein’s laboratory at Queen's University. This study has been reviewed for ethical compliance by the Queen’s University Health Sciences and Affiliated Teaching Hospitals Research Ethics Board.

Details of the Study:

We have invited you and your child for this visit that will last approximately 2.5 hours. You will be asked to wait in an adjacent room while your child completes the study. During the study, your child will be videotaped while completing a few tasks. After the instructions are clear, we will turn on the camera and record your child as he or she proceeds through the tasks. Later, we will analyze the videotapes and look for patterns that are general to all participants.

While being videotaped, we will also record information about heart rate, breathing rate, and the perspiration on the skin of the finger. These recordings will be used to provide information about how excited your child gets during the tasks. There is no harm in having these sensors placed on your body in several places: on the finger, below each clavicle, and a strap around the upper torso under the armpits. Only female research assistants will affix these electrodes to your child’s body and anyone can refuse to have these electrodes placed on their body at any point during your visit.

No harm can result from participation in this study. However, some participants may feel embarrassed or anxious being recorded on video. If feelings of discomfort do occur, any participant is welcome to stop participation at any time. If emotional issues arise that you would like to follow up, please feel free to ask for a list of professionals who may be of service.

Benefits:

We expect the adults and children in this study to have a positive experience. It can be interesting and informative to both you and your child to learn about individual patterns of thought and feeling as they change through the early adolescent years.

Freedom to withdraw or participate:

Your child’s participation in this research is completely voluntary. He or she can decide not to participate and you can choose to stop him or her from participating at any point. He or
she may also end the videotaped sessions at any time. The decision not to participate, or to stop participating, will be respected, and no negative evaluation, pressure, or any other unpleasant outcome will result.

Compensation:

Your child will receive a $20 gift certificate to Chapters. This is intended to thank you and your child for your participation in this study.

Confidentiality:

Any information gathered from this study will remain confidential, and published reports will not mention individuals. All files, including video, will be given a code number rather than a name to identify it. Only staff members of the project (including graduate students working with Dr. Hollenstein) will have access to the video recordings, unless you give us your express permission to use the videotapes for purposes of education. In that case, videos may be shown to university students and professionals in psychology and related disciplines, and these individuals will be asked to maintain confidentiality as well. The video will be saved on DVD and kept in a locked, secure cabinet in a locked room. Your data will be destroyed after 10 years. When the study is complete, we will be happy to share the results with you, and you are free to contact us at any time to learn more about the procedures or the results.
Appendix B

LAB VISIT: INITIAL CONSENT (CHILD)

I understand that the aim of this study is to learn more about the feeling and behaviour changes that happen when you become a teenager, and that all I will need to do is sit quietly and participate in certain tasks like talking about things that are interesting to me.

I understand that I will be videotaped while I do these tasks. I also understand that my heart rate, breathing rate, and skin perspiration will be recorded at the same time and that there is no harm from this kind of recording.

I understand that these videotapes will be private, and seen only by Dr. Hollenstein and his helpers, and possibly other adults interested in child development if that feels OK to me. I know that I will be assigned a number, and that my name will not be connected to the video.

I understand that I may skip any question that I do not want to answer. I understand that I may get out of the study at any time without giving a reason, and that nobody will be mad at me if I do. My parent can also decide, at any time, that we don’t want to be in this study any longer.

I understand that I may contact Dr. Hollenstein, or any of his helpers, at any time during the study, if I have questions. I also understand that I may contact the Head of the Psychology Department (Dr. Rick Benninger: (613) 533 – 2492) or the Chair of the Queen’s University Health Sciences and Affiliated Teaching Hospitals Research Ethics Board (Dr. Albert Clark, (613) 533-6081) if I have any concerns about the project.

Circling “I agree” below means that I would like to participate in the study.

I agree  I do not agree

Signature: ______________________________________   Date: __________________
Appendix C

LAB VISIT: FINAL CONSENT (CHILD)

Now that I have completed the study and understand more fully all of the things that have been recorded, I understand that I have the opportunity to review my consent. It has been explained to me that I may withdraw my participation at this point and any recordings that have been made will be destroyed. I understand I may also leave my consent unchanged so that these recordings may be kept in a secure and confidential place and analyzed.

Please complete either section A or B below.
A. I choose to remain in the study and wish to have my data included:

Name: __________________________  Date: __________________

Signature: _______________________

B. I wish to withdraw from the study. Please destroy the recordings and other information gathered today.

Name: __________________________  Date: __________________

Signature: _______________________

************************************************************************

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Appendix D

CONSENT FORM

Project: Individual differences in psychophysiological responsivity while regulating emotion.

Investigator: Dr. Tom Hollenstein

I have read the description of the study “Individual differences in psychophysiological responsivity while regulating emotion” and all of my questions, if any, have been answered to my satisfaction. I understand that my involvement consists of having my skin conductance, heart rate, and breathing rate measured while I go through several simple tasks. I will also be completing some questionnaires. I have been informed that the purpose of the study is to learn how different people experience their emotions physiologically and psychologically.

I understand that my participation is completely voluntary and that I am free to withdraw at any time. It is also clear to me that any information recorded will remain confidential and will only be identified with a number.

I also understand that if I have questions or concerns, I may contact the researcher, Dr. Tom Hollenstein (tom.hollenstein@queensu.ca), the Head of the Department of Psychology at Queen’s University, Dr. Richard Beninger (613-533-2486), or the Chair of the Queen's University General Research Ethics Board, Dr. Joan Stevenson, (613-533-6081) if I have any concerns about the project.

Name: __________________________ Date: _________________

Signature: ______________________
Appendix E

CONSENT FORM - FINAL

Project: Individual differences in psychophysiological responsivity while regulating emotion.

Investigator: Dr. Tom Hollenstein

Now that I have completed the study (“Individual differences in psychophysiological responsivity while regulating emotion”) and understand more fully all of the things that have been recorded, I understand that I have the opportunity to review my consent. It has been explained to me that I may withdraw my participation at this point and any recordings that have been made will be destroyed. I understand I may also leave my consent unchanged so that these recordings may be kept and analyzed.

Please complete either section A or B below.

A. I choose to remain in the study and wish to have my data included:

Name: __________________________  Date: ______________

Signature: ______________________

B. I wish to withdraw from the study. Please destroy the recordings and other information gathered today.

Name: __________________________  Date: ______________

Signature: ______________________
Appendix F

Ethic Approval Forms
QUEEN'S UNIVERSITY HEALTH SCIENCES AND AFFILIATED TEACHING HOSPITALS
ANNUAL RENEWAL

Queen's University, in accordance with the “Tri-Council Policy Statement, 1998” prepared by the Medical Research Council, Natural Sciences and Engineering Research Council of Canada and Social Sciences and Humanities Research Council of Canada requires that research projects involving human subjects be reviewed annually to determine their acceptability on ethical grounds.

A Research Ethics Board composed of:
Dr. A.F. Clark
Emeritus Professor, Department of Biochemistry, Faculty of Health Sciences, Queen's University (Chair)
Dr. H. Abdullah
Professor, Department of Medicine, Queen's University
Dr. M. Evans
Community Member
Dr. S. Horgan
Manager, Program Evaluation & Health Services Development, Geriatric Psychiatry Service, Providence Care, Mental Health Services Assistant Professor, Department of Psychiatry
Dr. I. Keeping-Burke
Assistant Professor, School of Nursing, Queen's University
Ms. D. Morales
Community Member
Dr. W. Racz
Emeritus Professor, Department of Pharmacology & Toxicology, Queen's University
Dr. B. Simchison
Assistant Professor, Department of Anaesthesiology, Queen's University
Dr. A.N. Singh
WHO Professor in Psychosomatic Medicine and Psychopharmacology Professor of Psychiatry and Pharmacology Chair and Head, Division of Psychopharmacology, Queen's University Director & Chief of Psychiatry, Academic Unit, Quinte Health Care, Belleville General Hospital
Dr. E. Tsai
Associate Professor, Department of Pediatrics and Office of Bioethics, Queen's University
Rev. J. Warren
Community Member
Ms. K. Weisbaum
LL.B. and Adjunct Instructor, Department of Family Medicine (Bioethics)
Dr. S. Wood
Director, Office of Research Services (Ex Officio)

has reviewed the request for renewal of Research Ethics Board approval for the project “Individual Differences in Psychophysiological Responsivity While Regulating Emotion in Adolescence” as proposed by Dr. Tom Hollenstein of the Department of Psychology, at Queen's University. The approval is renewed for one year, effective June 1, 2010. If there are any further amendments or changes to the protocol affecting the subjects in this study, it is the responsibility of the principal investigator to notify the Research Ethics Board. Any unexpected serious adverse event occurring locally must be reported within 2 working days or earlier if required by the study sponsor. All other adverse events must be reported within 15 days after becoming aware of the information.

Chair, Research Ethics Board

Aug 4, 2010

Date

REB# PSYC-082-00
August 3, 2010

Dr. Tom Hollenstein
Department of Psychology
Humphrey Hall
Queen's University

Re:  “Individual Differences in Psychophysiological Responsivity While Regulating Emotion in Adolescence” PSYC-082-08

Dear Dr. Hollenstein,

I am writing to acknowledge receipt of the following:

- Your email dated Tuesday, August 03, 2010 which requested approval for some amendments to the above-named study:
  - A variation on the basic lab protocol
  - Inclusion of both male and female adolescents
  - Dropping data collection from the parents and the exit interview
- Removal of some survey questionnaires and addition of some survey questionnaires
  - Questionnaires to be replaced: Multidimensional Anxiety Scale for Children (MASC) and Child Depression Inventory (CDI) – Replaced by Beck Anxiety Inventory (BAI) and Beck Depression Inventory (BDI)
  - Questionnaires to be added: Affective Style Questionnaire (ASQ), Coping Styles Checklist (CSC), Toronto Alexithymia Scale (TAS) and Youth Self-Report (YSR)
- Lab Visit: Initial Consent (Parent) – Version 1: August 1, 2010
- Lab Visit: Initial Consent (Child) – Version 1: August 1, 2010
- Lab Visit: Final Consent (Child) – Version 1: June 27, 2008
- Debriefing Script (for experimenter to recite)
- Debriefing Form: Child

I have reviewed these amendments and the additional survey questionnaires and hereby give my approval. Receipt of these amendments and forms will be reported to the Health Sciences Research Ethics Board.

Yours sincerely,

Albert Clark
Ph.D.
Chair
Research Ethics Board

AFC/kr
September 16, 2010

Dr. Tom Hollenstein
Department of Psychology
220 Craine Hall
Queen’s University

Re: “Individual Differences in Psychophysiological Responsivity While Regulating Emotion in Adolescence” PSYC-082-08

Dear Dr. Hollenstein,

I am writing to acknowledge receipt of your email dated Friday, September 03, 2010 which requested approval for the following:

- Amendments to the questionnaires – How Am I Feeling
- Addition of the following:
  - HHAGS questionnaire
  - ESUPP questionnaire
  - BV questionnaire

I have reviewed these amendments and the additional questionnaires and hereby give my approval. Receipt of these materials will be reported to the Health Sciences Research Ethics Board.

Yours sincerely,

Albert Clark, Ph.D.
Chair
Research Ethics Board

AFC/kr

think Research
think Queen's
November 8, 2010

Dr. Tom Hollenstein
Department of Psychology
Humphrey Hall
Queen’s University

Re: “Individual Differences in Psychophysiological Responsivity While Regulating Emotion in Adolescence” PSYC-082-08

Dear Dr. Hollenstein,

I am writing to acknowledge receipt of your email dated Tuesday, October 26, 2010 which included the following:

- A report on the lab visit with the 15 year old participant and his Cantonese speaking mother
- A copy of the consent form translated into Cantonese

Thank you for providing this update.

Yours sincerely,

Albert Clark, Ph.D.
Chair
Research Ethics Board

AFC/kr
November 15, 2010

Dr. Tom Hollenstein
Department of Psychology
Humphrey Hall
Queen's University

Re: "Individual Differences in Psychophysiological Responsivity While Regulating Emotion in Adolescence" PSYC-082-08

Dear Dr. Hollenstein,

I am writing to acknowledge receipt of your email dated Friday, November 12, 2010 which included the following:

- Confirmation that Ashley Murphy is the graduate student to be added to your study

This information will be reported to the Health Sciences Research Ethics Board.

Yours sincerely,

[Signature]

Albert Clark, Ph.D.
Chair
Research Ethics Board

AFC/kr
August 9, 2011

Dr. Tom Hollenstein
Department of Psychology
Humphrey Hall
Queen’s University

Re: “Individual Differences in Psychophysiological Responsivity While Regulating Emotion in Adolescence” PSYC-082-08

Dear Dr. Hollenstein,

I am writing to acknowledge receipt of your email which requested approval for some amendments to the above-named study. I have reviewed the following:

- Participants will now have the option of doing the entire lab protocol or only the questionnaires
- The Cyberball computer game will be replaced with a facial emotional expression task
- Addition of one questionnaire – the Test for Self-Conscious Affect (Tangney & Dearing, 2002) – Adolescent Version
- Revised telephone contact script
- Revised Debriefing Form: Child – July 26, 2011
- Revised Debriefing Form: Child – Questionnaires (July 26, 2011)
- Revised Questionnaires: Parent Consent (July 26, 2011)
- Revised Lab Visit: Initial Consent (Parent) – July 26, 2011
- Revised Lab Visit: Initial Consent (Child) – July 26, 2011
- Revised Questionnaires: Child Consent (July 26, 2011)
- Revised Lab Visit: Final Consent (Child) – July 26, 2011
- A copy of the Test for Self-Conscious Affect (TOSCA-A) questionnaire

I have reviewed these amendments and the revised forms and hereby give my approval. Receipt of these will be reported to the Health Sciences Research Ethics Board.

Yours sincerely,

Albert Clark, Ph.D.
Chair
Research Ethics Board

APC/kr