Effects of Facilitated Emotional Disclosure on Psychological and Cardiovascular Reactivity in Alexithymia

by

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Abstract

Alexithymia, meaning “lack of words for feelings”, is characterized by difficulty identifying and describing emotional experiences as well as increased somatization. These emotional difficulties, which can be exacerbated by social stressors, have been linked to psychopathology and negative health outcomes. Situations that include demand for emotional expression, which can thus increase uncertainty, have been found to increase psychological arousal and alterations in the autonomic nervous system in the individuals with alexithymia. However, most studies to date have not examined the influence of facilitated emotional disclosure, a commonly used therapeutic tool, on psychological and cardiovascular reactivity in individuals with alexithymia. Drawing from research on social facilitation and emotion disclosure, this study examined how increased demands for emotional expression may increase negative emotional and physiological arousal in individuals scoring higher in alexithymia. Using data from a larger study, one hundred forty-one participants with chronic lower back pain engaged in emotional disclosure tasks with differing levels of facilitation after an anger-inducing maze task involving harassment from a confederate. Alexithymia was assessed using the Toronto Alexithymia Scale (TAS-20) scores during intake. Changes in negative affect were calculated by subtracting baseline values from post-experimental task reports. Also, blood pressure and heart rate were collected during both the anger-inducing and emotion expression tasks, and compared with baseline averages to obtain a change score. The results show that, in general, alexithymia as measured by TAS-20 was not associated with emotional or cardiovascular reactivity across expression groups. The lack of support for stress reactivity in alexithymia in the context of emotion disclosure demands is

considered within the emotional disengagement characteristic of alexithymia as well as the decoupling and the alexithymia-stress model. Future studies to further investigate the cognitive appraisal and cardiovascular markers associated with alexithymia in situations with high emotional demand and perceived low resources as well as assessing task engagement may shed light on our understanding of stress processes and barriers to therapeutic treatments in alexithymia.

Keywords: Alexithymia, emotional disclosure, facilitated disclosure, demand and resources, stress reactivity, alexithymia-stress model

Chapter I

Introduction

Alexithymia is a subclinical phenomenon that is prevalent in about 10 - 13% of the general population, and somewhat more common in males (Mattila et al., 2006). This trait-like disorder is related to several psychosocial processes such as: psychosomatic disorders, traumatic memories, suicide risk, depression, eating disorders, and chronic pain, among others (Kojima, 2012; Kojima 2014; Taylor & Bagby, 2004; Grabe et al., 2004). Alexithymia has also been associated with different kinds of addictive disorders, such as pathological gambling, internet addiction, and maladaptive sexual behavior (Morie et al., 2018). Notably, alexithymia often results in unsatisfactory interpersonal relationships and decreased social adjustment (Spitzer et al., 2005). Additionally, alexithymia has been regarded as one of several predisposing factors that may increase the susceptibility to organic diseases such as ulcerative colitis and rheumatoid arthritis, substance dependence, and a biased perception and reporting of somatic sensations and symptoms (Luminet et al., 2018). Indeed, alexithymia has been associated with heightened stress reactivity including heightened HPA-axis activity and autonomic arousal linking alexithymia to organic diseases. Finally, it has also been linked to increased healthcare utilization, lost productivity, and increased risk of unemployment (Zonneveld et al., 2013).

Many factors have been found to exacerbate the negative emotional and behavioral aspects of alexithymia including lack of affection, difficulty with empathy, and a cold and hostile interpersonal style. Indeed, individuals with alexithymia have significant difficulty in interpersonal interactions that require emotional awareness and expression. In particular,

interactions that require substantial introspection and communication of emotion may lead to greater distress in the presence of alexithymia (Niolo et al., 2011).

The purpose of the present study is to examine the potential interaction between alexithymia and degrees of emotional expression on negative affect and arousal.

Alexithymia

Sifneos (1973) introduced the term “alexithymia" into clinical literature over four decades ago to describe patients with psychosomatic diseases characterized by 1) difficulty in identifying and describing emotional states, restricted imaginative capacities, 2) difficulty distinguishing between feelings and somatic sensations during emotional arousal, and 3) externally oriented thinking style. These characteristics are now conceptualized as a continuous stable personality trait with emotion processing deficits (Taylor et al., 1997).

Definition. Alexithymia is currently defined by a set of four characteristics: 1) difficulties identifying feelings and distinguishing feelings from bodily sensations of emotional arousal (DIF); 2) difficulties describing and communicating feelings to others (DDF); 3) constricted imaginal processes, as indicated by a relative deficiency of affect-related fantasies; and (no acronym here?)4) a style of thinking characterized by a fixation on external stimuli (EOT; Nemiah et al.,1976; Taylor et al.,1997; Taylor & Bagby, 2000). Although these characteristics are conceptually different, it has been suggested that they are interrelated and commonly manifest together (Taylor et al., 1997). For example, individuals with alexithymia have a greater tendency to experience negative emotions like anger, anxiety, depression, and feelings of shame and embarrassment, as well as a reduced capacity to experience positive emotions, such as happiness and affection (Bagby et al., 1994). However, while these individuals may report episodes of emotional disturbance, they have difficulty identifying them as feelings

and differentiating them from physiological responses to emotional arousal (e.g., increased heart rate, sweating, or dry mouth). For example, the experience of anxiety and hunger may be confused. The limited capacity of these individuals to identify and differentiate negative emotion, together with difficulties expressing these emotions in a sufficient or healthy way, can lead them to intensify and misinterpret ordinary bodily sensations associated with emotional arousal as physical disease (Taylor et al., 1997). Consequently, individuals who present to doctors with persistent complaints about bodily symptoms may be incorrectly treated or diagnosed with a somatoform disorder rather than being recognized and treated for their emotion processing deficits (Taylor, 1984).

In addition to difficulties identifying and differentiating feelings, individuals with alexithymia have difficulty describing and communicating their feelings to others, both verbally and nonverbally. They often describe their feelings as vague tension states of which they cannot interpret or elaborate any further (Taylor, 1977). Their communication style is characterized as flat and monotone, with an absence of nuance, metaphor, or the use of emotional language (Meganck et al., 2009; Taylor, 1984). These features generate conversation that has been described by therapists as dull, lifeless, and boring (Nemiah & Sifneos, 1970). Furthermore, difficulties communicating feelings nonverbally can produce a stiff posture and limited facial expressions in the individual (Taylor et al., 1997).-----why would this be important then…..think about what expressing emotions to others does----hint at link to gaining social support then.

Another feature of individuals with high alexithymia is a reduction or absence of fantasies, imagination, or other phenomena related to their inner, private mental life of attitudes, feelings, desires, and drives (Taylor et al., 1997). They lack the ability to self-reflect or examine their conscious thoughts and feelings (introspection) and to form new images and sensations that

are not perceived through their senses (imaginative ability, Campos et al., 2000), including daydreaming and dream recollection. The externally-oriented cognitive style of individuals with alexithymia is, to some extent, reflected by their impoverished inner fantasy life (Bagby et al., 1994). The reduced fantasy and imaginal activity in individuals with high alexithymia are replaced by a primary focus on external stimuli in their immediate environment, such as physical sensations. Conversations often involve repetitive recitation of concrete facts in excessive detail (Krystal, 1988). Indeed, this monotonous style of communication in individuals with high alexithymia, as well as their inability to interact emotionally and to link physical symptoms to feelings, may generate boredom and frustration in their social counterparts, which may ultimately affect the quality of their interpersonal relationships (Ogrodniczuk et al., 2005).

Etiology. While it is clear that alexithymia significantly affects the wellbeing, interpersonal relationships and overall functioning of individuals as well as increasing healthcare utilization, it represents a complex pathology with many contributing factors. For example, a large sample (n = 8785) twin study found heritability of alexithymia to be around 30%, and alexithymia has been associated with functional variants of the brain-derived neurotrophic factor and DRD2/ANKK1 gene polymorphism (Walter et al., 2010). Additionally, neuroimaging studies have led to an increasing amount of data on the neurobiological correlates of alexithymia (Moriguchi & Komaki, 2013; Abell, Happé & Frith, 2000). During recent years, for example, the abnormal function of the anterior cingulate cortex in alexithymia has been identified and a notable number of studies have pointed to alterations in the perception of emotions on the neurobiological level (e.g. amygdala; Goerlich, 2018).

Developmentally, a substantial amount of research has linked low socio-economic status, lack of social support, and general psychopathology in childhood to the progression and

maintenance of alexithymic features (Kauhanen et al., 1993; Lumley et al., 1996; Salminen et al., 1999). While one study has found higher alexithymia scores in Asian Americans and Malaysian participants than European Americans (Le et al., 2002), most studies have concluded that race alone is not a predictor of alexithymia scores. However, alexithymia scores can be more correlated with pain severity and illness behavior for African Americans than European Americans in chronic pain samples (Lumley, 2005). Research has also provided empirical support for the association of alexithymia with parenting styles and parent-child interaction. A meta-analysis examining the impact of parental bonding in alexithymia found moderate to strong negative correlations between maternal care characterized by neglect, overprotection and intrusiveness and overall scores of alexithymia, as well as difficulty identifying feelings and difficulty describing feelings (DDF; Brown et al., 2018; Thorberg et al., 2011). Berenbaum (1994) has also suggested that difficulties identifying and communicating emotions - an essential characteristic of alexithymia - may be consequences of a childhood environment where parents fail to model non-threatening expressions of emotion. Indeed, alexithymia has been shown to occur more frequently in adults who recall childhood family environments that did not encourage the expression of opinions and feelings within the family, and especially the expression of positive feelings and physical affection (Fonagy et al., 2002). Joukamaa and colleagues (2003) conducted a 31-year prospective study that examined the association between alexithymia in adulthood and the social situation of the child's family 31 years earlier. They found that unwanted children or children born into families with many children (5 or more) reported elevated levels of alexithymia in adulthood. The authors concluded that factors such as having unwanted or numerous children may limit the time and attention given to the child and disturb the development of normal early mother-infant intimacy.

Clinical significance. High alexithymia has been found in about 4.3% of nondepressed individuals, and about 32.1% in those scoring above 9 points in the Beck Depression Inventory (Honkalampi et al., 2000). Furthermore, depressive symptoms explained 29.2% of the variability in alexithymia scores (Son et al., 2012). In addition to depression, elevated rates of alexithymia have been observed in many anxiety disorders (Frewan et al., 2008; Beradis et al., 2008; Berthoz et al., 1999; Celikel & Saatcioglu 2006). In panic disorder, the prevalence of alexithymia seems especially high, ranging from 34% to 67% in different studies (Cox et al., 1995). Furthermore, high alexithymic traits in those suffering from panic disorder predict worse symptom severity (Zeitlin & McNally, 1993). Regarding obsessive-compulsive disorder (OCD), Grabe et al. (2008) showed that OCD patients have higher alexithymia levels compared to healthy controls, but the first-degree relatives of these groups did not differ in alexithymia levels. They thereby concluded that alexithymia is elevated in OCD but does not pose a familial risk factor for OCD. A recent review concluded that OCD patients show higher alexithymia scores compared to controls, but alexithymia levels are not higher in OCD compared to other clinical populations (Robinson & Fresston, 2014). Paniccia et al. (2017) studied adolescents with generalized anxiety disorder (GAD) and healthy controls, as well as their parents. They showed that adolescents suffering from GAD, as well as their mothers, had higher alexithymia levels compared to the control group and their mothers. Similarly, a Finnish study in a large population-based sample of adolescents showed that alexithymia was associated with anxiety, and that the majority of adolescents scoring high on alexithymia were highly anxious (Karukivi e al., 2010).

Problems in emotion regulation have been widely implicated in the etiology of substance abuse (Berking, 2011), and as such, it is not surprising that alexithymia, marked by emotion processing deficits, is linked to problematic use of many addictive substances (Morie et al.,

2016). An especially high prevalence (30- 49%) of alexithymia has been repeatedly observed in patient populations suffering from alcohol dependence (Rybakowski et al., 1988; Thorberg et al., 2009). An impaired capacity to regulate emotion may be a core component of psychotic disorders such as schizophrenia (Kohler & Martin, 2006). Thus, alexithymia is also assumed to represent a vulnerability factor for psychosis (Seghers et al., 2011).

Alexithymic traits have also been widely studied in the context of eating disorders and a recent systematic review concluded that across the spectrum of eating disorders, all diagnostic groups scored higher in alexithymia levels than healthy controls, with medium to large effect sizes (Westwood et al., 2017). Alexithymia is thought to be more prevalent in populations with ASD compared to healthy controls, but representative studies with adequate sample sizes are lacking (Kinnaird et al., 2019). In existing studies, approximately 50% of individuals with ASD seem to have co-occurring alexithymia (Albantakis et al., 2020; Poquerusse et al., 2018). From clinical observations of the interpersonal functioning of patients with high alexithymia, these patients have been observed to have a tendency toward social conformity and conflict avoidance, and they tend to approach others in a non-empathetic, cold, or detached way (Taylor et al., 1997; Nehemiah & Sifneos, 1970; Grabe et al., 2001). These patients avoid close social relationships, and if they do relate to others, they tend to position themselves as either dependent or impersonal, such that the relationship remains superficial. Chaotic interpersonal relations have also been observed (Sifneos, 1996), as well as inadequate differentiation between self and other (Taylor et al., 1997; Blaustein & Tuber, 1998). In line with these observations, many of the clinical sequelae associated with alexithymia have been hypothesized to be exacerbated by interpersonal dysfunction (Hemming et al., 2019; Grynberg et al., 2010; Vanheule et al., 2007).

Theoretical Considerations in Alexithymia

As stated earlier, the construct of alexithymia can be defined as a cognitive and affective deficit in some individual's capacity to recognize and communicate emotion (Timoney & Holder, 2013). According to a recent theoretical proposal, the features comprising the alexithymia construct reflect deficits in the processing and regulation of emotions (Taylor, 2000). This idea is based on the view that emotional responding and emotion regulation in humans involve three interrelated systems: neurophysiological (i.e. autonomic nervous system), motor-expressive (i.e. facial expressions), and cognitive-experiential (i.e. subjective awareness and verbal reporting) (Taylor, 2000). The regulation of emotions therefore involves interactions among these three systems. Additionally, an individual's social interactions provide important interpersonal emotion regulation that may be supportive or disruptive (Izard & Koback,1991; Thompson, 1994; Gross & Munoz, 1995). As such, the characteristics that comprise the alexithymia construct reflect deficits both in the cognitive-experiential component of emotion response systems and at the level of interpersonal regulation of emotion. Due to the inability to accurately identify their own subjective feelings, individuals with high degrees of alexithymia are not only limited in their ability to reflect on and regulate their emotions, but also limited in their ability to verbally communicate emotional distress to other people, thereby failing to enlist others for aid or comfort. In turn, the lack of emotion-sharing and social support may further contribute to the cognitive and affective deficits in emotional processing and regulation (Grynberg et al., 2012).

Despite the extensive research on the associations of alexithymia with different variables, several questions regarding the development of alexithymia remain. To explain the connection between alexithymic cognitive and affective deficits in emotion processing and health consequences, some have proposed that alterations in autonomic nervous system (ANS), a brain-

body interface for interoceptive and exteroceptive exchange, may play an important role. The following provides a background of the two main models of stress and alexithymia that has garnered most attention in the alexithymia literature.

Models of alexithymia.

***Stress-alexithymia hypothesis*.** One of the earliest models of alexithymia was the stress-alexithymia hypothesis, which states that alexithymia is associated with high levels of autonomic reactivity during stress (Martin & Pihl, 1985; Martin et al., 1986). It has been hypothesized that the limited emotional awareness and cognitive processing of affects lead to prolonged and amplified physiological arousal and reactivity to stress (Martin & Pihl, 1985; Martin et al., 1986). Such hyperarousal potentially disturbs the autonomic, pituitary-adrenal, and immune system. The dysregulation and heightened activation of the autonomic nervous system might therefore create conditions favorable to the development of stress-related disorders. However, while there is some support for autonomic hyperarousal during resting and anticipation periods (Martin & Piehl,1985; Martínez-Sánchez et al., 2001; Papciak et al., 1985), most studies to date have found either lower (i.e. hypoarousal; Wehmer et al., 1995; Lumley & Stettner, 1995; Linden et al., 1996) or comparable physiological reactivity between individuals with high-alexithymia and those with low-alexithymia during periods of stress (Friedlander et al., 1997) .

Decoupling hypothesis. The decoupling hypothesis (Papciak et al., 1985) has attempted to reconcile the conflicting results regarding alexithymic hyperarousal and hypoarousal during stress by proposing a dissociation of psychophysiological indicators of emotion from subjective reports of emotional state. Studies have largely supported alexithymic decoupling with exaggerated or normal subjective reaction along with decreased physiological reactivity.

Theory of Mind (ToM) in Alexithymia

Goldman (1995) asserts that empathy, in a broad sense, is critical to Theory of Mind, the ability to attribute mental states such as beliefs, intents, and emotions to self and others. He describes empathy as a "naive heuristic for interpreting, explaining and predicting others." The process is one of imaginatively projecting oneself into the situation of the target and then using one's own mental processes as a method of modeling the experience of the target individual and so predicting their beliefs and actions. The individual high on alexithymic traits will presumably find this process very difficult. From a ToM perspective, the high-alexithymia individual would use a set of predetermined interaction scripts when attempting to predict the beliefs and actions of others. These scripts would be termed tacit knowledge structures in a ToM account.

Alexithymia is characterized by a tendency to be "stimulus-bound" with an externally orientated cognitive style (Taylor, 1995). This implies that these individuals would find the mapping of the internal world of another person difficult. Research has observed difficulty describing another person's point of view in individuals with high alexithymia (Duquette, 2020). Yet there is a seeming contradiction as individuals with alexithymia can also be socially adaptive. The key appears to be their ability to anticipate and interact with others in order to form functional, but not intimate relationships, marked by inability to understand and interact with the subtleties of intimate relationships. Taylor et al. (1995) posited that, “individuals with high alexithymia tend to establish markedly dependent relationships, but that these relationships are highly interchangeable". Therefore, it appears that individuals with alexithymic characteristics can predict beliefs and actions at a macro-social level but have difficulty at the intimate individual level.

Langdon and Coltheart (1999) have used the false belief task to measure mentalizing ability from a Theory of Mind perspective. This task has built into it a scale designed to detect

distraction by ambiguous cues in the picture called the "capture" subscale. The scale specifically detects an external orientation in the process of mentalizing. It would appear that individuals with high alexithymia would in fact be a group who would be prone to distraction and as such would have poor mentalizing abilities as a result of being "captured" by ambiguous situation details.

Other research on alexithymia and Theory of Mind (ToM) has also revealed interesting findings regarding the different alexithymia facets. In their study on the relationship between ToM and the three facets of alexithymia, Demers and Koven (2015) hypothesized that EOT, not DIF and DDF, would correlate inversely with ToM (measured through the Reading the Mind in the Eyes Test) due to low levels of introspection and symbolic thought underlying EOT, a cognitive construct. Since symbolic thought is necessary for the development of perspective taking, it seems reasonable to speculate an inverse relationship between EOT and ToM. Results of their study supported that hypothesis and found that EOT alone accounted for 13% of unique variance to affective ToM. Although affective ToM is concerned with the ability to mentalize the emotions of others, compared to cognitive ToM which focuses on thoughts and beliefs, its relationship with EOT can be understood through two theories on mentalization. The Theory-Theory perspective posits that EOT may be associated with a deficit in higher order cognitive processes required for mentalization (Saxe, 2006). Without skills like abstraction (e.g., the ability to form, link, and understand the meaning of symbols) and differentiation (e.g., the ability to distinguish between the symbol and the object being symbolized), it would be difficult to engage in introspection and mentalization of the internal states of others (Demers & Koven, 2015). This is in line with Goldie's (1999) simulation theory that views introspection as a prerequisite for forecasting the mental states of others.

While correlational studies have found a relationship between the EOT facet of alexithymia and ToM, neuroimaging studies, on the other hand, have stressed the importance of context in evaluating specific cognitive processes in alexithymia. Moriguchi and Komaki (2013) have proposed four stimulus categories: 1) External emotional stimuli; 2) Imagery and fantasy; 3) Somatosensory or sensorimotor stimuli; and 4) Stimuli containing a social context.

The fourth category was used to specifically evaluate ToM. In their neuroimaging study of alexithymia, they used an animated ToM task, designed to elicit mental state attributions similar to a social context, and required the participants to describe the mental states of moving triangles while going through an fMRI (Moriguchi & Komaki, 2013). Results of the study showed that people with alexithymia had lower mentalizing scores in response to the animated triangle task. Furthermore, people with high levels of alexithymia exhibited lower activation of the medial prefrontal cortex (mPFC), a central region for representing the mental state of the self and others. Although alexithymia has largely been conceptualized as a disturbance in understanding one's own emotions, low mPFC activity towards social stimuli shows that people with alexithymia may have an impaired ability with perspective taking as well. These findings suggest interpersonal problems marked by poor ability to share other's feelings (affective) and understand another person's emotional state (cognitive).

Exacerbation of Interpersonal Dysfunction

In addition to specific cognitive and affective deficits, alexithymia has been linked to emotion suppression, low self-consciousness, and high experiential avoidance (Panayiotou et al., 2018), which may exacerbate interpersonal dysfunctions. More recent investigations focused on a connection between alexithymic traits and social interaction anxiety (Lyvers et al., 2019), lending support to the idea that difficulties identifying and communicating one's own emotions

may present major obstacles to social functioning, consistent with the ToM research. Moreover, social sharing of negative emotions - the communication of emotion in a socially shared language - has been shown to be more difficult for individuals with high alexithymia (Pollatos et al., 2011). A program of research on the effects of emotional disclosure on health also suggests that alexithymia may attenuate the effects of expressive writing or talking on health benefits (Lumley, 2005). Specifically, the inability to identify and describe feelings in emotional situations will make it difficult for those scoring high on alexithymia to engage in expressive activities about stressful emotions. Of particular interest in the context of this study is how demand for the communication of emotion may increase uncertainty in interpersonal interactions and as a result, given the deficits, elicit greater negative consequences for individuals scoring higher in alexithymia.

Emotional Disclosure

The emotional disclosure paradigm, developed by Pennebaker and colleagues (Pennebaker & Beall, 1986), posits that written disclosures can contribute to health benefits by allowing individuals to reveal their private thoughts, feelings, or experiences. In this paradigm, conditions are created to assess differences in health improvements between individuals tasked to write daily essays expressing emotional events in their lives and those asked to write about innocuous topics (Smyth & Pennebaker, 2001). This written disclosure task has been found to produce significant benefits such as fewer physical symptoms (Stanton et al., 2002) and fewer health care utilization (Rosenberg et al., 2002). While Pennebaker's original disclosure paradigm focused on written disclosure, some studies were conducted using a talking task (e.g. speaking into a tape recorder). Studies comparing the effects of written and talking disclosures have generally found comparable physiological and psychological effects (Esterling et al., 1994;

Donnelly & Murray, 1991; Murray et al., 1989). Lumley and colleagues extended this area of research by examining alexithymia (i.e. TAS-20 scores) as a moderating variable that interferes with the effects of emotional disclosure due to their affective deficits (Lumley, 2004). In one disclosure study involving students with migraine, greater alexithymia scores predicted increased health impairment three months after disclosure writing (Kraft et al., 2008). TAS-20 scores also predicted increased pain for the disclosure group in another study with women who suffer from chronic pelvic pain (Norman et al, 2004). Medication use, healthcare utilization, and less improvement in positive affect for individuals in the emotional disclosure group compared to the control group were also found in other disclosure studies using physically symptomatic students (Lumley, 2004). In these studies, the different facets of the TAS-20 appear to interact with the experimental groups differently. Notably, greater DIF was associated with increased physical symptoms in the disclosure group whereas EOT predicted increased anxiety and depression in the disclosure group (Lumley, 2004).

Alexithymia and Psychosocial Uncertainty

Uncertainty, which can be defined as an emotional state elicited by perceived threatening or ambiguous situation, is experienced when the individual is required to find a strategy to handle changing contexts without immediate solutions (Grenier e al., 2005). Intolerance of uncertainty (IU) is defined as the negative appraisal of uncertainty and beliefs about its connotations and consequences. IU has also been suggested to be related with individuals' attempts to gain control over perceived uncertain/adverse situations, thus reinforcing maladaptive thinking and behaviors (Carleton, 2016). Still, IU is considered an important predictor of worry (Carleton, 2012), and individuals with high levels of IU may have an increased likelihood of perceiving problems as a threat rather than a challenge. The exaggerated

belief about uncertainty may in turn contribute to a negative problem-solving orientation, which may result in negative ruminations. As we describe below, several theories of social uncertainty within the context of alexithymia have been proposed.

Social facilitation theories. Zajonc (1965) put forward a theoretical account of effects of social facilitation based on a modification of his original Drive theory which showed that a wide range of species, including humans, change their behavior in the presence of conspecifics. As social situations pose various threats to the organism, the organism must maintain a high level of alertness in order to react quickly. This idea was further developed by Guerin and Innes (1984) in their Monitoring theory. Both the Drive theory and the Monitoring theory claim that organisms are predisposed to monitor and be prepared to react to the ever-changing demands induced by social presence, and therefore one can expect stronger arousal when the performing organism feels threatened, unable to monitor the observer, or is unfamiliar with the observer.

Adding to Zajonc's notion of psychological arousal, Frith and Frith (2006) proposed that in the presence of an observer, people will intrinsically perform reputation management. Additionally, Fridlund (1991) observed that facial expressions are amplified when participants believe they are being watched, supporting the notion of a communicative self-construal towards implicit and/or explicit audiences. Essentially, the audience effect draws on the assumption that in the presence of an observer, three cognitive processes will take place:

1. Individual believes he/she is being evaluated
2. Actively seek out social cues
3. Adjusting behavior to communicate or to manage reputation

Hamilton and Lind (2016) proposed that the process of mentalizing underlies these three processes. Similar to the ToM hypothesis, they described mentalizing as a process by which

people take others' mental states into consideration, and make attempts to manipulate such mental states in order to manage their own reputation. This process involves the ability to consider what another person thinks, believes, desires, and feels, and is implicitly communicative. Other empirical evidence has also found that alexithymia is characterized by problems in understanding the mind of others, as well as, social communication with others (Spitzer et al., 2005; Oakley et al., 2020) due to their general deficits in interception and disturbance of emotion processing.

Based on the three processes set forth by Hamilton and Lind, it seems logical to assert that psychophysiological arousal will also take place when an audience is explicitly present. This speculation is supported by studies using skin conductance to evaluate stress while subjects are under observation. One study found that direct gaze from an observer led to a significant increase in both skin conductance and heart rate compared to conditions without direct observation (Nicholas & Champness, 1971; Gale et al., 1975).

In regard to social facilitation, Uziel (2007) proposed that people with different personality traits will either take on a "positive-self-assured" or a "negative-apprehensive" path when they believe they are being observed. People with negative-apprehensive responses tend to have low self-esteem and high introversion. According to Uziel (2007), uncertainty has been observed to invoke stress in patients with trait anxiety by increasing worrying behavior. Studies on social facilitation have proposed "evaluation apprehension" occurs when the audiences create the conditions for anxiety (eg. evaluation of the individual's performance). The arousing effects of uncertainty are also well documented in studies on adaptation to unpredictable environments. (Lucas & Baird, 2004).

Alexithymia is linked to both introversion and low self-esteem (Wise et al., 1992), and also positively correlated with social anxiety. Additionally, individuals scoring high on EOT lack the mentalizing ability to perform perspective-taking. These findings lead us to speculate that an audience effect will likely result in high arousal with negative affect in individuals with high alexithymia, especially those scoring high on the EOT measure, in addition to high scores on the two affective facets of TAS-20. As such, when confronted with social uncertainty, alexithymia, as a stable personality trait, may exacerbate distress specifically by inducing negative affect.

The Present Study

Using data from a larger experimental study of the effects of anger suppression and emotional expression on pain experiences in patients with low back pain, the current study will examine the effect of emotional disclosure on physiological responding and negative affect for individuals with alexithymia. The original study selected patients with lower back pain because TAS-20 is correlated with both the presence and unpleasant experience of chronic pain (Lumley et al., 2007), and anger has been found to be elevated and disruptive in individuals with chronic pain (Burns et al., 2015). Prior research has also demonstrated the benefits of emotional disclosure on pain severity and depressed mood for chronic pain patients (Lumley et al., 2012).

The current study was designed to assess the associations between these variables in emotional disclosure conditions marked by differing levels of uncertainty and facilitation. Given the difficulties with insight-oriented communication and the mentalizing difficulties in alexithymia, particularly when difficulty of communicative task and action uncertainty are high, it is reasonable to hypothesize that alexithymia would be associated with both physiological

arousal and negative affect and that these association would differ depending on the level of uncertainty and facilitation during an interpersonal interaction.

Hypotheses of the present study. Under differing conditions of social facilitation on emotional disclosure, we hypothesize that:

Hypothesis 1: Consistent with an increased stress response following a maze task, scores of alexithymia (TAS-20) will be positively associated with changes in scores for anxious, sad, annoyed, angry, and on edge as measured by the affect checklist for both suppress and non-suppress groups.

Hypothesis 2: Similarly, TAS-20 scores will be positively associated with a blood pressure and heart rate cardiovascular reactivity for both suppress and non-suppress groups.

Hypothesis 3: TAS-20 scores will not be associated with changes in negative affect in the distraction control group.

Hypothesis 4: Alexithymia scores will not be associated with cardiovascular reactivity in the distraction control group.

Hypothesis 5: Consistent with uncertainty, a statistically significant difference will be found between the correlations of TAS-20 and negative affect reactivity for the guided response group and free response group with the guided response group demonstrating a larger effect size.

Hypothesis 6: Consistent with uncertainty, a statistically significant difference will be found between the correlations of TAS-20 and cardiovascular reactivity for the guided response group and free response group with the guided response group demonstrating a larger effect size.

Chapter II

Methods

Participants

The current study, with IRB approval from the University of Michigan- Dearborn, used an existing data set from a larger experimental study of the effects of anger suppression and expression on pain and functioning in patients with chronic low back pain. In the larger study, adults with chronic low back pain were recruited from flyers at local pain clinics or through clinic staff referral in metropolitan Detroit. Participant eligibility was determined by a phone screening, with physician confirmation when needed. Eligible patients were adults with musculoskeletal pain of the lower back as the primary source of chronic pain complaint (≥ 6months). Exclusion criteria were determined by patient-reported medical conditions that could put participants at risk from anger induction (e.g., cardiac disease, uncontrolled hypertension), severe obesity, current substance dependence, a psychotic or bipolar disorder, autoimmune disorder, current use of beta-blockers , or the inability to walk. The final sample for the current analyses was 141 adults (53.2% women) with a mean age of 46.8 years (SD = 11.1, range = 21-69). Racial make-up consisted of 70.2% African Americans, 24.1% European American, 2.1% Middle Eastern, 1.4% Native American/Pacific Islander, 0.7% Asian, and 1.4% other).

Measures

Toronto Alexithymia Scale-20. The TAS-20 is a self-report questionnaire that assesses three components of the alexithymia construct: difficulty identifying feelings (DIF; seven items), difficulty describing feelings (DDF; five items), and externally oriented thinking (EOT; eight

items) (Bagby et al., 1994). Items for each component are scored on a 5-point Likert scale, from 1 (strongly disagree) to 5 (Strongly agree). The TAS-20 is currently the most widely used instrument in assessing alexithymia in both clinical and general populations due to strong psychometric properties. The present study demonstrated high internal reliability (α = .81). Further validating the instrument itself, test-rest reliability over three weeks is also high (*r* = .77, Bagby et al., 1994), and good construct validity. The TAS-20 is also positively correlated with anxiety and depression (Bagby et al., 1988).

Affect checklist. As a manipulation check on the anger induction protocol, fourteen 11-point numeric rating scales (0 = not at all; 10 = extremely) of participants' affect were administered after the anger induction and emotion expression tasks. For the purposes of this study, we only focused on sub-scales assessing negative affect: "anxious", "sad", "irritated", "hopeless", "on edge", "annoyed", "discouraged", "angry", and "uneasy". For the present study, the internal reliability was very high (α = .88).

Physiological measures. Cardiovascular Reactivity: The larger study involved several physiological recordings, and for the purpose of the current study, systolic and diastolic blood pressure and heart rate were recorded using an automated blood pressure cuff attached to the non-dominant arm. Three recordings were assessed during each phase of the study including pre-anger induction, anger-induction maze task, and anger expression task. While not part of the current study, it should be noted that the larger study included electromyography of the back and neck. The instrumentation for this was part of the overall participant experience.

Procedure

Anger induction task. An anger induction protocol using a harassment manipulation involving a confederate that reliably generates anger and annoyance (Engebretson et al., 1989).

This deception-based protocol has been used successfully in several studies (Burns et al., 2008; Quartana & Burns, 2007). The participants were told that he or she would be working together with a "fellow research participant who also has chronic pain" (the confederate) to solve a computerized maze as a test of stress and teamwork, and that it should be solved as quickly and accurately as possible. The participant was told that he or she had been randomly assigned to be the maze "runner," and the other person (the confederate) was the "guide," who would give verbal instructions to the participant, who had to follow the guide's instructions to navigate the maze. (To decrease suspicion, the participant was also told that the roles would subsequently be reversed, although this did not occur.) The participant and confederate were seated at a table opposite each other, with the confederate looking at a computer screen with a maze on it, which the participant could not see. The participant moved a computer mouse "left, right, up, and down" according to the instructions given by the confederate, who purportedly was watching the movement of the mouse cursor on the maze on the screen. The dyad was given 5 min by the experimenter to solve the maze. Following a standardized script, the confederate began in a straightforward manner with instructions, but over time made increasingly rude, exasperated comments toward the participant, such as, "You're not very good at this," and "You are never going to get this done," and unclear instructions such as, "Move to your left. No, your other left." Four age-matched confederates (male and female, Black and White) participated and were randomly assigned to patients. Participants completed the Pain Intensity and Mood Scale (Jasinski et al.,2016) immediately before and after the anger induction maze task.

Anger expression task. Following an anger-induction maze task, the participants were randomly assigned into one of three anger expression conditions to engage in a 4-minute expression task with the experimenter.

Distraction. This condition controls for the 5-minute time passage and presence of experience, but also controls for speaking and interaction with the experimenter. The distraction task is designed to prevent participants from expressing emotions by having them describe two pictures in a span of 4 minutes.

Free expression. This is one of the two emotion conditions designed to reverse the effects of anger suppression. This condition allows the participants to express their thoughts and emotions about their maze-task experience without facilitation; in other words, in the participants own style of expression.

Guided expression. The facilitated expression condition began with the experimenter giving the same initial instructions as in the free expression condition. After 30 seconds, the experimenter asked participants to speak about their thoughts and feelings about the "partner" and to direct these feelings toward the empty chair where the partner had been sitting. The experimenter also prompted with statements such as, "I thought that your partner treated you rudely during the maze task. How do you feel about that? Go ahead and tell him (or her)." The experimenter continued prompting and suggesting until the participant was able to either directly express anger or come as close as possible to it within the 4-minutes limit.

The three conditions are intended to reflect the different degrees of social facilitation of emotional expression and uncertainty. The entire expression task was audio and video recorded, with the camera showing a close view of the participant's upper body and face.

Procedure Steps

The larger study was conducted in two phases and identically at two different sites. The procedures described in this section pertain to the current study and do not describe all procedures involved in the larger study. In the first phase following the screening described

above, participants consented and completed the TAS-20 to assess trait alexithymia characteristics. Participants were then scheduled to return in one week for phase two which included the anger induction maze task followed by the anger expression task.

In phase two, returning participants had instrumentation setup including the attachment of a blood pressure cuff to their non-dominant arm. Unrelated to the current study participants also had electrodes for electromyography. Upon completion of instrumentation, baseline blood pressure and pulse rate data were collected over 10 minutes, the last 5 of which were used for data analysis. Following baseline data collection, the first affect checklist was completed. Participants were then randomly assigned to one of two maze tasks. While both maze tasks were identical, one group was instructed to suppress their feelings while completing the task and the other group was instructed to express their feelings freely. Otherwise, instructions on completing the task were identical. The participants then completed the 5 minute maze task with the confederate. During the task, blood pressure and pulse rate data were collected every 120 seconds. Immediately following the maze task participants completed a second affect checklist. Upon completion of the checklist, the confederate was dismissed from the study and left the room.

Participants were then randomly assigned to one of three anger expression tasks, distraction, free expression or guided expression. Participants were asked to sit diagonally from the experimenter with an empty chair across the table from the participant. Blood pressure and pulse rate was collected every 120 seconds during the expression tasks. Immediately after the post-expression one-minute resting period, participants completed a third Affect Checklist to assess the impact of expression. The larger study included subsequent tasks that are not relevant

to the current study. At the end of the study, participants were fully debriefed about the deception and behavior of the confederate, and were compensated for their time.

Chapter III

Results

Data Screening

Descriptive statistics for baseline TAS-20, Systolic Blood Pressure, Diastolic Blood Pressure, Heart Rate, and Negative Affect Ratings are presented in Table 1. Furthermore, to assess whether scores of alexithymia are associated with baseline characteristics, bivariate correlations were conducted. Although cut-off scores for "alexithymic" and "non-alexithymic" have been established by Taylor et al., (1997), the authors of TAS-20 have recommended viewing alexithymia as a continuous rather than categorical construct (Bagby et al., 1994). While this reflects some inconsistency in the clinical conceptualization of the alexithymia construct as assessed by the TAS-20, for the purpose of this study, TAS-20 scores were analyzed as continuous variables. Consistent with other studies (Honkalampi et al., 2000; Saarijarvi et al., 2001), TAS-20 was significantly associated with baseline sadness ($r = .254$, $p < .01$), and marginally associated with baseline anger *(*$r = .156$, $p < .05$; Jasinski et al., 2016). It is noteworthy that with the exception of anxious, all other baseline negative affect ratings displayed excessive skewness and kurtosis: sad (skewness = 2.12, SE = .21; kurtosis = 4.45; SE = .41), on edge (skewness = 1.469, SE = .204; kurtosis = 1.469, SE = .406), annoyed (skewness = 1.79, SE = .204; kurtosis = 2.823; SE = .41), and angry (skewness = 2.883 SE = .204; kurtosis = 8.034; SE = .406). The skewness was found to be heavily driven by the majority of participants endorsing a "0" (i.e."not at all") baseline negative affect. Given the skewness, primary hypotheses were first examined using a Poisson regression model for log-transformation. However, this model did not

significantly improve the analysis, thus, for ease of interpretation, bivariate correlations using change scores were used for hypothesis testing. Change scores for cardiovascular reactivity for the maze task were calculated by subtracting the average baseline cardiovascular values from the average cardiovascular values from the maze task. Similarly, change scores for negative affect reactivity were calculated by subtracting baseline values from post-maze scores. In order to assess the unique effect of the differing emotion expression groups as independently as possible from the impact of the maze task, change scores for cardiovascular and negative affect reactivity were calculated by subtracting post-maze scores from the emotion expression scores.

In order to verify the integrity of the randomization, baseline scores for all variables were compared using a t-test for the suppression and non-suppression groups, and a one-way ANOVA with pairwise comparisons for the guided, free, and distraction-control expression groups. Results showed a significant difference in baseline sadness with the suppression group scoring higher ($t = -2.187$, $p < .05$). For the expression groups, no significant differences were found using Tukey's pairwise comparison of means.

Manipulation Check

A manipulation check using paired sample t-tests were performed to evaluate the effect of the anger-inducing maze task prior to analysis of the primary hypotheses. Baseline blood pressure, heart rate, and five negative emotions (anger, annoyed, anxious, sad, and on edge) were compared with post-maze measures. Results (as shown in Table 2) indicate significant changes from baseline to maze task such that systolic and diastolic blood pressure and all emotion variables except "sad" increased as expected. Furthermore, a series of t-tests were conducted on the reactivity change scores to assess potential differences between the suppression and non-suppression groups. As expected, the groups did not differ in terms of reactivity.

Hypothesis 1 Results: *Scores of alexithymia (TAS-20) will be positively associated with changes in scores for anxious, sad, annoyed, angry, and on edge as measured by the affect checklist for both suppress and non-suppression groups after the maze task.*

Results of the Pearson correlation did not support the hypothesis as only annoyed was significantly associated with TAS-20 in the suppression group ($r(64) = .271$, $p < .05$). No significant association was found between negative affect and TAS-20 in the non-suppression group.

Hypothesis 2 Results: *TAS-20 scores will be positively associated with blood pressure and heart rate cardiovascular reactivity for both suppress and non-suppress groups.*

Results of the Pearson correlation only partially supported the hypothesis for the non-suppression group, and not the suppression group. For the non-suppression group, statistically significant correlations were found between TAS-20 and both change in systolic ($r(64) = -.382$, $p < .001$) and change in diastolic blood pressure ($r(64) = -.290$, $p < .05$). Fisher's z-Test on these correlations were conducted and differences between groups were significant ($z = -2.901$, $p = .0037$)

Hypothesis 3 Results*: TAS-20 scores will not be associated with changes in negative affect in the distraction control group during the emotion disclosure task.*

As expected, there were no significant associations between TAS-20 and changes in negative affect in the distraction control group.

Hypothesis 4 Results: *TAS-20 scores will not be associated with physiological reactivity in the distraction control group during the emotion disclosure task.*

As expected, there were no significant associations between TAS-20 and physiological reactivity in the distraction control group.

Hypothesis 5 Results: *A significant difference will be found between the correlations of TAS-20 and negative affect reactivity for the guided response group and free expression group with the guided response group demonstrating a larger effect size.*

The correlations between TAS-20 and changes in negative affect for the guided and free response groups are shown in Table 3 and Table 4. No statistically significant associations were found between TAS-20 and changes in anger, anxious, sad, annoyed, and on edge in both the guided and free expression groups.

Hypothesis 6 Results: *A significant difference will be found between the correlations of TAS-20 and physiological reactivity for the guided response group and free response group with the guided response group demonstrating a larger effect size.*

The correlations between TAS-20 and changes in negative affect for the guided and free response groups are shown in Table 3 and Table 4. No statistically significant associations were found between TAS-20 and physiological reactivity in both the guided and free expression groups.

Chapter IV

Discussion

The primary purpose of this study was to examine post an anger induction task, the association of alexithymia scores on negative emotional and cardiovascular reactivity within the context of differing levels of demand for emotional disclosure. In order to examine the general descriptive statistics of the sample, baseline scores, and the TAS-20 scores within the sample ranged from 23 to 82, reflecting a broad range of scores. The most commonly used clinically-relevant alexithymia score is 61, which consists of approximately 16% of the current sample. This distribution of TAS-20 scores is typical within chronic pain samples where the prevalence of clinical alexithymia is roughly 10-13%.

Furthermore, alexithymia as measured by TAS-20 was associated with baseline sadness, which is in line with previous research that has found significant associations between TAS-20 and depression, anxiety, and general negative affect (Hemming et al., 2019; Kojima et al., 2014; Honkalampi et al., 2000).

In addition to examining baseline sample characteristics, the randomization into the suppression and non-suppression maze groups was tested. Overall, the randomization was effective despite the groups differing on baseline sadness. This difference may simply reflect a spurious finding given the large number of baseline variables.

Finally, the manipulation check showed that, consistent with previous literature (Burns et al., 2008; Quartana & Burns, 2007) the anger-inducing maze task elicited negative affect reactivity in most variables and increased measures on all cardiovascular scores. While reactivity

of sadness and anxious did not reach statistical significance, both variables were marginally significant in the expected direction. Thus, the maze task was effective in eliciting a stressful response as expected.

Hypothesis 1 Discussion

It was hypothesized that Alexithymia scores (TAS-20) would be positively associated with changes in scores for emotional states anxious, sad, annoyed, angry, and on edge, as measured by the affect checklist for both suppression and non-suppression groups after the maze task. Unexpectedly, we did not find any significant associations between changes in anger, sad, annoyed, on edge, and anxious with TAS-20 in the non-suppression group, and only "annoyed" was correlated with TAS-20 in the suppression group. This finding was surprising as it was expected that regardless of the instructions to suppress or express emotional and cognitive experiences during the maze task, that individuals scoring higher in alexithymia would experience greater physiological and emotional arousal due to the interaction with the maze task confederate. That is, while the harassment from the confederate would increase performance uncertainty for all participants, the inability to identify and regulate the arousal as a result of the uncertainty would prompt a stress-response in individuals scoring higher in alexithymia.

While it was expected that in the context of the maze task TAS-20 scores would predict negative emotion reactivity in general as reported by other authors (Lumley et al., 2007), the fact that the only positive association was with annoyed in the suppression group may be more indicative of a potential spurious finding given the number of variables. In general, the lack of association between changes in subjective ratings of negative emotional reactivity and TAS-20 may be due to the maze task using attentional resources and interfering with attention to negative stimuli from the confederate. Indeed, other research using emotional Stroop paradigms has found

similar attentional effects between high alexithymia and low alexithymia individuals (Lundh & Simonsoon-Sarnecki, 2002; Parker et al, 1993; Mueller et al., 2006). Thus, the nature of the stress task as either a performance or interpersonal task may be relevant given the tendency to focus on external details and emotional expression deficits in those scoring higher in alexithymia.

Hypothesis 2 Discussion

While it was anticipated that changes in cardiovascular reactivity would be positively associated with TAS-20 in both maze conditions, this hypothesis was only partially supported as TAS-20 scores correlated with greater increases in systolic and diastolic blood pressure in the non-suppression group only. The significant correlations found in the non-suppression group are consistent with the alexithymia-stress hyperarousal model (Martin & Pihl, 1985), and together with findings from hypothesis one, these results may also provide support for the decoupling hypothesis (Martin & Pihl, 1986; Papciack et al., 1985; Luminet & Rime, 1998), where greater physiological reactivity is associated with reduced or normal self-reported affective reactivity. As the non-suppression condition better reflects ecological validity, this finding further supports the idea that deficits in recognizing emotions can result in failure to regulate physiological arousal thus creating conditions susceptible to the development of psychophysiological pathologies.

On the other hand, the lack of association between TAS-20 and cardiovascular reactivity in the suppression group may be explained by the decreased demand for emotion expression. It may be that instructions to not express or think about emotions may not have placed additional burden on individuals with high alexithymia compared to non-alexithymic subjects, but problems with accurately characterizing their affective responses resulted in discordant self-ratings of

negative affect in comparison to physiological responses. It should also be noted that other studies have shown mixed results for the alexithymia-stress hyperarousal model with some authors reporting greater arousal (Martin & Pihl, 1985; Papciack et al., 1985; Newton & Contrada, 1994) and others finding less reactivity in participants scoring high in alexithymia (Lumley & Stettner, 1995; Linden et al., 1996; Nemiah et al., 1977; Wehmer et al., 1995).

Hypothesis 3 and 4 Discussion

It was hypothesized that TAS-20 scores will not be associated with stress reactivity in the distraction control group during the emotion disclosure task. As anticipated, TAS-20 scores were not significantly associated with affective and cardiovascular reactivity in the distraction control group. These results are consistent with the externally-oriented characteristic of alexithymia which is a tendency to focus on concrete details of external events, and detachment from emotional expression. This again highlights the tendency for individuals with high alexithymia to appear cold and detached in interpersonal interactions.

Hypothesis 5 and 6 Discussion

While it was hypothesized that alexithymia as measured by the TAS-20 would be associated with affective and cardiovascular reactivity in both guided and free-expression conditions, this was not supported by the results. The only significant result found was a significant negative association between TAS-20 and heart rate reactivity in the guided response condition ($r = -.331$, $p < 0.05$). No other significant associations between TAS-20 scores and any emotion or cardiovascular reactivity measures were found in either experimental conditions. The finding for the significant association between TAS-20 and heart rate reactivity may suggest lesser parasympathetic withdrawal for those scoring higher on alexithymia; however, the finding may be spurious as the overall patterns of results suggest no significant associations. While the

self-report nature of the emotional response for participants who score higher on the TAS-20 may create some limitations as discussed below, the lack of cardiovascular reactivity provides a more objective assessment of stress reactivity. One possible explanation is that while the two groups prompted the participants to disclose emotional and cognitive experiences during the maze stress task, the level of demand in terms of the prompts used may have potentially allowed participants to focus on external details. Laboratory conditions that challenge participants to focus solely on emotional introspection may be more stress inducing for those scoring higher on the TAS-20. From a demand and resources perspective, it is possible that the results were related to the low demand for emotional disclosure which allowed participants with higher TAS-20 scores to respond in a way that is consistent with their externally-oriented characteristic. Indeed, the EOT facet of alexithymia has been shown to minimize individuals' cognitive and behavioral involvement in affective content process as a potential protective mechanism (Davydov et al., 2013).

Additionally, the tendency for individuals with high TAS-20 scores to have difficulties with identifying and describing their emotional experiences may be more of a problem in ambiguous emotional contexts. As described in other studies, demand appraisals involve the perception of uncertainty and required effort whereas resource appraisals involve the perception of skills, abilities, and energy (Blascovich & Mendes, 2000). The presence of emotional disclosure facilitation in the current study explicitly seeking anger expression thus may have affected the demand side of the equation by reducing uncertainty, and it is also possible that a supportive experimenter (providing prompts and being non-demanding) may also have increased the resources side as well by identifying and describing the emotional content of the stressful situation to the participants.

Furthermore, while it was hypothesized that the guided response group would demonstrate a greater association between TAS-20 scores and cardiovascular and affect reactivity due to the additional prompts by the experimenter for a higher level of anger disclosure, this was not found. Again, facilitative responses such as, *"Most people would feel mad or angry about being treated that way. I would. How about you?"* may allow them to provide desirable responses without the need to experience and label emotional material. As mentioned above, this may actually decrease the task demand and increase resources for individuals high on TAS-20.

Finally, it may be that the individuals scoring higher in alexithymia failed to demonstrate greater cardiovascular and affective reactivity during the response tasks consistent with the hypothesis that alexithymic deficits in emotion processing is associated with experiential avoidance (Panayiotou et al., 2015; Neumann et al., 2004) and attenuated reactivity. In line with previous research (Linden et al., 1996; Wehmer et al., 1995; Newton & Contrada, 1994), which suggested that alexithymia may represent a learned coping mechanism that involves unconscious avoidance of unpleasant affective states, and the focus on external details could represent a consequence associated with the avoidance. As such, individuals with difficulties identifying and describing emotions may be able to use this avoidance strategy efficiently, which may provide immediate relief but ultimately amplifies emotion dysregulation in the long-term.

Post-Hoc Analysis

Given the multifaceted nature of the alexithymia construct and the surprising lack of findings for the primary hypotheses, we further analyzed the association between the different facets of alexithymia as measured by the TAS-20 and emotional and cardiovascular reactivity. Bivariate correlations were conducted using TAS-20 scores for the individual DIF, DDF, and

EOT scales, as well as changes scores that were calculated by subtracting Post-Maze scores from Post-Expression scores to better reflect the impact of only the disclosure conditions. Significant correlations were found in the guided expression condition between DIF and annoyed (r =-.304, p < .05), DDF and heart rate (r =-.320, p <.05), and EOT and heart rate (r =-.351, p < .05). The significant correlations between DDF and EOT, and heart rate are in line with our previous discussions suggesting potential parasympathetic withdrawal in those scoring higher on the TAS-20. However, this result should be interpreted with caution as Fisher's r-to-z transformations on these correlations indicated no significant between-group differences. Given the general lack of significant findings for the individual scales, this further supports the findings from the omnibus results. Thus, suggesting that the alternative explanations provided above including the demand and resources appraisal, perceived uncertainty, and engagement/disengagement should be further examined in future research.

Limitations and Future Research

A major limitation of the current study is that the original experiment was not designed to study the relationship between alexithymia and uncertainty in emotional expression, and as such, intolerance of uncertainty was not assessed. As challenge or threat appraisals in the face of uncertainty involves an interplay of affective and cognitive processes, future research examining the role uncertainty plays in alexithymic responses to demands for emotional disclosure should first examine the association between TAS-20 and intolerance of uncertainty (i.e. Intolerance of Uncertainty Scale; Freeston et al., 1994) in order to elucidate how alexithymia facets may impact the cognitive appraisal of uncertainty. Moreover, the use of self-reported affect ratings from individuals with high-alexithymia scores may have been problematic due to poor affect differentiation in alexithymia. Future research that combines implicit (e.g. the Implicit Positive

and Negative Affect Test) and observer-rated emotion measure may be better positioned to characterize affective reactivity of individuals with alexithymic characteristics. Although cognitive and affective reactivity are important outcomes given the high prevalence of psychopathology in individuals with high alexithymia, future research should also examine whether physiological reactivity extend to cardiovascular markers for threat and challenge appraisals, as demonstrated in many empirical works on social facilitation (e.g., Blascovich & Tomaka, 1996; Tomaka et al., 1997; Blascovich et al., 1999; Thayer et al., 2012). As the cardiovascular system is particularly attuned to stress appraisal, future alexithymia studies can also be improved by taking into account heart rate variability to assess cognitive appraisal and tap into challenge and threat patterns of cardiovascular reactivity for individuals scoring high on alexithymia. Lastly, within the current sample, it is noteworthy that while self-identified participants with hypertension were excluded, several participants had baseline blood pressure readings that would be consistent with hypertension, and may have impacted the cardiovascular results of the study.

Strength and Implications

To the author's knowledge, this is the first study to examine stress reactivity in relation to alexithymia characteristics through uncertainty as a result of task demand and resources. As intolerance of uncertainty (IU) has been recognized as a transdiagnostic causal mechanism for various psychopathologies, and a pathway for internalizing difficulties in high alexithymia individuals, it follows that this line of research warrants more attention. The current study found no main effects of emotion-expression conditions on the relationship between alexithymia and stress reactivity indicating that the demands for emotional disclosure within our experimental conditions did not induce more stress in individuals scoring higher on the TAS-20. Because the

relevant literature on alexithymia and stress reactivity has presented conflicting results, more research on this topic is clearly necessary. It may be that the psychopathological and dispositional correlates of alexithymia - social anxiety, introversion, and autism - can inhibit engagement with the experimenter in experimental expression conditions. This may be particularly relevant in experimental conditions where emotional disclosure demand is relatively low. As mentioned in the introduction, this may imply that one way alexithymia could moderate the therapeutic effects of emotional disclosure on reducing chronic pain and psychopathological symptoms is through disengagement from emotional demands. Thus, the general lack of support for our primary hypothesis may reflect the need to include measures of engagement/disengagement from disclosure tasks. Results of the current study again highlight the multifaceted nature of alexithymia and the need to tease out the differential effects each alexithymia facet has on the demand for emotional expression.

Tables

Table 1: Baseline Statistics of Sample Data

Variable	*N*	*M*	*SD*	*SEM*
Age	141	46.8	11.137	0.938
Baseline SBP	139	135.74	18.201	1.544
Baseline DBP	139	78.88	12.055	1.022
Baseline HR	139	73.98	11.759	0.997
TAS-20	140	51.01	11.491	0.971
Baseline Anxious	137	3.51	2.739	0.234
Baseline Sad	137	1.2	2.069	0.177
Baseline Annoyed	141	1.47	2.27	0.191
Baseline Angry	141	0.88	2.13	0.179
Baseline On edge	141	1.82	2.454	0.207

Note. SBP = Systolic blood pressure, DBP = Diastolic blood pressure, HR = Heart rate, TAS-20 = Toronto Alexithymia Scale

Table 2: Manipulation Check of Psychological and Cardiovascular Responses

	Baseline			Maze Task			Cohen's *d*
	n	*M*	*SD*	*n*	*M*	*SD*	
Systolic BP	135	135.14	17.647	135	142.91	17.572	0.441**
Diastolic BP	135	78.82	11.967	135	82.23	10.908	0.298**
Heart Rate	135	74.34	11.587	135	77.65	10.926	0.294
Anger	138	0.89	2.15	138	4.77	3.012	1.483**
Anxious	136	3.48	2.72	136	4.45	2.969	0.341**
Annoyed	141	1.47	2.27	141	4.66	3.277	1.132**
On Edge	140	1.79	2.437	140	3.61	3.166	0.644**
Sad	137	1.2	2.069	137	1.55	2.494	0.153

** = Paired samples t-test $p < 0.01$

Table 3: Correlations between TAS-20 and Changes in Negative Affect and Cardiovascular Reactivity in Free Response Group

	TAS-20	SBP	DBP	HR	Anger	Anxious	Annoyed	On Edge	Sad
TAS-20	--	-.243	-.103	-.149	.094	-.072	-.058	-.049	.239
ΔSystolic BP		--	.202	.356*	-.096	-.003	-.013	.190	-.116
ΔDiastolic BP			--	.174	-.055	.187	-.096	.007	.086
ΔHeart Rate				--	-.146	-.048	-.110	.120	-.231
ΔAnger					--	.172	.567**	.353*	.448**
ΔAnxious						--	.022.	.454**	.270
ΔAnnoyed							--	.392**	.245
ΔOn Edge								--	.053
ΔSad									--

Note: TAS-20 = Toronto Alexithymia Scale, SBP = Systolic Blood pressure, DBP = Diastolic Blood Pressure, HR = Heart Rate, Δ indicates change scores (Cardiovascular changes calculated by subtracting maze-task average from expression task average; affect changes calculated by subtracting post-maze scores from post-expression scores)
** = $p < 0.01$
* = $p < 0.05$

Table 4: Correlations between TAS-20 and Changes in Negative Affect and Cardiovascular Reactivity in Guided Response Group

	TAS-20	SBP	DBP	HR	Anger	Anxious	Annoyed	On Edge	Sad
TAS-20	--	-.105	.063	-.331*	-.072	-.005	-.205	-.035	-.040
ΔSystolic BP		--	.728**	.525**	.204	.208	.270	.257	.106
ΔDiastolic BP			--	.317*	.155	.203	.221	.205	.112
ΔHeart Rate				--	.087	.292	.295	.149	.010
ΔAnger					--	.410**	.780**	.798**	.550**
ΔAnxious						--	.366**	.574**	.443**
ΔAnnoyed							--	.711**	.428**
ΔOn Edge								--	.526**
ΔSad									--

Note: TAS-20 = Toronto Alexithymia Scale, SBP = Systolic Blood pressure, DBP = Diastolic Blood Pressure, HR = Heart Rate, Δ indicates change scores (Cardiovascular changes calculated by subtracting maze-task average from expression task average; affect changes calculated by subtracting post-maze scores from post-expression scores)
** = $p < 0.01$
* = $p < 0.05$

Appendices

Appendix A: Toronto Alexithymia Scale (TAS-20)

1. I am often confused about what emotion I am feeling (DIF)
2. It is difficult for me to find the right words for my feelings (DDF)
3. I have physical sensations that even doctors don't understand (DIF)
4. I am able to describe my feelings easily (reverse-keyed) (DDF)
5. I prefer to analyze problems rather than just describe them (reverse-keyed)(EOT)
6. When I am upset I don't know if I am sad, frightened, or angry (DIF)
7. I am often puzzled by sensations in my body (DIF)
8. I prefer to just let things happen rather than to understand why they turned out that way(EOT)
9. I have feelings that I can't quite identify (DIF)
10. Being in touch with emotions is essential (reverse - keyed)(EOT)
11. I find it hard to describe how I feel about people (DDF)
12. People tell me to describe my feelings more (DDF)
13. I don't know what going on inside me (DIF)
14. I often don't know why I am angry (DIF)
15. I prefer talking to people about their daily activities rather than their feelings (EOT)
16. I prefer to watch "light" entertainment shows rather than psychological drama(EOT)
17. It is difficult for me to reveal my innermost feelings, even to close friends (DDF)
18. I can feel close t someone, even in moments of silence (reverse-keyed)(EOT)
19. I find examination of my feelings useful in solving personal problems (reverse-keyed)(EOT)
20. Looking for hidden meanings in moves or plays distracts from their enjoyment (EOT)

Appendix B: Affect Checklist

For each word below place a slash on the line to indicate how you feel NOW:

anxious 0 1 2 3 4 5 6 7 8 9 10

Not at all Extremely

sad 0 1 2 3 4 5 6 7 8 9 10

on edge 0 1 2 3 4 5 6 7 8 9 10

annoyed 0 1 2 3 4 5 6 7 8 9 10

angry 0 1 2 3 4 5 6 7 8 9 10

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