Exploring the Relationship Between Alexithymia and Empathy: The Role of Emotion Recognition and Metacognitive Ability

Liam Spicer (BPsychSc)

A report submitted as a partial requirement for the degree of Bachelor of Psychological Science with Honours in Psychology at the University of Tasmania, 2018.
Statement of Sources

I declare that this report is my own original work, and that the contributions of others have been duly acknowledged.

Liam Spicer

Date: 8th November 2018
Acknowledgements

First and foremost, I would like to thank my supervisor, Dr. Cynthia Honan, for the constant support, encouragement, and guidance throughout the year. I really appreciate all the time you have devoted to this project, and for encouraging me to be autonomous in my learning. Your knowledge, wisdom, patience, and optimism has made this process a very rewarding experience, and I am privileged to have had the opportunity to learn from such an experienced and passionate academic.

I would also like to thank my fellow Honours cohort in Launceston, Bonnie, Nick, Laura and Sean. It has been such a pleasure sharing the journey with a group of talented, enthusiastic, and hardworking individuals. The experiences, memories and laughs we have shared together will be something I will cherish forever. I wish you all the best for the future. I would especially like to thank my research partner Bonnie. I have thoroughly enjoyed working together with such a hardworking, determined, supportive, and encouraging individual.

To all the psychology staff at the University of Tasmania, I would like to thank you for all the ways you have supported me and assisted in my development over the course of my degree. Thank you to all of the people who have generously volunteered their time to participate in my research.

To my partner Katie, I would not have been able to do this without you. Your constant understanding, kindness, encouragement, and support has been unwavering. Every step of the way you have been by my side, and through your love and guidance you have inspired me to achieve my goals.

I would also like to say a big thank you to my wonderful family, who have been there constantly throughout this journey. I could not have done this without you all. I thank you for your love, patience, and supporting me in pursuing my ambitions. Thank you to all my beautiful friends, I am very appreciative of everything you have done for me throughout this year.

In loving memory of my dear friend Brad, thanks for playing a big part in the person I am today.
Table of Contents

Acknowledgements ........................................................................................................ ii

List of Tables .................................................................................................................. vii

List of Figures ................................................................................................................ viii

List of Acronyms.............................................................................................................. ix

Abstract .......................................................................................................................... 1

Introduction ..................................................................................................................... 2

Aetiology of Alexithymic Traits ..................................................................................... 3

Alexithymic Traits and Social-Cognitive Functioning .................................................. 5

Empathy ............................................................................................................................ 8

Alexithymia and Empathy ............................................................................................... 11

Emotion Recognition as a Mediator ............................................................................. 13

Metacognition ................................................................................................................ 15

The Current Study .......................................................................................................... 17

Method ............................................................................................................................. 18

Participants ..................................................................................................................... 18

Primary Measures .......................................................................................................... 19

Secondary Measures ...................................................................................................... 22

Procedure ....................................................................................................................... 23

Design and Statistical Analyses .................................................................................... 24

Results ............................................................................................................................. 27

iv
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Descriptive Statistics</td>
<td>28</td>
</tr>
<tr>
<td>Reliability Analyses</td>
<td>29</td>
</tr>
<tr>
<td>Moderated Mediation Analyses</td>
<td>29</td>
</tr>
<tr>
<td>Affective Models</td>
<td>29</td>
</tr>
<tr>
<td>Cognitive Models</td>
<td>33</td>
</tr>
<tr>
<td>Discussion</td>
<td>41</td>
</tr>
<tr>
<td>Limitations and Future Directions</td>
<td>45</td>
</tr>
<tr>
<td>Theoretical Implications</td>
<td>47</td>
</tr>
<tr>
<td>Practical Implications</td>
<td>48</td>
</tr>
<tr>
<td>Summary and Conclusion</td>
<td>49</td>
</tr>
<tr>
<td>References</td>
<td>50</td>
</tr>
<tr>
<td>Appendices</td>
<td>71</td>
</tr>
<tr>
<td>Appendix A: Toronto Alexithymia Scale</td>
<td>71</td>
</tr>
<tr>
<td>Appendix B: Interpersonal Reactivity Index</td>
<td>72</td>
</tr>
<tr>
<td>Appendix C: Emotion Recognition Task</td>
<td>75</td>
</tr>
<tr>
<td>Appendix D: Depression, Anxiety, Stress Scales – 21</td>
<td>76</td>
</tr>
<tr>
<td>Appendix E: Rosenberg Self-Esteem Scale</td>
<td>77</td>
</tr>
<tr>
<td>Appendix F: Ethics approval letter</td>
<td>79</td>
</tr>
<tr>
<td>Appendix G: Participant Recruitment Flyer</td>
<td>80</td>
</tr>
<tr>
<td>Appendix H: Information Sheet</td>
<td>81</td>
</tr>
<tr>
<td>Appendix I: Participant Consent Form</td>
<td>83</td>
</tr>
</tbody>
</table>

v
Appendix J – Correlations of all variables .............................................................. 79

Appendix K – Reliability of all Self-Report Measures ......................................... 87

Appendix L: Write-up of Affective Moderated-Mediation Models......................... 88
List of Tables

Table 1. Descriptive Statistics for All Measures.........................................................28

Table 2. Summary of the Six Moderated Mediation Models ........................................37

Table 3. Summary of the Conditional Indirect Effects (M (±) SD) for all Six Moderated Mediation Models.........................................................................................38
List of Figures

Figure 1. The Emotion Recognition Task .............................................................22

Figure 2. Conceptual Model 14 of PROCESS ......................................................24

Figure 3. Statistical Model 14 of PROCESS .......................................................27

Figure 4. The Conditional Indirect Effect of Affective Alexithymic Traits on
Affective Empathy Through Emotion Recognition Ability for Anger as a Function of
Metacognitive Ability .........................................................................................30

Figure 5. The Conditional Indirect Effect of Affective Alexithymic Traits, on
Affective Empathy Through Emotion Recognition Ability for Fear, as a Function of
Metacognitive Ability .........................................................................................31

Figure 6. The Conditional Indirect Effect of Affective Alexithymic Traits, on
Affective Empathy Through Emotion Recognition Ability for Sadness, as a Function
of Metacognitive Ability ...................................................................................32

Figure 7. The Conditional Indirect Effect of Affective Alexithymic Traits on
Affective Empathy Through Emotion Recognition Ability for Anger, as a Function
of Metacognitive Ability ...................................................................................34

Figure 8. The Conditional Indirect Effect of Affective Alexithymic Traits on
Affective Empathy Through Emotion Recognition Ability for Fear as a Function of
Metacognitive Ability .........................................................................................36

Figure 9. The Conditional Indirect Effect of Affective Alexithymic Traits on
Affective Empathy Through Emotion Recognition Ability for Sadness, as a Function
of Metacognitive Ability ...................................................................................38
### List of Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>ANDI</td>
<td>Adjusted Normalised Discrimination Index</td>
</tr>
<tr>
<td>DASS-21</td>
<td>Depression, Anxiety and Stress Scale – 21 items</td>
</tr>
<tr>
<td>DIF</td>
<td>Difficulty Identifying Feelings</td>
</tr>
<tr>
<td>DDF</td>
<td>Difficulty Describing Feelings</td>
</tr>
<tr>
<td>EC</td>
<td>Empathic Concern</td>
</tr>
<tr>
<td>ERT</td>
<td>Emotion Recognition Task</td>
</tr>
<tr>
<td>EOT</td>
<td>Externally Oriented Thinking</td>
</tr>
<tr>
<td>FS</td>
<td>Fantasy</td>
</tr>
<tr>
<td>IRI</td>
<td>Interpersonal Reactivity Index</td>
</tr>
<tr>
<td>PD</td>
<td>Personal Distress</td>
</tr>
<tr>
<td>PT</td>
<td>Perspective Taking</td>
</tr>
<tr>
<td>RSE</td>
<td>Rosenberg Self-Esteem Scale</td>
</tr>
<tr>
<td>TAS-20</td>
<td>Toronto Alexithymia Scale – 20</td>
</tr>
</tbody>
</table>
Exploring the Relationship between Alexithymia and Empathy: The Role of Emotion Recognition and Metacognitive Ability

Liam Spicer (BPsychSc)

Word Count: 9988
Abstract
Alexithymic traits have been consistently found to be associated with deficits in social functioning. These social deficits in individuals with alexithymic traits have been suggested to be related to the reduced levels of empathy in those with alexithymic traits. Factors underlying this relationship, however, are presently not understood. Such an understanding may provide insight into addressing the empathy deficits seen in alexithymic individuals. This study aimed to support prior studies that indicate a relationship between cognitive and affective alexithymic traits and cognitive and affective domains of empathy, respectively. A preliminary investigation of the impact of emotion recognition ability (anger, fear, sadness) and metacognitive ability on the relationship between alexithymic traits and empathy was also of interest. One hundred and twenty participants aged between 18 and 55 years (68 females; \( M = 24.95, SD = 7.19 \)) completed the Toronto Alexithymia Scale – 20, the Interpersonal Reactivity Index (IRI), the Emotion Recognition Task (ERT) and provided confidence ratings for each presented emotion of the ERT to assess metacognitive ability. The study identified negative relationships between cognitive alexithymic traits, and cognitive empathy across the emotions of anger, fear, and sadness. A moderated mediation effect for this relationship was also found for the emotion sadness. The findings suggest poor emotion recognition of sadness negatively impacts the relationship between cognitive alexithymic traits and cognitive empathy, but only for those with low levels of metacognitive ability. No significant relationships were found between affective alexithymic traits and affective empathy. These findings upon further testing in a clinical population may contribute to addressing empathy deficits seen in alexithymic individuals, in order to improve their social functioning.
Emotions give meaning and texture to everyday life, enhance connections with others, drive behaviour, and inform individuals about needs, frustrations and rights (Smith & Lazarus, 1990; Leahy, 2012). Thus, the ability to correctly identify another’s emotions (e.g., through facial expressions), and display empathy towards them, is a fundamental aspect of social competence and communication (Decety & Lamm, 2006). With increasing research demonstrating detrimental social and interpersonal effects associated with deficits in the ability to interpret and respond to the emotions of another, constructs underlying these difficulties have been investigated. One construct which has received an increasing amount of interest is that of alexithymia.

Alexithymia is a psychological construct characterised by difficulties in identifying, analysing and verbalising emotions (Grynberg et al., 2012). Furthermore, alexithymic individuals have a tendency to demonstrate an externally oriented cognitive style, a restricted imaginal capacity, and confusion between emotions and the accompanied physical sensations (Grynberg et al., 2012; Taylor, Bagby, & Parker). Initially introduced by Nemiah and Sifneos in the early 1970’s, Alexithymia was a term used to describe a group of behaviours commonly occurring together in individuals with psychosomatic disorders (Sifneos, 1973; Van der Velde et al., 2013). Alexithymia is often regarded as a condition due to its organic basis in the brain, however many authors conceptualise alexithymia as a multidimensional personality construct, comprising of both affective and cognitive dimensions (Mattila et al., 2010).

The affective dimension of alexithymia contains two facets: difficulty identifying feelings in oneself, and difficulty describing one’s own feelings (Loas et al., 2001). This difficulty in identifying and describing one’s own feelings, involves
an undifferentiated emotional awareness and diminished emotional expression, respectively (Demers & Koven, 2015, Jongen et al., 2014). On the other hand, the cognitive dimension of alexithymia is characterized by the specific tendency to focus attention externally, and to engage in a concrete, practical style of thinking (Jongen et al., 2014; Nicolò et al., 2011). Put simply, affective alexithymic traits are primarily associated with “feelings” in oneself, whereas cognitive alexithymic traits are more so related to the process of “thinking” about emotions in one’s self.

The prevalence of alexithymic traits in adults within the general population has been estimated to be approximately 5-13% (Franz et al., 2008; Mattila, Salimen, Numini, & Joukamaa, 2006), however in clinical samples this estimation is higher at 40-67% (Loas, Fremaux, Otmani, Lecercle, & Delahousee, 1997; Lyvers, Hinton, Edwards, & Thorberg, 2015). Alexithymia is regarded as a trans-diagnostic deficit, meaning it is a common condition associated with several disorders (Grynberg et al., 2012). Some disorders that are highly comorbid with alexithymic traits, and are seen to be a risk factor for alexithymia include: schizophrenia, autism spectrum disorder, anxiety disorders, somatoform disorders, eating disorders, depressive disorders, personality disorders, sexual disorders, post-traumatic stress disorder, and substance use disorders (Cochrane, Brewerton, Wilson, & Hodges, 1993; Duddu, Isaac & Chaturvedi, 2003; Fukunishi, Kikuchi, Wogan & Takubo, 1997; Michetti, Rossi, Bonanno, Tiesi, Simonelli, 2006; Thorberg, Young, Sullivan, Lyvers, 2009; Van’t Wout, Aleman, Bermond & Kahn, 2007).

**Aetiology of Alexithymic Traits**

The origin of alexithymia is not fully understood; however, a combination of environmental, psychological and neurological factors have been proposed. A theory that provides a possible explanation for the cognitive and affective emotion
difficulties found in those with alexithymic traits, is Lane and Schwartzs’ (1987) cognitive-developmental theory of emotional awareness. This theory suggests that emotional awareness is a cognitive skill where individuals progress from lower to higher stages of emotional awareness, similar to Piaget’s theory of cognitive development (Timoney & Holder, 2013). More specifically, individuals with higher levels of alexithymic traits generally function at a preoperational level where individual feelings are biologically experienced, yet their awareness of these emotions are limited or restricted, and they struggle to see the perspective of others (Lemche et al., 2004). This limited emotional awareness has been suggested to be due to maladaptive experiences during childhood driven from feelings of isolation, and/or experiencing trauma or neglect (Karukivi & Saarijärvi, 2014). It is suggested that often children develop various defence mechanisms in response to adverse emotional experiences (Gilbert, 2000). Thus, alexithymic traits may arise as a defence mechanism to emotional trauma (Krystal, 1982). This suggestion has been supported by several studies. For example, Barenbaum (1996) found alexithymic traits to be positively associated with a history of childhood abuse. Further, Lumley, Mader, Gramzow and Papineau (1996) demonstrated an association between alexithymic traits and general psychopathology in the family throughout the child’s years of early development.

The suggestion of the impact of emotional trauma in the development of alexithymic traits, is echoed in an alternative neuroanatomical account of alexithymia. Parker, Keightley, Smith and Taylor (1999) suggest that in those with alexithymic traits, there is an interhemispheric deficit in the transfer of emotional information from the right hemisphere of the brain to the language regions in the left hemisphere. This in turn reduces the ability to label or verbalise emotions. This
interhemispheric deficit has been suggested to be due to reduced connectivity in the corpus callosum, which interestingly is an area of the brain also thought to be compromised in those who have suffered childhood trauma (De Belis, Spratt & Hooper, 2011; Paul, 2011). This neuroanatomical account provides a possible suggestion of an interplay between neuroanatomical structures, and the aforementioned social and psychological factors such as trauma and/or neglect as described in Lane and Schwartz’s (1987) theory. As there is no conclusive evidence on this distinct distribution of hemispheric functions, this account may only partially explain the development of alexithymic traits, therefore other models have been proposed.

Another neuroanatomical account of the aetiology of alexithymia is that proposed by Lane, Ahern, Scwartz & Kazniaz (2007). The ‘blindfeel’ hypothesis suggests that the impaired emotional processing in alexithymic individuals lies in the conscious self-awareness of emotions in one’s self, which is implicated in several critical brain regions. This includes the anterior cingulate cortex (ACC), which is involved in the generation, appraisal and expression of emotions, and also the insula, striatum and amygdala, which are involved in emotional awareness and the detection of emotional significance (Lane, Reiman, Axelrod, & Yun, 1998; Heinzel et al., 2010). This hypothesis has been supported extensively in the literature, including brain imaging studies in both non-clinical and clinical samples (Demers, Olson, Crowley, Rauch, Rosso, 2015; Moriguchi & Komaki, 2013). Several authors suggest that low activation in the aforementioned neural regions may be an underlying explanation for the impaired emotional processing in alexithymic individuals (Kano, Fukudo, 2013; Van der Velde et al., 2013).
Alexithymic Traits and Social-Cognitive Functioning

The cognitive and affective difficulties associated with alexithymic individuals have been consistently demonstrated to have pervasive, and often enduring social and interpersonal consequences. For example, alexithymic individuals have a reduced capacity to establish and maintain meaningful relationships (Lumley, Stettner & Wehmer, 1996). This is of great importance as the absence of meaningful social relationships has been closely related to poorer mental health, and reduced quality of life (Diener & Seligman, 2002). In addition, Spitzer, Siebel-Jürges, Barnow, Grabe and Freyberger (2005) suggest that alexithymic individuals are often deficient in having the essential qualities required for effective social communication, and often they lack a basic desire for social closeness and support. As a consequence, alexithymic individuals often experience high levels of family, romantic and social loneliness (Qualter, Quinton, Wagner, & Brown, 2009), and display a tendency to engage in relationships at a superficial level (Guttman & Laporte, 2002). These interpersonal difficulties are also of concern in clinical settings, as the client-therapist relationship has been demonstrated to be a strong marker of therapeutic effectiveness (Saunders, 2001).

These social and interpersonal impairments in alexithymic individuals have been proposed to be due to underlying impairments in social cognition (Aaron, Benson, Park, 2013). Social cognition is defined as the ability to identify, perceive, and interpret interpersonal cues displayed by others and apply this information in social interactions to guide behaviour (Amodio & Frith, 2006; McDonald, Honan, Kelly, Byom, & Rushby, 2013). Good social cognitive skills enable an individual to effectively communicate, share experiences, establish and maintain relationships, and predict the behaviour of another (McDonald, 2013). Adolphs (2003) suggests
that because humans are intensely social animals, social cognition is an evolutionary imperative, which has developed independently from non-social information processing skills in order to survive. This distinction between non-social and social cognition, is supported by several studies. For example, Happé (1994) suggests individuals with Autism Spectrum Disorder appear to have an inordinate difficulty with social information, despite average or above average functioning in other cognitive domains. In addition, individuals with discrete frontal lesions often present with disproportionately impaired social functioning in comparison to their general cognition (McDonald, Honan, Kelly, Byom, Rushby, 2013; Tranel, Bechara, & Denburg, 2002). Social cognition encompasses both lower order social cognitive abilities such as emotion recognition, and also higher-order social cognitive abilities such as Theory of Mind (ToM) and empathy (Javed & Charles, 2018).

Emotion recognition is defined as a context-sensitive process involving the ability to perceive and recognize emotional information in others (Grynberg et al., 2012). This emotional information is detected through the integration of various cues derived from another person’s body movement and gestures, speech, and importantly, facial expressions (Grynberg et al., 2012). The face, especially the eye region, plays a critical role in the expression of emotions, providing a quick indication of the person’s feelings or possible intended behaviour (Parker, Taylor & Bagby, 1993). Unlike other emotional cues such as posture, or body language, facial expressions can be both universal and culturally specific (depending on the emotion), making them very important in daily emotional communication and social functioning (Matsumoto, Keltner, Shiota, Frank & Sullivan, 2008). Deficits in recognising the emotions of another can result in misunderstandings, and incorrect interpretation of intent and reaction (Walter et al., 2011). Thus, emotion recognition
is an essential aspect of human interaction, and is suggested to be critical for engaging in higher-order social cognitive abilities (Jayed & Charles, 2018). ToM refers to the ability to attribute mental states to oneself, and another (Singer, 2006). This understanding facilitates the process of recognising that each individual has their own set of beliefs, intentions, desires, emotions, and knowledge that can be applied to create meaningful social interactions (Meltzoff & Gopnik, 1994).

Empathy, another higher order social-cognitive ability builds upon the ToM hypothesis, from an understanding that another has a mental state, to the capacity to respond to another’s mental with an appropriate emotion (Baron-Cohen, 2000).

**Empathy**

Empathy varies largely in definition, yet generally it is regarded as the ability to experience and understand the momentary emotional state of another (Salazar-Lopez et al., 2015). The ability to be empathetic plays a critical role in both interpersonal and social domains. It enables individuals to express experiences, desires, and needs appropriately between each other, and it facilitates the process of pro-social behaviour through providing a connection with others within a social environment (Riess, 2017). Empathy allows an individual to understand reasons behind human behaviour, and the impact an individual’s actions can have on another (Decety & Lamm, 2006). Behavioural and neural deficits in the capacity to be empathetic are characteristic of many psychiatric populations, suggesting empathy is a relevant trans-diagnostic dimension (Decety & Moriguchi, 2007). This indicates deficits in this ability have various implications for functional impairment and treatment development (Valdespino, Antezana, Ghane, Richey, 2017).

Similar to alexithymia, empathy can be broken down into two inter-related, yet distinct dimensions: cognitive empathy and affective empathy (Joliffe &
Farrington, 2006; Cox et al., 2012). Current evolutionary evidence indicates empathy is mediated by several brain systems including the phylogenetically early emotional contagion system and more advanced cognitive perspective-taking system (De Waal, 2007). The early emotional contagion system relates to affective empathy, the ability to feel and share the emotional experience of another (Shamay-Tsoory, 2011). According to Preston and De Wahls’ (2002) perception-action hypothesis, the perception of behaviour in another results in an automatic representation of that behaviour in one’s self. This process is referred to as ‘simulation’ and is facilitated through mirror neurons in the premotor cortex (Shamay-Tsoory, 2011). Given mirror neurons are initiated both when an individual engages in a behaviour, and also when that individual observes that behaviour in another, they help individuals to share the experience of another (Carr, Lacoboni, Dubeaut, Mazziota, & Lenzi, 2003; Rizzolatti & Sinigaglia, 2010). Numerous brain imaging studies support this notion revealing the same key neural areas are activated both when observing another’s emotional state, and also when the emotional state is experienced by the self (Blackmore & Frith, 2005; Wicker et al., 2003). Activity associated with affective empathy involves brain regions involved in emotional processing (thalamus), emotional awareness (right anterior insula), understanding/simulating other actions (inferior parietal lobule), and the perception of faces and bodies (fusiform gyrus; Carr et al., 2003; Shamay-Tsoory, Tomer, Goldsher, Berger & Aharaon-Peretz, 2004). This state-matching reaction is a bottom up process, whereby the process of ‘simulation’ results in an individual being able to achieve a similar state of feeling (Shamay-Tsoory, 2011). Put simply, affective empathy is our automatic drive to respond appropriately to another’s emotions (Ang & Goh, 2010).
The more advanced cognitive perspective taking system relates to cognitive empathy. Cognitive empathy is a top-down process and is defined as the capacity to understand the emotional state of another, based upon our ability to distinguish ourselves from others (Jankowiak-Siuda, Rymarczyk, & Grabowska, 2011). More specifically, cognitive empathy is the capacity to recognise that an individual may be experiencing particular emotions, enabling insight into another’s beliefs, actions, desires and intentions (Hein & Singer, 2008). Hence, cognitive empathy is often used synonymously with the term ‘affective ToM’ (Olderbak, Sassenrath, Keller & Wilhelm, 2014). Brain regions thought to mediate cognitive empathy include the fusiform gyrus (involved in facial and body recognition), parahippocampal gyrus (involved in memory encoding and retrieval), and the cuneus (responsible for integrating somatosensory information with other sensory stimuli, as well as learning and attention) (Rameson, Morelli, & Lieberman, 2012, Völlm et al., 2006).

Although the affective and cognitive dimensions of empathy can be distinguished at the level of regional activation in the brain (Fan, Duncan, Greck & Northoff, 2011), the ability of empathy is mediated by a core neural network, which facilitates the processes of the cognitive and affective dimensions. In a whole brain quantitative meta-analysis of fMRI studies, it was revealed that the anterior mid cingulate cortex (aMCC), dorsal anterior cingulate cortex (dACC), bilateral anterior insula, and supplementary motor area (SMA) are consistently activated in empathy (Fan et al., 2011). Some of these key neural regions within the network of empathy including the ACC, insula, and striatum, have been determined to partially overlap with the brain regions associated with alexithymic traits, providing a possible explanation for the empathy deficits seen in alexithymic individuals.
Alexithymia and Empathy

According to the shared networks model (2012), brain networks responsible for emotional processing in the self, involve the same key neural regions involved in the representation of emotions in others (Bernhart & Singer, 2012; Bird et al., 2010). As empathy and alexithymia share some of the same key neural regions including the ACC, insula, and striatum, a disruption in these areas would likely affect the processes underlying both alexithymia and empathy (Bernhart & Singer, 2012; Bird et al., 2010). It makes sense that the ability to identify or understand one’s own emotions is a necessary step in the ability to identify or understand the feelings of another (i.e., empathy), and this notion is supported strongly throughout the literature.

Early clinical (Krystal, 1979) investigation and empirical research has confirmed a negative relationship between alexithymic traits and empathy, in both clinical and non-clinical populations (Råstam, Gillberg, Gillberg, & Johansson, 1997). For example, Moriguchi et al., (2007) in a sample of healthy college students revealed a negative relationship between empathy and alexithymia. In another study, Guttman and Laporte (2002) explored the relationship between the cognitive and affective dimensions of alexithymic traits and empathy with the use of the Toronto Alexithymia Scale-20 (TAS-20; Bagby, Parker & Taylor, 1994) and the Interpersonal Reactivity Index (IRI; Davis, 1980). Their analysis revealed negative relationships between the affective components of the TAS-20 (difficulty identifying feelings, DIF; difficulty describing feelings, DDF), and the affective components of the IRI (personal distress, PD; empathic concern, EC). In addition, negative relationships between the cognitive sub-scales of the IRI, perspective taking (PT) and fantasy (F) with the cognitive sub-scale of the TAS-20 (externally oriented
thinking, EOT) were observed. Grynberg et al., (2012) found similar results, revealing the cognitive (EOT with F and PT) and affective (DIF and DDF with PD) dimensions of alexithymia and empathy to be negatively related. Although the relationship between alexithymic traits and empathy, and their cognitive and affective dimensions are firmly established, factors underlying this relationship are not at present understood, which is a primary aim of the present study.

In order to understand the complex relationship between alexithymic traits and empathy, and gain insight into possible mechanisms, theoretical models have been applied to this relationship. The Self-to-Other Model of Empathy outlined by Bird and Viding (2014) suggests that in alexithymic individuals there is a disruption within the affective representation system, which is involved in the representation/simulation of another’s affective state. Due to a disruption in the affective representation system, alexithymic individuals suffer a reduction in the ability to form a consciously accessible representation of their own affective states. Therefore, through a lack of differentiated affective states, these individuals are provided no opportunity to learn the perceptual cues associated with those states in another, impacting upon empathy processing in a number of ways (Bird & Viding, 2014; Valdespino et al., 2017). For example, an individual may be aware they are experiencing an emotion but unsure what emotion they are experiencing (consistent with Lane and Schwartz’s (1987) ideas of pre-operational processing), or they may be aware another has had a change in emotional state, yet they cannot identify what emotion. When detailing the Self-to-Other Model of Empathy, Bird and Viding (2014) argued that an atypical affective representation system is likely to involve deficits in emotion recognition. Despite this, and the understanding that lower order social cognitive abilities (i.e., emotion recognition) are needed for higher order
social cognitive abilities (i.e., empathy), limited research has examined whether emotion recognition impacts the relationship between alexithymia and empathy. This limitation of the previous research is important to address, as not only will this provide further insight to Bird and Viding’s (2014) theoretical account, it may provide potential answers to addressing the empathy deficits seen in alexithymic individuals.

**Emotion Recognition as a Mediator**

In line with the shared networks model (2012), emotion recognition ability represents a compelling mediator of the relationship between alexithymic traits and empathy. In an fMRI study by Marsh et al., (2008), it was demonstrated that emotion recognition ability is mediated by activity in the anterior insula, ACC and amygdala, some of the same key neural regions which form central networks for both alexithymia and empathy. This may suggest that if these brain regions are compromised, both lower order social cognitive abilities (i.e., emotion recognition) and higher order social cognitive abilities (i.e., empathy) could be impacted, and these deficits could be associated with the impairments seen in alexithymic individuals.

Strong support in the research has determined that individuals high in alexithymic traits have deficits in recognising facial expressions (Cook, Brewer, Shah, & Bird, 2013; Parker, Taylor, & Bagby, 1993). For example, Lane, Sechrest, Riedal, Shapiro, and Kaszniak (2000) found alexithymia scores to be negatively correlated with the ability to identify Ekman and Friesan’s (1976) six basic universal emotions (happiness, surprise, disgust, anger, fear, sadness). In addition, a large systematic review of the literature by Grynberg et al., (2012) determined that in both clinical disorders and ‘healthy’ populations levels of alexithymia were strongly
correlated with deficits in recognising and labelling all six basic emotions. Despite some studies finding no relationship between alexithymia scores and the identification of emotional expressions (McDonald & Prkachin, 1990; Mayer, DiPaulo, and Salovey, 1990), these studies have been criticised due to using unreliable measures and lacking power through the use of small sample sizes.

There is strong support that emotion recognition deficits in alexithymic individuals are worse for negative, compared to positive valence emotions (Grynberg et al., 2012). Importantly, recognising negative valence emotions is associated with greater social and interpersonal difficulties, due to their association with vulnerability and threat (Berthoz et al., 2002). Being unable to identify when someone is feeling angry or sad for instance, is likely to have greater negative implications then being unable to detect an individual feeling happy. In a study by Prkachin, Casey and Prkachin (2009) high levels of alexithymic traits were associated with marked deficits in recognising sadness, anger, and fear, however this effect was not as strong for the emotions of happiness, surprise, and disgust. Overall, it appears that the negatively valenced emotions appear harder to detect in those with alexithymic traits, and an ability to detect these emotions may be more critical for social and interpersonal functioning.

The argument for emotion recognition to mediate the relationship between alexithymic traits and empathy, is also supported by studies demonstrating associations between emotion recognition and empathy. For example, Bessel (2006) demonstrated that a reduced ability to recognise emotions, was associated with a reduction in the ability to be empathetic. Furthermore, some recent preliminary research in a non-clinical population provides support for the likely role of emotion recognition in the relationship between alexithymic traits and empathy. Lyvers,
McCann, Coundoris, Edwards, & Thorberg (2018) demonstrated that the negative relationship between the TAS-20 cognitive sub-scale EOT and cognitive empathy was partially mediated by impaired emotion recognition. This finding is supported by Grynbergs (2012) suggestion that the relationship between alexithymic traits and empathy may be logically attributed to deficient facial recognition of emotions. Although these preliminary results are promising, the study by Lyvers et al., (2018) did not examine the affective dimensions of alexithymic traits and empathy. In addition, this study utilised the Reading in the Mind Eyes Test (Baron-Cohen, 2001) to assess emotion recognition ability, which has been shown to lack internal consistency reliability and ecological validity (Olderbak, Wilhelm, Olaru, Geiger, Brenneman, & Roberts, 2015). Therefore, the current study will address these limitations. In addition, the current study will also examine additional factors which may be impacting the relationship between alexithymic traits and empathy, such as awareness of emotion recognition performance.

**Metacognition**

Metacognition is a higher-order cognitive process involving the ability to understand the thinking of one’s self and others and to use this knowledge to problem solve and learn (Dimaggio et al., 2007). There is little doubt that accurate metacognition would be a valuable skill within the context of emotion recognition, and social functioning more broadly. An individual with good metacognitive skills can be aware of one’s own ability (or lack of) to detect emotions in others, use this knowledge to take more time, or use alternative methods to compensate for difficulties such as asking how the other person is feeling. This may prevent an individual from arriving at an incorrect conclusion, and allow the individual to respond more appropriately, so that negative social and interpersonal consequences
can be avoided (Benjamin, Bjork, & Schwart, 1998; Finn, 2008). The MAMID cognitive affective architecture outlined by Hudlika (2005, 2008) suggests emotional deficits (i.e., emotion recognition), are impacted on by an individual’s confidence and awareness of these particular processes. Therefore, if an individual has decreased confidence and awareness of critical abilities such as emotion recognition, this results in a reduction in the capacity to process emotional information accordingly, consequently evidencing emotional deficits such as reduced empathy (Hudlika, 2008). If an individual was aware of their emotion recognition ability being reduced, this could allow compensatory processes to come into action and a more conscious effort may occur to improve emotional deficits.

No research to our knowledge has examined the impact of metacognitive ability on emotion recognition when a part of the alexithymic traits-empathy relationship. However, some studies provide support for the likely role of metacognition in this relationship indirectly. In recent research with a sample of individuals with diagnosed schizophrenia, a disorder highly co-morbid with alexithymic traits, metacognition was related to, and had a trending relationship with cognitive empathy and affective empathy, respectively (Bonfils, Lysaker, Minor, & Salvers, 2017). Other studies have found relationships between metacognition and empathy. For example, WeiMing, Lysaker and Kai (2015) found positive correlations between overall metacognition scores and both cognitive and affective empathy. These studies however, only examined global metacognitive functioning or measures of metacognitive strategies, rather than metacognitive functioning in relation to a particular ability. By examining a specific metacognition in relation to a specific ability, we can gain a better understanding of whether changing metacognitive awareness of that ability can facilitate adjusted responses. The current
study proposes that metacognitive ability may impact on the relationship between alexithymic traits and empathy, through its impact on emotion recognition ability.

The Current Study

Inspecting the relationship between alexithymic traits and empathy, and the impact of emotion recognition, conditional of metacognitive functioning, is of great importance and thus is an important aim of this study. Although the present study is preliminary in nature and is with a non-clinical sample, if emotion recognition and metacognitive ability influences the relationship between alexithymic traits and empathy, this would act as a starting point for future research in a clinical population in order to guide targeted treatment for those experiencing difficulties with alexithymia and empathy.

Accordingly, this study aims to provide further support for the relationship between alexithymic traits and empathy, and the respective cognitive and affective dimensions of these constructs. In addition, this study will examine whether emotion recognition ability, when moderated by metacognitive ability, would influence the strength and/or direction of the relationship between alexithymic traits and empathy. This research will focus on the negative valence emotions of anger, fear, and sadness, as an inability to detect these emotions has more severe social and interpersonal consequences due to their association with vulnerability and threat (Berthoz et al., 2002).

It is hypothesised that there will be a negative relationship between affective alexithymic traits and affective empathy, such that the reduced ability to identify and describe feelings in oneself, would lead to a reduced ability to feel emotions another person is feeling. Secondly, it is predicted that there will be a significant negative relationship between cognitive alexithymic traits and cognitive empathy, such that
high levels of a concrete, externally oriented thinking style will result in a reduced ability to understand another's emotional state. For the cognitive, and affective models, it is predicted that emotion recognition, when moderated by metacognitive ability, would partially mediate the relationship between alexithymic traits and empathy. This effect is only proposed to occur for low levels of metacognitive ability, not for mean or high levels. Based on the suggestion that the cognitive dimension of alexithymia is associated with deficits in recognising and understanding the emotions of others (Demers & Koven, 2015), and metacognition is more of a cognitive, rather than effective process (Bonfils, Lysaker, Minor, & Salvers, 2017), it is expected that the moderated mediation effects would be stronger for the cognitive models.

Method

Participants

Participants consisted of 120 individuals between the ages of 18 and 55 years (M = 24.95, SD = 7.19) who were either students at the University of Tasmania, or members of the wider Northern Tasmanian community. There were 52 males (M = 24.90, SD = 6.28) and 68 females (M = 25.00, SD = 7.85). First year Psychology students were recruited via SONA, a secure online electronic platform, and through the delivery of presentations to classes. Further recruitment involved advertisements in the form of flyers displayed throughout the University of Tasmania’s Newnham campus and the wider Northern Tasmanian community. First year Psychology students were awarded 45 minutes course credit for participation, and other participants went into the draw to receive one of three double movie vouchers.
Exclusion criteria included those without normal or corrected to normal vision, severe depression (scores over 28 on the depression scale of the DASS-21), a history of any neurological condition, and pregnancy. One-hundred and thirty-five individuals completed the screening questionnaire, however nine were excluded based on the exclusion criteria, and six did not respond following the initial pre-screening. Individuals with severe depression and/or anxiety scores were provided with information on the University of Tasmania on-campus counselling services.

An *a-priori* power analysis using G*power 3.1.9.2 (Faul et al., 2007) was conducted to determine the minimum sample size needed to detect significant effects. In a study examining emotion recognition ability, alexithymic traits, mood and empathy by Lyvers et al., (2018) an effect size of $R^2 = .18$ was produced. Based on this effect size, an alpha of .05, and power of .90, it was suggested that at least 69 participants would be needed for the present study. The present study however aimed to collect data from 120 participants to ensure a more robust analysis.

**Primary Measures**

**Toronto Alexithymia Scale-20** (TAS-20; Bagby et al., 1994; Appendix A). The TAS-20 is 20-item self-report questionnaire used to assess levels of alexithymic traits across three sub-scales: Difficulty Identifying Feelings (DIF, seven items, e.g., ‘I am often confused about what emotion I am feeling’); Difficulty Describing Feelings (DDF, five items, e.g., ‘I am able to describe my feelings easily’); and Externally Oriented Thinking (EOT, eight items, e.g., ‘I prefer to analyse problems rather than just describe them’). Each item is rated on a 5-point Likert-type scale (1 = ‘strongly agree’ to 5 = ‘strongly disagree’) where items are summed to arrive at a total score (20-100), and scores for each sub-scale. Higher scores indicate greater levels of alexithymic traits. The TAS-20 is regarded as the gold standard
measurement of alexithymia and its three-factor structure has been confirmed in both clinical and non-clinical samples in 19 countries (Taylor et al., 2003). In non-clinical populations, the TAS-20 has good internal reliability ($\alpha = 0.80$), with all three subscales revealing acceptable reliability (DIF $\alpha = 0.78$, DDF $\alpha = 0.73$, and EOT $\alpha = 0.64$; Parker, Bagby, Taylor, Endler & Schmitz, 1993).

**Interpersonal Reactivity Index** (IRI; Davis, 1980; Appendix B). The IRI is a 28-item self-report measure, assessing both the cognitive and affective dimensions of empathy across four sub-scales. Empathetic Concern (EC) and Personal Distress (PD) are affective measures assessing feelings of sympathy (e.g., ‘I often have tender, concerned feelings for people less fortunate than me’), and the tendency to experience distress in response to others distress (e.g., ‘Being in a tense emotional situation scares me’), respectively. Perspective Taking (PT) and Fantasy (FS) are cognitive measures assessing the ability to take the perspective of others (e.g., ‘I sometimes try to understand my friends better by imagining how things look from their perspective’), and the tendency to transpose one’s self into fictional situations (e.g., ‘When I am reading an interesting story or novel, I imagine how I would feel if the events in the story were happening to me’), respectively. Each item is rated on a 5-point Likert-type scale (e.g., ‘A = Does not describe me well’, to ‘E = Describes me very well’), with seven items for each sub-scale. There are 9 negatively worded items (3, 4, 7, 12, 13, 14, 15, 18 & 19), which are reversed scored. The possible range of scores for each subscale is 0-28, with higher scores indicating greater levels of empathic tendencies. The IRI demonstrates good construct validity as determined by factor analysis (Delic et al., 2011), and acceptable test-retest reliability ($r = .62$) (Bernstein & Davis, 1982). The IRI has acceptable internal consistency reliability ($\alpha = .70$) overall, and acceptable to good internal consistency reliability for the four
sub-scales (EC $\alpha = .80$, PD $\alpha = .76$, PT $\alpha = .75$, FS $\alpha = .79$) (Baldner & McGinley, 2014).

**Emotion Recognition Task** (ERT; Montagne et al., 2007; Appendix C). The ERT is a computerised task that assesses an individual’s ability to identify six basic universal emotions (happiness, surprise, disgust, anger, fear, sadness). The task consists of 120 trials where each emotional expression is presented in a video clip on one of either two male or female Caucasian faces. The video clips are presented in a random, pre-determined order that increases in length, with each emotion being displayed four times at five intensity levels, beginning with a neutral face and morphing from lower to higher intensities (0-20%, 0-40%, 0-60%, 0-80%, and 0-100%). Participant’s select the expression they perceived on each trial using an alternative forced-choice format of the six emotions. To ensure participants were familiar with the task, participants completed three practice trials, where assistance was provided if they did not understand the procedure. The ERT has been demonstrated to be valid in both non-clinical (Kessels, Montagne, Hendriks, Perrett, & de Haan, 2013), and clinical populations (Rosenberg, McDonald, Dethier, Kessels, & Westbrook, 2014).
Figure 1. The Emotion Recognition Task (ERT; Montagne et al., 2007). Picture shows gradually increasing intensity for the emotion of disgust. The actual test shows these frames morphing from a neutral expression in 10% increments to one of the five intensity levels (20%, 40%, 60%, 80%, 100%).

Metacognition of emotion recognition ability was assessed by asking participants to give a verbal confidence rating of their performance in correctly identifying the emotional expression on each item of the ERT. Participants provided a figure from 0 – 100%, with 0% indicating not at all confident in their response and 100% indicating extremely confident in their response.

Secondary Measures

To further profile participants and gain useful information on the characteristics of the sample the following measures were used.

**Depression, Anxiety and Stress Scale – 21** (DASS21; Lovibond & Lovibond, 1995; Appendix D). The DASS-21 consists of three self-report scales (7 items each) measuring levels of negative emotional state – depression (e.g., ‘I felt down-hearted and blue’), anxiety (e.g., ‘I felt scared without any good reason’) and stress (e.g., ‘I found it hard to wind down’) in the previous week. Responses are rated on a 4-point Likert-type scale (0 = ‘Did not apply to me at all’ to 3 = ‘Applied
THE RELATIONSHIP BETWEEN ALEXITHYMIA AND EMPATHY

to me very much, most of the time’). Scores for each subscale are created by summing items defining each sub-scale and multiplying by two according to manualised scoring instructions. The DASS-21 was included to examine mood as a possible covariate of the present study, in addition to characterising the sample. In both clinical and non-clinical samples, the DASS-21 has good validity (Crawford & Henry, 2003; Brown, Chorpita, Korotitsch, & Barlow, 1997), and excellent internal reliability for the depression (\(\alpha = .82\)), anxiety (\(\alpha = .90\)) and stress (\(\alpha = .93\)) sub-scales (Henry & Crawford, 2005).

**Rosenberg Self-Esteem Scale** (RSE; Rosenberg, 1965; Appendix E). The RSE is a 10-item measure assessing levels of positive (e.g., ‘I feel I have a number of good qualities’) and negative (e.g., ‘I feel I do not have much to be proud of”) feelings about the self. Participants rate items on a 4-point Likert-type scale (1 = ‘strongly agree’ to 4 = ‘strongly disagree’). There are 5 items that are negatively worded (2, 5, 6, 8, & 9), which are reverse scored. Items are summed to arrive at a total score ranging from 0-40, with higher scores indicating higher self-esteem. As self-esteem has been identified to correlate negatively with alexithymia (Sasai, Tanaka, & Hishimoto, 2010), the RSES was included to examine current-self-esteem as a possible co variate, in addition to characterising the sample. The RSE is highly internally reliable (\(\alpha = .88\)), as demonstrated by a large study involving undergraduate students (Gray-Little, Williams, & Hancock, 1997).

**Procedure**

Ethical clearance (See appendix F) was obtained by the Tasmanian Social Sciences Human Research Committee (HREC: H0016480). Upon recruitment through SONA, presentations to classes, or flyers (Appendix G), participants read the participant information sheet (Appendix H) and completed a screening
questionnaire on Survey Monkey. The survey included demographic information (age, sex, ethnicity, marital status, highest level of educational attainment, and whether English was spoken as a first language), medical history relevant to eligibility, and the DASS-21. If eligible, a time for the experimental session was arranged. Following informed consent (Appendix I), participants completed the following questionnaires on a computer: the TAS-20, IRI, DASS-21, and RSE. Participants then completed the computerised ERT and verbally provided confidence ratings. Participants were then de-briefed, provided with the opportunity to ask questions, and thanked for their time.

**Design and Statistical Analyses**

A cross-sectional correlational design was employed. Correlational analyses and moderated mediation models were conducted on IBM SPSS Version 24. Correlational analyses were conducted to assess relationships between variables, and to identify possible co-variates for the six subsequent moderated mediation models (Please see appendix J for correlations of all variables). To adhere to the rule of parsimony and to ensure that there was no overfitting of the model, only co-variates that significantly predicted the outcome when a part of the model were included in the final analyses. This resulted in sex and anxiety being added as covariates for the affective models, and sex being added as a covariate for the cognitive models. All correlations were interpreted according to the guidelines of Cohen (1992) whereby .10 indicates a small effect, .30 a moderate effect and .50 a large effect.

Reliability analyses were conducted as item parcelling procedures were implemented, and to ensure the measures had adequate internal consistency reliability in the present sample. Item parcelling involved adding the relevant affective and cognitive items of the TAS-20 and IRI to create cognitive and affective
composite scores of both constructs. Cognitive alexithymic traits were represented by the EOT sub-scale of the TAS-20, and affective alexithymic traits were represented by combining the DIF and DDF sub-scales of the TAS-20. Cognitive empathy composite scores involved combining the FS and PT sub-scales of the IRI, and affective empathy composite scores involved combining the EC and PD sub-scales of the IRI. Cronbach’s α was used to index internal reliability for the combined items. Values were interpreted as follows: $\alpha \geq 0.9 = \text{excellent}; 0.9 > \alpha \geq 0.8 = \text{good}; 0.8 > \alpha \geq 0.7 = \text{acceptable}; 0.7 > \alpha \geq 0.6 = \text{questionable}; 0.6 > \alpha \geq 0.5 = \text{poor}; \text{and } 0.5 > \alpha = \text{unacceptable}$ (Gliem & Gliem, 2003).

Conditional process analysis models from Hayes (2013) PROCESS macro were used. Model 14 of Hayes’ PROCESS combines both moderation and mediation, linking the indirect effects to values of the moderator. This approach produces a formal test of the conditional indirect effect, known as the index of moderated mediation. Hayes (2018) suggests when testing whether an indirect effect is moderated, the index of moderated mediation and inspection of the confidence intervals not overlapping zero is the best statistical inference for a significant effect (Hayes, 2018). Although some researchers suggest some of the causal pathways need to be significant to infer mediation, Hayes (2018) suggests these relationships are not always needed. As the independent variables (affective alexithymic traits and cognitive alexithymic traits) were created from the same measurement (TAS-20) unstandardised beta (B) values will be reported. This is in line with Hayes (2018) suggestion that unstandardised beta values are more useful for ‘real world’ predictions. As the sampling distribution was not normal in the present study, bootstrapping procedures were conducted (Field, 2015). Based on Hayes (2018) suggestion that bias corrected-bootstrapping is better for statistical inference, 10,000
bias corrected bootstraps of the original data were used. Although bootstrapping eliminates the assumptions of normality, when testing conditional indirect effects, linearity and independence of observations need to be satisfied. Scatterplots confirmed linear relationships, and participants only took part once, therefore these assumptions were satisfied.

Model 14 tests the conditional effect of X on Y, through M, as a linear function of V. This is a second stage moderated mediation whereby the strength and/or direction of the relationship between the mediator and the outcome, is impacted on by the moderator. For all moderated mediation models in the current study, the predictor variable (X) was alexithymic traits (cognitive or affective); the outcome variable (Y) was empathy (cognitive or affective); the mediator variable (M) was emotion recognition ability; and the moderator variable (V) was metacognitive ability. There was a total of six moderated mediation models tested, three affective, and three cognitive, for each of the negative valence emotions of anger, fear and sadness. The conceptual model is presented in Figure 2. The statistical model presented in Figure 3.

![Conceptual Model 14 of PROCESS (Hayes, 2018).](image)
**Figure 3.** Statistical Model 14 of PROCESS (Hayes, 2018).

**Metacognitive ability.** Calibration analyses measure the degree of fit between an individual’s judgement of performance and their actual performance on a task (Bol & Hacker, 2012). In this study, calibration will be assessed using the Adjusted Normalised Discrimination index (ANDI). ANDI is an index that evaluates resolution – the degree to which an individual’s confidence ratings can discriminate between correct and incorrect responses (Palmer et al., 2013; Vredeveldt & Sauer, 2015). The ANDI statistic gives a value ranging from 0 (no resolution) to 1 (perfect discrimination).
Results

Descriptive Statistics. Descriptive statistics for all self-report measures, the ERT and metacognitive ability (ANDI) are presented in Table 1.

Table 1

Descriptive Statistics for All Measures

<table>
<thead>
<tr>
<th></th>
<th>M</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>TAS-20</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Affective Alexithymic Traits</td>
<td>29.82</td>
<td>8.34</td>
</tr>
<tr>
<td>Cognitive Alexithymic Traits</td>
<td>13.90</td>
<td>3.19</td>
</tr>
<tr>
<td><strong>IRI</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Affective Empathy</td>
<td>30.93</td>
<td>7.20</td>
</tr>
<tr>
<td>Cognitive Empathy</td>
<td>34.33</td>
<td>7.90</td>
</tr>
<tr>
<td><strong>ERT</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anger</td>
<td>15.76</td>
<td>2.84</td>
</tr>
<tr>
<td>Fear</td>
<td>6.32</td>
<td>3.51</td>
</tr>
<tr>
<td>Sadness</td>
<td>8.61</td>
<td>3.45</td>
</tr>
<tr>
<td><strong>ANDI</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anger</td>
<td>0.27</td>
<td>0.28</td>
</tr>
<tr>
<td>Fear</td>
<td>0.15</td>
<td>0.20</td>
</tr>
<tr>
<td>Sadness</td>
<td>0.17</td>
<td>0.20</td>
</tr>
<tr>
<td><strong>DASS-21</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td>6.96</td>
<td>7.25</td>
</tr>
<tr>
<td>Anxiety</td>
<td>5.31</td>
<td>6.62</td>
</tr>
<tr>
<td>Stress</td>
<td>11.63</td>
<td>8.24</td>
</tr>
<tr>
<td><strong>RSES</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>7.90</td>
<td>1.30</td>
</tr>
</tbody>
</table>

Note. TAS-20 = Toronto Alexithymia Scale, IRI = Interpersonal Reactivity Index, ERT = Emotion Recognition Task, ANDI = ANDI Statistic (metacognitive ability), DASS-21 = Depression, Anxiety and Stress Scale, RSES = Rosenberg Self-Esteem Scale
Reliability Analyses

Internal reliability was acceptable-to-good for cognitive empathy \((\alpha = .79)\), affective empathy \((\alpha = .78)\), and affective alexithymic traits \((\alpha = .87)\). Cognitive alexithymic traits \((\alpha = .61)\) indicated questionable internal consistency reliability, however some authors suggest an alpha value over .60 is adequate (Butts & Michaels, 2006). Inspection of item reliability statistics revealed item deletion would not improve any of the four reliability values. Refer to appendix K for Cronbachs \(\alpha\) values of all self-report measures used in this study.

Moderated Mediation Analyses

Affective Models. All affective models demonstrated no significant direct, or indirect effects, after controlling for sex and anxiety. The model for anger is summarised in Figure 4, the model for fear is summarised in Figure 5, the model for sadness is summarised in Figure 6. A full write up of all the affective models is presented in Appendix L. A summary of all the affective and cognitive moderated mediation models is provided in Table 3, and a summary of the conditional indirect effects for all models is presented in Table 4.
The indirect effect: $a_1b_3$ pathway; $B = .02$, 95% BCI [-.20, .19].

Figure 4. The conditional indirect effect of affective alexithymic traits on affective empathy through emotion recognition ability for anger as a function of metacognitive ability. Both sex ($B = 7.33$, SE = 1.12, 95% CI [5.13, 9.55], $p < .001$) and anxiety ($B = .26$, SE = .09, 95% CI [0.07, 0.44], $p = .006$) significantly predicted cognitive empathy. Note. ER = Emotion Recognition. MC = Metacognitive Ability.
Indirect effect: $a_1b_3$ pathway; $B = .001$, 95%BCI [-.09, .10].

Figure 5. The conditional indirect effect of affective alexithymic traits, on affective empathy through emotion recognition ability for fear, as a function of metacognitive ability. Both sex ($B = 7.33$ SE = 1.11, 95%BCI [5.14, 9.52], $p < .001$) and anxiety ($B = .25$ SE = .09, 95%BCI [0.07, 0.43], $p = .008$) significantly predicted cognitive empathy. Note. ER = Emotion Recognition. MC = Metacognitive Ability.
Figure 5. The conditional indirect effect of affective alexithymic traits, on affective empathy through emotion recognition ability for sadness, as a function of metacognitive. Both sex (B = 6.72, SE = 1.10, 95%BCI [4.54, 8.90], p < .001) and anxiety (B = .24 SE = .09, 95%BCI [0.06, 0.42], p = .008) significantly predicted cognitive empathy. Note. ER = Emotion Recognition. MC = Metacognitive Ability.
Cognitive Models

Anger. Figure 7 shows the conditional indirect effect of cognitive alexithymic traits, on cognitive empathy through emotion recognition ability (anger), as a function of metacognitive ability. Both emotion recognition ability ($b_1$ pathway; $B = -.07, SE = .31, 95\%CI [-.68, .54], p = .821$) and metacognitive ability ($b_2$ pathway; $B = .95, SE = 15.98, 95\%CI [-30.71, 32.61], p = .953$) did not significantly predict cognitive empathy. No significant interaction effect of emotion recognition ability and metacognitive ability, on cognitive empathy was found ($b_3$ pathway; $B = .09, SE = .93, 95\%CI [-1.76, 1.94], p = .925$). Sex significantly predicted cognitive empathy ($B = 3.90, SE = 1.31, 95\%CI [1.30, 6.50], p = .004$). The direct effect of cognitive alexithymic traits on cognitive empathy was significant ($c’$ pathway; $B = -.98, SE = .20, 95\%CI [-1.38, -0.57], p < .001$). The hypothesised conditional indirect effect of cognitive alexithymic traits on cognitive empathy through emotion recognition ability, as a function of growth orientation was non-significant, $a_1b_3$ pathway; $B = -.00, SE = .08, 95\%CI [-.21, .14]$. Conditional indirect effects revealed that at high, mean and low levels of metacognitive ability, emotion recognition ability was not significantly related to cognitive empathy, as the bootstrapped 95\% confidence intervals all contained zero.
Figure 6. The conditional indirect effect of affective alexithymic traits on affective empathy through emotion recognition ability for anger, as a function of metacognitive ability. Note. ER = Emotion Recognition. MC = Metacognitive Ability.
Fear. Figure 8 shows the conditional indirect effect of cognitive alexithymic traits, on cognitive empathy through emotion recognition ability (fear), as a function of metacognitive ability. Both emotion recognition ability ($b_1$ pathway; $B = -0.11$, $SE = 0.22$, $95\% CI [-0.55, 0.34]$, $p = 0.638$) and metacognitive ability ($b_2$ pathway; $B = 3.71$, $SE = 4.90$, $95\% CI [-6.00, 13.41]$, $p = 0.451$) did not significantly predict cognitive empathy. No significant interaction effect of emotion recognition ability and metacognitive ability, on cognitive empathy was found ($b_3$ pathway; $B = 0.74$, $SE = 0.81$, $95\% CI [-0.86, 2.34]$, $p = 0.361$). Sex significantly predicted cognitive empathy ($B = 4.22$, $SE = 1.26$, $95\% CI [1.72, 6.73]$, $p = 0.001$). The direct effect of cognitive alexithymic traits on cognitive empathy was significant ($c'$ pathway; $B = -1.05$, $SE = 0.20$, $95\% CI [-1.45, -0.66]$, $p < 0.001$). The hypothesised conditional indirect effect of cognitive alexithymic traits on cognitive empathy through emotion recognition ability, as a function of metacognitive ability was non-significant, $a_1b_3$ pathway; $B = -0.18$, $SE = 0.27$, $95\% BCI [-0.74, 0.27]$. Conditional indirect effects revealed that at high, mean and low levels of metacognitive ability, emotion recognition ability was not significantly related to cognitive empathy, as the bootstrapped 95% confidence intervals all contained zero.
The relationship between alexithymia and empathy

Indirect effect: $a_1b_3$ pathway; $B = -.18$, 95% BCI [-.74, .27].

Figure 7. The conditional indirect effect of affective alexithymic traits on affective empathy through emotion recognition ability for fear, as a function of metacognitive ability. Note. ER = Emotion Recognition. MC = Metacognitive Ability.
Sadness. Figure 9 shows the conditional indirect effect of cognitive alexithymic traits, on cognitive empathy through emotion recognition ability (sad), as a function of metacognitive ability. Both emotion recognition ability (b₁ pathway; B = -.46, SE = .25, 95%CI [-.03, .95], p = .067) and metacognitive ability (b₂ pathway; B = 11.56, SE = 7.07, 95%CI [-2.46, 25.58], p = .105) did not significantly predict cognitive empathy. No significant interaction effect of emotion recognition ability and metacognitive ability, on cognitive empathy was found (b₃ pathway; B = -1.14, SE = .72, 95%CI [-2.57, .29], p = .116. Sex significantly predicted cognitive empathy (B = 3.50, SE = 1.30, 95%CI [.93, 6.07], p = .008). The direct effect of cognitive alexithymic traits on cognitive empathy was significant (c’ pathway; B = -.96, SE = .20, 95%CI [-1.36, -0.56], p < .001). The hypothesised conditional indirect effect of cognitive alexithymic traits on cognitive empathy through emotion recognition ability, as a function of growth orientation was significant, a₁b₃ pathway; B = .26, SE = .17, 95%BCI [.01, .72]. Conditional indirect effects revealed that at high, and mean levels of metacognitive ability, emotion recognition ability was not significantly related to cognitive empathy, as the bootstrapped 95% confidence intervals both contained zero. However, at low levels of metacognitive ability, emotion recognition ability was negatively and significantly related to cognitive empathy, as the bootstrapped 95% confidence intervals did not contain zero, B = -.10, 95%BCI [-.29, -.01]. This moderated mediation effect demonstrates that individuals with higher levels of cognitive alexithymic traits, have reduced emotion recognition ability (sadness), which in turn results in reduced cognitive empathy, but only for those with low levels of metacognitive ability.
Indirect effect: $a_1b_3$ pathway; $B = .26$, 95%BCI [.01, .72].

Figure 8. The conditional indirect effect of affective alexithymic traits on affective empathy through emotion recognition ability for sadness, as a function of metacognitive ability. Note. ER = Emotion Recognition. MC = Metacognitive Ability.
Table 2

Summary of the Six Moderated Mediation Models. Each Model Explored the Relationship Between Alexithymic Traits (Cognitive or Affective) and Empathy (Cognitive or Affective), Through Emotion Recognition Ability as a Function of Metacognitive Ability.

<table>
<thead>
<tr>
<th>Model</th>
<th>Direct Effect (c')</th>
<th>Indirect Effect – Index of Moderated Mediation (a'b^3)</th>
<th>Model Summary (Outcome – Empathy)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(B)</td>
<td>(SE)</td>
<td>95% CI</td>
</tr>
<tr>
<td>Affective-Anger</td>
<td>.09</td>
<td>.07</td>
<td>[.05, .24]</td>
</tr>
<tr>
<td>Affective-Fear</td>
<td>.08</td>
<td>.07</td>
<td>[.06, .22]</td>
</tr>
<tr>
<td>Affective-Sad</td>
<td>.10</td>
<td>.07</td>
<td>[.04, .24]</td>
</tr>
<tr>
<td>Cognitive-Anger</td>
<td>-1.98</td>
<td>.20</td>
<td>[-1.38, -.57]</td>
</tr>
<tr>
<td>Cognitive-Fear</td>
<td>-1.05</td>
<td>.20</td>
<td>[-1.45, -0.66]</td>
</tr>
<tr>
<td>Cognitive-Sad</td>
<td>-1.96</td>
<td>.20</td>
<td>[-1.36, .56]</td>
</tr>
</tbody>
</table>

Note: \(B\) = unstandardised beta, \(r\) = zero-order correlation, \(r^2\) = zero-order correlation squared, MSE = mean square error, SE = standard error.
Table 3

Summary of the Conditional Indirect Effects (M (±) SD) for all Six Moderated Mediation Models.

<table>
<thead>
<tr>
<th>Model</th>
<th>MC Value</th>
<th>B</th>
<th>SE</th>
<th>95% BCA CI</th>
<th>MC Value</th>
<th>B</th>
<th>SE</th>
<th>95% BCA CI</th>
<th>MC Value</th>
<th>B</th>
<th>SE</th>
<th>95% BCA CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affective-Anger</td>
<td>.000</td>
<td>-.00</td>
<td>.01</td>
<td>[.45, .01]</td>
<td>.272</td>
<td>.00</td>
<td>.01</td>
<td>[-.08, .04]</td>
<td>.552</td>
<td>.01</td>
<td>.02</td>
<td>[-.01, .08]</td>
</tr>
<tr>
<td>Affective-Fear</td>
<td>.000</td>
<td>-.00</td>
<td>.01</td>
<td>[-.02, .01]</td>
<td>.154</td>
<td>-.00</td>
<td>.01</td>
<td>[-.02, .01]</td>
<td>.363</td>
<td>-.00</td>
<td>.01</td>
<td>[-.03, .02]</td>
</tr>
<tr>
<td>Affective-Sad</td>
<td>.000</td>
<td>-.00</td>
<td>.02</td>
<td>[-.05, .03]</td>
<td>.165</td>
<td>-.00</td>
<td>.01</td>
<td>[-.04, .02]</td>
<td>.370</td>
<td>-.00</td>
<td>.01</td>
<td>[.03, .01]</td>
</tr>
<tr>
<td>Cognitive-Anger</td>
<td>.000</td>
<td>.00</td>
<td>.03</td>
<td>[-.43, .07]</td>
<td>.272</td>
<td>.00</td>
<td>.03</td>
<td>[-.04, .06]</td>
<td>.552</td>
<td>.00</td>
<td>.04</td>
<td>[-.07, .09]</td>
</tr>
<tr>
<td>Cognitive-Fear</td>
<td>.000</td>
<td>.03</td>
<td>.07</td>
<td>[-.08, .20]</td>
<td>.154</td>
<td>-.00</td>
<td>.06</td>
<td>[-.12, .11]</td>
<td>.363</td>
<td>.04</td>
<td>.09</td>
<td>[-.23, .10]</td>
</tr>
<tr>
<td>Cognitive-Sad</td>
<td>.000</td>
<td>-.10</td>
<td>.07</td>
<td>[-.29, -.01]</td>
<td>.165</td>
<td>-.06</td>
<td>.05</td>
<td>[-.20, .01]</td>
<td>.370</td>
<td>-.01</td>
<td>.05</td>
<td>[-.12, .08]</td>
</tr>
</tbody>
</table>

Note. Bootstrapped sample size = 10,000. SE B = Bootstrapped SE, B = unstandardised beta, 95% BCA CI = Bootstrapped Confidence Intervals. MC Value = Metacognition Value. One SD below the mean was replaced with the minimum because one SD below the mean is outside of the range of the data.
Discussion

The present study utilised conditional process analyses to explore the relationship between alexithymic traits and empathy, and factors which may underlie this relationship. The first aim of the present study was to add further support to the vast literature demonstrating a relationship between alexithymic traits and empathy, and their cognitive and affective dimensions. Secondly, in the absence of studies which have sought to determine factors underlying the relationship between alexithymic traits and empathy, the present study investigated whether emotion recognition and metacognitive ability would be mechanisms underlying the interplay between alexithymic traits and empathy. It was predicted that the relationship between alexithymic traits and empathy, would be partially mediated by emotion recognition, conditional of low levels of metacognitive ability.

The first hypothesis, that there would be a significant negative relationship between affective alexithymic traits and affective empathy, was not supported. No relationship between the ability to identify and describe feelings in one self, and the ability to feel emotions another person is feeling was detected in this study. This finding is inconsistent with previous findings by Guttman and Laporte (2002) and Grynberg et al. (2012) who showed significant negative relationships between the DIF and DDF sub scales of the TAS-20 (affective alexithymic traits) and the PD and EC sub scales of the IRI (affective empathy). The Self-to-Other Model of Empathy (2014) suggests that in individuals with alexithymic traits there is a disruption in the affective representation system, whereby they have difficulties interpreting and representing affective states in themselves. As a result, learning how to represent affective states of another is difficult, resulting in empathetic difficulties (Bird & Viding, 2014). In line with this model, the absence of significant effects may due to
the present studies non-clinical sample having low-to-moderate levels of alexithymic traits. Thus, there may not have been a significant disruption in the affective representation system, and the ability to be empathetic was not reduced, to the extent that was anticipated. Furthermore, given the sample may be considered ‘healthy’, it is possible compensatory mechanisms may have prevented this negative relationship from occurring. For example, a healthy individual may be aware that they have difficulties in identifying and describing feelings in one self, therefore they put more conscious effort into being empathetic towards another.

The second hypothesis that there will be a significant negative relationship between cognitive alexithymic traits and cognitive empathy was supported by all three cognitive models (anger, fear, sadness). For all models, where there was an increase in an externally oriented, practical, concrete style of thinking, there was a significant reduction in the ability to recognise and understand another’s emotional state. These findings further substantiate research demonstrating the EOT (cognitive) sub scale of the TAS-20 to be related to the PD and FS (cognitive) sub scales of the IRI (Grynberg, 2012; Guttman & Laporte, 2002). This specific finding is consistent with the shared networks model (2012), suggesting that as alexithymia and empathy share some of the same key neural regions (ACC, insula, striatum) a disruption in these areas is likely to affect both constructs. In relation to this notion, several studies have determined that both cognitive alexithymia and cognitive empathy are implicated by abnormal functioning in the insula cortex (Gu, Hof, Friston, & Fan, 2013). The insular cortex, particularly its most anterior portion, is involved in emotional experience in one’s self, in addition to the understanding of another’s emotional state (i.e., cognitive empathy; Singer, Critchely, Preuschoff, 2009). The
relationship between cognitive alexithymic traits and cognitive empathy in the present study may therefore be due to atypical activity within the insular cortex.

This study is the first to explore the impact of emotion recognition and metacognitive ability on the relationship between alexithymic traits and empathy. Real world interactions are dependent on the ability of an individual to recognise accuracies and inaccuracies, and to use this knowledge to inform the processes of recognising and interpreting emotions (Kelly & Metcalfe, 2011). Evaluating emotion recognition ability as well as metacognitive functioning together increases the ecological validity of the study, as it allows a more accurate representation of emotion recognition in everyday interactions (Honan, Skromanis, Johnson, & Palmer 2017). For example, if you perceive someone which seems isolated in a social environment, if you are aware that your ability to recognise their emotion is reduced, you may then look for other social and environmental cues which can provide insight into how they are feeling (e.g., you may realise an individual is sad as their car tire is flat). The ability to monitor and reflect on your emotion recognition performance has numerous implications. These include improving emotion recognition ability and compensating for difficulties, promoting learning, and ensuring flexibility in social interactions (Hudlika, 2005; Kelly & Metcalfe, 2011). Consequently, this can assist in the ability to respond appropriately in social interactions, thereby strengthening relationships with others (Kelly & Metcalfe, 2011).

In examining the mechanisms by which alexithymic traits might relate to empathy, moderated mediation effects were evident. The model for sadness when controlling for sex showed a significant moderated mediation effect. This demonstrated that an increase in an externally oriented, practical style of thinking, resulted in a reduction in the ability to recognise sadness, which in turn reduced the
ability to understand another’s emotional state, but only for those with low levels of metacognitive ability. As expected this effect was only demonstrated for low levels of metacognitive ability, not for mean or high levels. This indicates that if you have greater awareness of your emotion recognition performance, your emotion recognition ability would not have a significant impact on the relationship between cognitive alexithymic traits and cognitive empathy. This finding extends upon the research by Lyvers et al., (2018) which demonstrated that the negative relationship between the externally oriented thinking sub scale of the TAS-20 and cognitive empathy was partially mediated by impaired emotion recognition. This result also aligns with the suggestion by Demers and Koven (2015) that deficits in facial emotion recognition and cognitive empathy may reflect underlying deficits in metacognition associated with alexithymia. This was the first study to support this notion by demonstrating metacognitive functioning, through its impact on emotion recognition, to influence the relationship between cognitive alexithymic traits and cognitive empathy. No moderated mediation effects were displayed for the fear and anger models, however trending effects were evident. This finding may be due to the emotional state of sadness having more of an association with empathy (Eisenberg & Fabes, 1990), in comparison to anger and fear which are often related to threat (Berthoz et al., 2002). With a more clinical sample where the deficits are more pronounced, it is expected that effects for the anger and fear models may emerge.

For the affective models, when controlling for anxiety and sex no moderated mediation effects were present for any of the three models. These non-significant conditional indirect effects may be firstly due to the low-moderate levels of alexithymic traits within the sample, and also due to the healthy population which may have compensatory processes to inhibit this anticipated effect occurring. Prior
studies demonstrating a relationship between affective alexithymic traits and affective empathy used samples with an even distribution of alexithymia scores, containing participants with high or even clinical levels (> 61 on the TAS-20) of alexithymic traits (Kano et al., 2003; Moriguchi et al., 2007). Through revisiting the definition of metacognition, which is ability to think about and integrate one’s own mental experiences and those of others, this is more akin to cognitive than affective empathy (Lysaker, et al., 2013; Semerari et al., 2003). In addition, emotion recognition is suggested to be more of a cognitive, rather than affective process (Bonfils et al., 2017). Therefore, despite this preliminary investigation being of importance, it is possible that emotion recognition ability and metacognitive ability may not impact on the relationship between affective alexithymic traits and affective empathy. This encourages the exploration of other factors which may be impacting on this relationship.

Limitations and Future Directions

Future research needs to consider the role of sex as a possible moderating variable in the relationship between alexithymic traits and empathy. For both the affective and cognitive models, sex had a large relationship with empathy and it positively predicted empathy (both cognitive and affective) when apart of each model. It is frequently cited that females are more astute in a range of social-emotional functions than males (Hoffman, 1977), demonstrating greater functioning in abilities such as empathy, and theory of mind (Baron-Cohen, & Wheelwright, 2004). On the contrary, males have been shown to display higher levels of alexithymic traits than females in prior research (Parker, Taylor, & Bagby, 1993; Grynberg, Luminet, Corneille, Grezes, & Berthoz, 2010). This male bias for alexithymia is suggested to be due to socialisation processes which reinforce that
males should not openly exhibit feelings and suppress feelings of vulnerability and tenderness (Levant et al., 2006; Kerakais, & Levant, 2012). Due to these findings, the impact of sex differences needs to be examined in future research.

There are a few noteworthy considerations pertaining to the materials of the present study. Although the ERT is more ecologically valid than tasks using static images (Montagne, Kessels, Haan, Perret, 2007), it has various limitations. Several emotion researchers suggest that emotions consist of various elements such as body language, tone, and posture, which are dependent on the social and environmental context in which they occur (Averill, 1988; Parkinson, 1998; Christophe & Rimé, 1997). In addition, Fridlund (1994) suggests emotions evolve in response to selection pressures (external agents affecting an organisms ability to survive) within the environment, and others responsivity towards them influences this process. Therefore, the ERT may not provide an accurate representation of real world performance due to it not including additional emotional cues, social and environmental context, and due to the faces merging from neutral facial expressions. As such it would be beneficial for future research to utilise emotion recognition assessments which display real life interactions such as The Awareness of Social Inference Test - Emotion Perception subtest (TASIT; Honan, McDonald, Sufani, Hine, & Kumfor, 2016) or the Complex Audio-Visual Emotion Assessment Task (CAVEAT; Rosenberg, McDonald, Rosenberg, & Westbrook, 2016). These measures have both been demonstrated to be ecologically valid and highly reliable (McDonald, Flanagan, Martin, & Saunders, 2004; Vellante et al., 2013). In addition, although the TAS-20 is currently the gold-standard measurement for alexithymia, as the labelling and describing of emotions is difficult for individuals with alexithymic traits, the accuracy of self-report judgements has been questioned (Lane, Sechrest,
Reidel, Weldon, Kaszniak, & Scwartz, 1996). Therefore, future research would be of benefit to utilise observer-rated measures of alexithymic traits such as the Toronto Structured Interview for Alexithymia (TSIA; Bagby, Taylor, Parker, & Dickens, 2006) or the Observer Alexithymia Scale (Haviland, Warren & Riggs, 2000), in conjunction with the TAS-20. These measures may be useful in identifying individuals with high-severe levels of alexithymic traits.

As the current study was only preliminary in nature and was conducted in a non-clinical sample, future research needs to be conducted within a clinical sample in order to make inferences about the clinical implications of this study. Although the present findings are the first of its kind and could be a useful starting point for future clinical research, it is important to not generalise the results of the present study to clinical populations. Furthermore, as this study only examined the relationships between alexithymic traits and empathy in a cross-sectional design, causality cannot be inferred based on the results.

**Theoretical Implications**

There are several theoretical implications from the present study. Firstly, as a significant negative relationship between cognitive alexithymic traits and cognitive empathy was identified, this suggests that an individual’s thinking style may partially account for the empathy deficits seen in alexithymic individuals. When outlining the Self-to-Other Model of Empathy (2014) to explain the relationship between alexithymic traits and empathy, Bird and Viding (2014) focused primarily on the affective representation system, providing little indication to the extent that cognitive processes would impact on the ability to be empathetic. Taking the cognitive dimensions of alexithymia and empathy into account within the model may prove useful when applying it to future research. Of particular importance, and
interest in the present study was the finding that emotion recognition, conditional of low levels of metacognitive ability, mediated the relationship between cognitive alexithymic traits and cognitive empathy. This was only the second study to our knowledge to provide support for Bird and Viding (2014) suggestion that emotion recognition is likely to be an intermediary sequence in the Self-to-Other Model of Empathy (Bird & Viding, 2014). Upon further replication of these findings, incorporating emotion recognition into the Self-to-Other Model of Empathy (Bird & Viding, 2014) may prove useful in clarifying the complex relationship between alexithymic traits and empathy.

**Practical Implications**

Given this present research was conducted in a non-clinical sample, practical implications in terms of therapeutic interventions cannot be substantiated. However, they may suggest what is likely to occur in a clinical sample and thus may have important clinical implications. As previously mentioned, alexithymic traits are highly co-morbid with a wide range of clinical disorders such as schizophrenia, autism spectrum disorder, anxiety disorders, somatoform disorders, eating disorders, depressive disorders, personality disorders, substance use disorders, post-traumatic stress disorder, and sexual disorders (Cochrane et al., 1993; Duddu et al., 2003; Fukunishi et al., 1997; Michetti et al., 2006; Thorberg et al., 2009; Van’t Wout et al., 2007). As alexithymia is a trans-diagnostic precursor to empathy abnormalities, meaning across multiple disorders the effects of alexithymic traits on empathy are present (Bird et al., 2010), this emphasises the importance of targeted interventions.

Metacognitive therapy based on Wells and Matthews Information Processing Model (1996) has been shown to be effective in reducing symptomology of a wide range of clinical disorders. Vanhelue, Verhaege, and Desmet (2011) suggest that
from clinical observations and controlled studies the treatment of alexithymic traits and the associated emotional deficiencies are often difficult. Therefore, perhaps targeting metacognitive awareness of emotion recognition performance, may improve the empathy deficits seen in alexithymic individuals. Future research however is needed in a clinical population. This is of great importance as addressing the empathy deficits in alexithymic individuals may have a positive impact on social functioning and the quality of interpersonal relationships (Hofelich & Preston, 2012).

Summary and Conclusion

Alexithymic traits have been consistently demonstrated to be associated with difficulties in interpersonal relationships and social functioning. This has suggested to be due to the reduced levels of empathy seen in individuals with alexithymic traits, however factors underling this relationship are not at present understood. While this study found negative relationships between cognitive alexithymic traits and cognitive empathy, there was no such relationship between affective alexithymic traits and affective empathy. Of particular importance was the moderated mediation effect demonstrated for the cognitive model of sadness. Further studies in a clinical sample may generate highly important clinical implications for this effect. Targeting metacognitive awareness of emotion recognition performance may be a useful clinical intervention to help improve empathy deficits seen in those with alexithymic traits.
References


Fridlund, A. J. (1994). Evolution and facial action in reflex, social motive, and paralanguage. *Biological psychology, 32*(1), 3-100. doi: 10.1016/0301-0511(91)90003-Y


McDonald, S., Honan, C., Kelly, M., Byom, L., & Rushby, J. (2013). Disorders of social cognition and social behaviour following severe TBI. *Social and communication disorders following traumatic brain injury, 119*-159.


THE RELATIONSHIP BETWEEN ALEXITHYMIA AND EMPATHY


empathy, feelings and thermography. *Consciousness and cognition, 34*, 149-162. doi: 10.1016/j.concog.2015.04.003


Appendices

Appendix A: Toronto Alexithymia Scale

TAS-20

For each statement, please indicate how well it describes you by choosing the appropriate number on the scale at the top of the page: 1, 2, 3, 4, or 5. Please circle your answer to each statement. Answer as honestly as you can about how you are generally, there are no right or wrong answers.

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

The following statements inquire about your thoughts and feelings in a variety of situations. For each item, indicate how well it describes you by choosing the appropriate letter on the scale at the top of the page: A, B, C, D, or E. When you have decided on your answer, fill in the letter on the answer sheet next to the item number. READ EACH ITEM CAREFULLY BEFORE RESPONDING. Answer as honestly as you can. Thank you.

ANSWER SCALE:

A               B               C               D               E
DOES NOT DESCRIBES ME
DESCRIBE ME     VERY WELL
WELL

1. I daydream and fantasize, with some regularity, about things that might happen to me.

2. I often have tender, concerned feelings for people less fortunate than me.

3. I sometimes find it difficult to see things from the "other guy's" point of view.

4. Sometimes I don't feel very sorry for other people when they are having problems.

5. I really get involved with the feelings of the characters in a novel.

6. In emergency situations, I feel apprehensive and ill-at-ease.

7. I am usually objective when I watch a movie or play, and I don't often get completely caught up in it.

8. I try to look at everybody's side of a disagreement before I make a decision.

9. When I see someone being taken advantage of, I feel kind of protective towards them.

10. I sometimes feel helpless when I am in the middle of a very emotional situation.

11. I sometimes try to understand my friends better by imagining how things look from their perspective.

12. Becoming extremely involved in a good book or movie is somewhat rare for me.

13. When I see someone get hurt, I tend to remain calm.

14. Other people's misfortunes do not usually disturb me a great deal.
15. If I'm sure I'm right about something, I don't waste much time listening to other people's arguments.

16. After seeing a play or movie, I have felt as though I were one of the characters.

17. Being in a tense emotional situation scares me.

18. When I see someone being treated unfairly, I sometimes don't feel very much pity for them.

19. I am usually pretty effective in dealing with emergencies.

20. I am often quite touched by things that I see happen.

21. I believe that there are two sides to every question and try to look at them both.

22. I would describe myself as a pretty soft-hearted person.

23. When I watch a good movie, I can very easily put myself in the place of a leading character.

24. I tend to lose control during emergencies.

25. When I'm upset at someone, I usually try to "put myself in his shoes" for a while.

26. When I am reading an interesting story or novel, I imagine how I would feel if the events in the story were happening to me.

27. When I see someone who badly needs help in an emergency, I go to pieces.

28. Before criticizing somebody, I try to imagine how I would feel if I were in their place.
Appendix C: Emotion Recognition Task

3 Sample Items displaying the emotions of happiness, happiness, and disgust.

Participants select one of the following labels for each dynamically displayed image:

ANGRY
DISGUSTED
HAPPY
SAD
SURPRISED
FEARFUL
## Appendix D: Depression, Anxiety, Stress Scales – 21

Please read each statement and circle a number 0, 1, 2 or 3 which indicates how much the statement applied to you over the past week. There are no right or wrong answers. Do not spend too much time on any statement. The rating scale is as follows:

- 0 Did not apply to me at all
- 1 Applied to me to some degree, or some of the time
- 2 Applied to me to a considerable degree, or a good part of time
- 3 Applied to me very much, or most of the time

<table>
<thead>
<tr>
<th></th>
<th>Statement</th>
<th>0</th>
<th>1</th>
<th>2</th>
<th>3</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>I found it hard to wind down</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>I was aware of dryness of my mouth</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>I couldn't seem to experience any positive feeling at all</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>I experienced breathing difficulty (e.g., excessively rapid breathing,</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>breathlessness in the absence of physical exertion)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>I found it difficult to work up the initiative to do things</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>I tended to over-react to situations</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>I experienced trembling (e.g., in the hands)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>I felt that I was using a lot of nervous energy</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>I was worried about situations in which I might panic and make a fool</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>of myself</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>I felt that I had nothing to look forward to</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>I found myself getting agitated</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>I found it difficult to relax</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>I felt down-hearted and blue</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>I was intolerant of anything that kept me from getting on with</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>what I was doing</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>I felt I was close to panic</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>I was unable to become enthusiastic about anything</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>I felt I wasn't worth much as a person</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td>---</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>I felt that I was rather touchy</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>19</td>
<td>I was aware of the action of my heart in the absence of physical exertion (e.g., sense of heart rate increase, heart missing a beat)</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>20</td>
<td>I felt scared without any good reason</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>21</td>
<td>I felt that life was meaningless</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>
Appendix E: Rosenberg Self-Esteem Scale

Below is a list of statements dealing with your general feelings about yourself. Please indicate how strongly you agree or disagree with each statement.

1. On the whole, I am satisfied with myself.
   - Strongly Agree
   - Agree
   - Disagree
   - Strongly Disagree

2. At times I think I am no good at all.
   - Strongly Agree
   - Agree
   - Disagree
   - Strongly Disagree

3. I feel that I have a number of good qualities.
   - Strongly Agree
   - Agree
   - Disagree
   - Strongly Disagree

4. I am able to do things as well as most other people.
   - Strongly Agree
   - Agree
   - Disagree
   - Strongly Disagree

5. I feel I do not have much to be proud of.
   - Strongly Agree
   - Agree
   - Disagree
   - Strongly Disagree

6. I certainly feel useless at times.
   - Strongly Agree
   - Agree
   - Disagree
   - Strongly Disagree

7. I feel that I'm a person of worth, at least on an equal plane with others.
   - Strongly Agree
   - Agree
   - Disagree
   - Strongly Disagree

8. I wish I could have more respect for myself.
   - Strongly Agree
   - Agree
   - Disagree
   - Strongly Disagree

9. All in all, I am inclined to feel that I am a failure.
   - Strongly Agree
   - Agree
   - Disagree
   - Strongly Disagree

10. I take a positive attitude toward myself.
    - Strongly Agree
    - Agree
    - Disagree
    - Strongly Disagree
Appendix F: Ethics approval letter

Sent: Wed 21/03/2018 1:01 PM  
To: Cynthia Honan  
Cc: Bonnie Dell; Liam Spicer; Nikki Turner  
Subject: Ethics Amendment Approved: H0016480: An investigation of emotion recognition ability and metacognitive judgements of emotion recognition performance in trait narcissism

Dear Dr Honan,

Ethics Ref: H0016480  
Title: An investigation of emotion recognition ability and metacognitive judgements of emotion recognition performance in trait narcissism

This email is to confirm that the following amendment was approved by the Chair of the Tasmania Social Sciences Human Research Ethics Committee on 21/3/2018:

1. Personnel changes - remove Nikki Turner and add Liam Spicer and Bonnie Dell
2. Research Question - inclusion of an additional research question
3. Change in Methodology - relating to participant recruitment

All committees operating under the Human Research Ethics Committee (Tasmania) Network are registered and required to comply with the National Statement on Ethical Conduct in Human Research (NHMRC 2007, updated May 2015).

This email constitutes official approval. If your circumstances require a formal letter of amendment approval, please let us know.

Should you have any queries please do not hesitate to contact me.

Kind regards

Natasha Jones  
Admin Officer
Appendix G: Participant Recruitment Flyer

Research Volunteers Wanted: Personality, Emotion Perception and Perceptions of Ability
Are you aged between 18-65 years?

We are looking for volunteers to participate in a study investigating certain personality traits on emotion perception ability and perceptions of ability. As a participant, you will be asked to complete some brief baseline questionnaires, and undertake a computer-based emotion recognition task. The questionnaires and testing should take no longer than 45 minutes to complete.

To volunteer or for more information, please email: liam.spicer@utas.edu.au

Go into the draw to win one of three double movie vouchers
(KHA111/112 Students may receive 45 mins course credit)

This study has been approved by the Tasmanian Health and Medical Human Research Ethics Committee (#H0016480)
Appendix H: Information Sheet

Personality, Emotion Perception and Perceptions of Ability.

Information Sheet for Participants

Invitation

You are invited to participate in a research project examining the relationship between specific personality traits and emotion perception ability. This research is being conducted in partial fulfilment of an Honours degree in psychology for Liam Spicer and Bonnie Dell under the supervision of Dr. Cynthia Honan, a Lecturer and Clinical Neuropsychologist in the Discipline of Psychology, School of Medicine, University of Tasmania.

What is the purpose of this study?

The purpose of this study is to examine the relationship between personality and how emotions in other people are perceived. It is possible that the way we appraise the emotions of others is dependent on a person’s specific personality traits.

Why have I been invited to participate?

You have been invited to participate because you meet the following criteria:

- Are aged between 18 and 65 years of age.
- Have normal or corrected-to-normal vision.
- Are fluent in English.
- Are not pregnant.
- You have no history of traumatic brain injury or other neurological condition.
- You are able to spend approximately 20 minutes to complete questionnaires and a further 20 minutes to complete an emotion perception task.

What will I be asked to do?

You will be asked to complete some standard questionnaires which will ask you for basic demographic information, and information relating to current mood, personality traits and social functioning. You will also be asked to complete an emotion recognition task on the computer. You may complete the questionnaires up to 7 days prior to completing the emotion perception task. A mutually suitable appointment time will be arranged with you to complete the emotion perception task. It is expected that the questions and task together will take approximately 45 minutes to complete.

Are there any possible benefits from participation in this study?

Your participation will help us to understand the way in which personality traits may be related to the perception of emotions in others. This will allow us to identify whether specific personality groups exhibit specific social difficulties and will inform future research into the possible mechanisms that may underlie social difficulties.
University of Tasmania students who are undertaking the KHA111/KHA112 course will receive 45 minutes of course credit for their time. Participants who are not undertaking the KHA111/KHA112 course will go into the draw to win one of three double movie passes.

**Are there any possible risks from participation in this study?**

We do not expect there will be any risks associated with participation in this study. The data collected will be in no way identifiable to you.

**What if I change my mind during or after the study?**

Participation in this research project is voluntary and you are free to withdraw at any time. Participants who withdraw during the research process are free to do so with no explanation. Your withdrawal will not in any way affect your relationship with the researchers involved in this study or the School of Medicine. Should you withdraw from participating at any time, your data will be destroyed and will not included in the final study results.

**What will happen to the information when this study is over?**

The data from this study will be stored securely within the Discipline of Psychology, School of Medicine. Your data will also be stored anonymously using a unique ID code. Identifiable information such as your name and contact details will only be used for the purpose of arranging a testing session. Once your testing session has been arranged any identifying information will be destroyed. You will be provided with a unique ID code, which you will use to complete the questionnaires and testing session.

Data you provide in this research will be stored for a period of five years following the completion of the study. After this period, all data will be destroyed.

**How will the results of the study be published?**

The results will be published in Honours theses by Liam Spicer and Bonnie Dell. This will be available at the University of Tasmania library after the 3rd November 2018. A summary of the research results will also be available on the discipline of Psychology, University of Tasmania webpage (http://www.utas.edu.au/courses/study/psychology).

No participants will be identifiable in the publication of the results. Research results may be published in a peer-reviewed academic journal. Research results can also be obtained by contacting the researchers directly.

**What if I have questions about this study?**

If you have any questions regarding this research, please contact Liam Spicer or Bonnie Dell (liam.spicer@utas.edu.au). Alternatively, you can contact Dr Cynthia Honan on 03 6324 3266 or email cynthia.honan@utas.edu.au.

This study has been approved by the Tasmanian Social Sciences Human Research Ethics Committee. If you have concerns or complaints about the conduct of this
study, please contact the Executive Officer of the HREC (Tasmania) Network on +61 3 6226 6254 or email human.ethics@utas.edu.au. The Executive Officer is the person nominated to receive complaints from research participants. Please quote ethics reference number [H0016480].”

This information sheet is for you to keep. If you would like to participate in the research, please ask the researcher for a participant consent form to complete.

Thank you for taking the time to read this information sheet.
Appendix I: Participant Consent Form

Personality, Emotion Perception and Perceptions of Ability

Consent form for participants

1. I agree to take part in the research study named above.
2. I have read and understood the Information Sheet for this study.
3. The nature and possible effects of the study have been explained to me.
4. I understand that the study involves completing questionnaires to determine demographic information, current mood, empathy levels, personality traits, and social cognitive functioning. Participants will then be asked to complete an emotion recognition task on the computer.
5. I understand that participation involves no foreseeable risks to participants.
6. I understand that all research data will be securely stored on the Psychology Department, School of Medicine premises for five years from the publication of the study results, and will then be destroyed.
7. Any questions that I have asked have been answered to my satisfaction.
8. I understand that the researcher(s) will maintain confidentiality and that any information I supply to the researcher(s) will be used only for the purposes of the research.
9. I understand that the results of the study will be published so that I cannot be identified as a participant.
10. I understand that my participation is voluntary and that I may withdraw at any time without any effect.

If I so wish, I may request that any data I have supplied be withdrawn from the research during testing. I understand that I will not be able to withdraw my data after completing the testing session, as data will be anonymous.

Participant’s name:
_______________________________________________________

Participant’s signature:
_______________________________________________________

Date: ________________________
Statement by Investigator

I have explained the project and the implications of participation in this study to this volunteer, and I believe that the consent is informed and that he/she understands the implications of participation.

If the Investigator has not had an opportunity to talk to participants prior to them participating, the following must be ticked.

☐ The participant has received the information sheet where my details have been provided so participants have had the opportunity to contact me prior to consenting to participate in this project.

Investigator’s name:
_____________________________________________________

Investigator’s signature:
_____________________________________________________

Date: ____________________________
**Appendix J – Correlations of all variables**

<table>
<thead>
<tr>
<th></th>
<th>AffTAS</th>
<th>CogTAS</th>
<th>AffIRI</th>
<th>CogIRI</th>
<th>A_ERT</th>
<th>S_ERT</th>
<th>F_ERT</th>
<th>AAndi</th>
<th>Sandi</th>
<th>FAndi</th>
<th>Age</th>
<th>Sex</th>
<th>Depression</th>
<th>Anxiety</th>
<th>Stress</th>
<th>Self-Esteem</th>
</tr>
</thead>
<tbody>
<tr>
<td>AffTAS</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CogTAS</td>
<td>.365***</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AffIRI</td>
<td>.196*</td>
<td>-.190*</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CogIRI</td>
<td>-.080</td>
<td>-.456***</td>
<td>.562***</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>A_ERT</td>
<td>-.090</td>
<td>-.023</td>
<td>.015</td>
<td>.044</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S_ERT</td>
<td>-.020</td>
<td>-.199*</td>
<td>.250**</td>
<td>.237**</td>
<td>.275**</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F_ERT</td>
<td>-.009</td>
<td>-.226*</td>
<td>.120</td>
<td>.122</td>
<td>.233*</td>
<td>.408***</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AAndi</td>
<td>.052</td>
<td>-.213*</td>
<td>.130</td>
<td>.210*</td>
<td>.153</td>
<td>.074</td>
<td>.208*</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sandi</td>
<td>-.109</td>
<td>-.231*</td>
<td>.067</td>
<td>.178</td>
<td>.232*</td>
<td>.352***</td>
<td>.165</td>
<td>-.051</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FAndi</td>
<td>.110</td>
<td>.098</td>
<td>.062</td>
<td>.123</td>
<td>.000</td>
<td>-.063</td>
<td>-.092</td>
<td>.080</td>
<td>.214*</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age</td>
<td>-.248**</td>
<td>-.248**</td>
<td>.095</td>
<td>.048</td>
<td>-.010</td>
<td>.046</td>
<td>.029</td>
<td>.104</td>
<td>.100</td>
<td>-.016</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>.099</td>
<td>-.176</td>
<td>.522***</td>
<td>.327***</td>
<td>.163</td>
<td>.209*</td>
<td>.137</td>
<td>.171</td>
<td>.052</td>
<td>-.100</td>
<td>.007</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Depression</td>
<td>.469***</td>
<td>.027</td>
<td>.284*</td>
<td>.180*</td>
<td>-.103</td>
<td>.027</td>
<td>.124</td>
<td>.102</td>
<td>-.007</td>
<td>.058</td>
<td>-.005</td>
<td>.103</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Anxiety</td>
<td>.412***</td>
<td>.004</td>
<td>.316***</td>
<td>.203*</td>
<td>-.136</td>
<td>.082</td>
<td>.067</td>
<td>.112</td>
<td>-.038</td>
<td>.166</td>
<td>-.069</td>
<td>.073</td>
<td>.687***</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stress</td>
<td>.385***</td>
<td>.089</td>
<td>.306**</td>
<td>.165</td>
<td>-.079</td>
<td>.130</td>
<td>.044</td>
<td>-.007</td>
<td>-.035</td>
<td>.092</td>
<td>-.001</td>
<td>.154</td>
<td>.600***</td>
<td>.640***</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>Self Esteem</td>
<td>.134</td>
<td>.061</td>
<td>.037</td>
<td>-.147</td>
<td>.023</td>
<td>.045</td>
<td>.023</td>
<td>-.076</td>
<td>.008</td>
<td>-.033</td>
<td>.051</td>
<td>.165</td>
<td>.047</td>
<td>-.010</td>
<td>-.138</td>
<td>-</td>
</tr>
</tbody>
</table>

Note. AffTAS = Affective Alexithymia Traits, CogTAS = Cognitive Alexithymia Traits, AffIRI = Affective Empathy, CogIRI = Cognitive Empathy, A_ERT = Anger Emotion Recognition, S_ERT = Sadness Emotion Recognition, F_ERT = Fear Emotion Recognition, AAndi = Anger ANDI Statistic, Sandi = Sad ANDI Statistic, FAndi = Fear ANDI Statistic. *denotes p < .05, **denotes p < .01, ***denotes p < .001.
### Appendix K – Reliability of all Self-Report Measures

<table>
<thead>
<tr>
<th>Variable</th>
<th>Cronbach’s α</th>
</tr>
</thead>
<tbody>
<tr>
<td>Affective Alexithymic Traits</td>
<td>.87</td>
</tr>
<tr>
<td>Cognitive Alexithymic Traits</td>
<td>.61</td>
</tr>
<tr>
<td>Affective Empathy</td>
<td>.78</td>
</tr>
<tr>
<td>Cognitive Empathy</td>
<td>.79</td>
</tr>
<tr>
<td>Depression</td>
<td>.87</td>
</tr>
<tr>
<td>Anxiety</td>
<td>.83</td>
</tr>
<tr>
<td>Stress</td>
<td>.85</td>
</tr>
<tr>
<td>Self Esteem</td>
<td>.88</td>
</tr>
</tbody>
</table>
Appendix L: Write-up of Affective Moderated-Mediation Models

**Anger.** Both emotion recognition ability (b₁ pathway; B = .08, SE = .27, 95%CI [-.45, .63], p = .763) and metacognitive ability (b₂ pathway; B = 12.31, SE = 14.21, 95%CI [-15.85, 40.47], p = .388) did not significantly predict cognitive empathy. No significant interaction effect of emotion recognition ability and metacognitive ability, on cognitive empathy was found (b₃ pathway; B = -.70 SE = .83, 95%CI [-2.35, 0.94], p = .401. Both sex (B = 7.33, SE = 1.11, 95%CI [5.12, 9.55], p < .001) and anxiety (B = .25 SE = .09, 95%CI [0.07, 0.43], p = .006) significantly predicted cognitive empathy. The direct effect of cognitive alexithymic traits on cognitive empathy was non-significant (c’ pathway; B = .09, SE = .07, 95%CI [-0.05, 0.24], p = .203). The hypothesised conditional indirect effect of cognitive alexithymic traits on cognitive empathy through emotion recognition ability, as a function of growth orientation was non-significant, a₁b₃ pathway; B = .02, SE = .044, 95%BCI [-.20, .19]. Conditional indirect effects showed that at high, mean and low levels of metacognitive ability, emotion recognition ability was not significantly related to cognitive empathy, as the bootstrapped 95% confidence intervals all contained zero.

**Fear.** Both emotion recognition ability (b₁ pathway; B = .10, SE = .19, 95%CI [-.27, .49], p = .583) and metacognitive ability (b₂ pathway; B = 2.98, SE = 4.32, 95%CI [-5.58, 11.55], p = .492) did not significantly predict cognitive empathy. No significant interaction effect of emotion recognition ability and metacognitive ability, on cognitive empathy was found (b₃ pathway; B = -.12, SE = .71, 95%CI [-1.54, 1.28, p = .857. Both sex (B = 7.32, SE = 1.10, 95%CI [5.13, 9.51], p < .001) and anxiety (B = .24, SE = .09, 95%CI [0.06, 0.42], p = .008) significantly predicted cognitive empathy. The direct effect of cognitive alexithymic
traits on cognitive empathy was non-significant (c’ pathway; $B = .07$, $SE = .07$, 95%CI [-0.06, 0.22], $p = .271$). The hypothesised conditional indirect effect of cognitive alexithymic traits on cognitive empathy through emotion recognition ability, as a function of growth orientation was non-significant, $a_1b_3$ pathway; $B = .001$, $SE = .049$, 95%BCI [-.09, .10]. Conditional indirect effects showed that at high, mean and low levels of metacognitive ability, emotion recognition ability was not significantly related to cognitive empathy, as the bootstrapped 95% confidence intervals all contained zero.

**Sadness.** Emotion recognition ability was a significant positive predictor of cognitive empathy ($b_1$ pathway; $B = .43$, $SE = .21$, 95%CI [-.01, .86], $p = .042$). Metacognitive ability did not significantly predict cognitive empathy ($b_2$ pathway; $B = 7.75$, $SE = 6.10$, 95%CI [-4.33, 19.84], $p = .206$). No significant interaction effect of emotion recognition ability and metacognitive ability, on cognitive empathy was found ($b_3$ pathway; $B = -.81$, $SE = .62$, 95%CI [-2.05, 0.41], $p = .192$). Both sex ($B = 6.72$, $SE = 1.10$, 95%BCI [4.53, 8.90], $p < .001$) and anxiety ($B = .24$, $SE = .08$, 95%CI [0.06, 0.41], $p = .008$) significantly predicted cognitive empathy. The direct effect of cognitive alexithymic traits on cognitive empathy was non-significant ($c’$ pathway; $B = .09$, $SE = .07$, 95%CI [-0.04, 0.23], $p = .171$). The hypothesised conditional indirect effect of cognitive alexithymic traits on cognitive empathy through emotion recognition ability, as a function of growth orientation was non-significant, $a_1b_3$ pathway; $B = .007$, $SE = .048$, 95%BCI [-.05, .17]. Conditional indirect effects showed that at high, mean and low levels of metacognitive ability, emotion recognition ability was not significantly related to cognitive empathy, as the bootstrapped 95% confidence intervals all contained zero.