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Establishing the Theoretical Components of Alexithymia via Factor Analysis:

Introduction and Validation of the Attention-Appraisal Model of Alexithymia

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Abstract

Alexithymia is an important mental health construct, but there is continuing debate regarding its definition and measurement. We attempt to resolve this definitional uncertainty in two ways. Firstly, we trace the development of the alexithymia construct, focusing particularly on what we call the Toronto and Amsterdam models, and examine a body of empirical research that shows strong support for the hypothesis that alexithymia consists of three components (difficulty identifying feelings, difficulty describing feelings, and externally orientated thinking). Based on these components, we formulate an alternate theoretical model of alexithymia, the *attention-appraisal model of alexithymia*, that aligns alexithymia theory with recent advances in the broader emotion regulation field. Secondly, we examine the construct's latent structure by factor analysing data from multiple psychometric measures administered to a community sample ($N = 368$). Our results suggest statistical support for our model, rather than the Toronto or Amsterdam models. We end by discussing how our model accounts for several unresolved issues within the alexithymia field, including the construct's relation to imaginal capacities and emotional reactivity, whether alexithymia is a deficit or a defence, how it might be addressed in psychiatric treatment, and the discordance that has existed between alexithymia theory and alexithymia measurement.

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Psychoanalytic practitioners working with psychosomatic patients in the middle part

of the 20th century observed that they often presented with a cluster of emotion[7] processing

deficits. These patients were unable to "describe their feelings or to differentiate among

them" and displayed "an absence of the capacity to produce fantasies with the result that

[their] thought content [was] restricted to a preoccupation with external objects, people, and

environmental events" (Nemiah, 1984, p. 127). Sifneos and Nemiah first used the term

alexithymia (from the Greek, *a* = lack, *lexis* = word, *thymos* = feeling) to describe this

phenomenon (Nemiah & Sifneos, 1970; Sifneos, 1973).

Modern authors still use the term alexithymia to describe this cluster of emotion

processing deficits and it is widely considered to be a dimensional trait that is normally

distributed in the general population (e.g., Parker, Keefer, Taylor, & Bagby 2008).

Researchers have further confirmed that psychosomatic patients do typically present with

elevated levels of alexithymia (Duddu, Isaac, & Chaturvedi, 2003) and it is also regarded as

an important transdiagnostic risk factor for a range of psychopathologies, including,

depression (Honkalampi, Hintikka, Laukkanen, & Viinamaki, 2001), anxiety disorders

(Zeitlin & McNally, 1993), personality disorders (Berenbaum, 1996), eating disorders

(Taylor et al., 1996), and substance use (Thorberg et al., 2009). The alexithymia construct is,

thus, of substantial clinical interest. There is, however, continuing debate regarding its

definition, measurement, and theoretical underpinnings (Lane et al., 2015; Taylor et al., 2016;

Watters, Taylor, & Bagby, 2016).

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[7] Most authors (e.g., Gross, 2014; Lane & Schwartz, 1987) use the term *emotion* to refer to loosely coupled changes that arise across three channels of the emotion system: the subjective-experiential (e.g., feeling of fear), physiological (e.g., increased heart rate), and behavioural (e.g., urge to run) channels. This is the meaning we intend when using the term emotion throughout this paper.

In this paper, we attempt to resolve some of this definitional uncertainty in two ways. Firstly, we trace the development of the alexithymia construct, focusing particularly on what we will refer to as the Toronto and Amsterdam models, and examine a body of empirical research that shows strong support for the hypothesis that alexithymia consists of three components. Based on these components, we use Gross's (2015a) *extended process model of emotion regulation* to formulate an alternate theoretical model of alexithymia that we refer to as the *attention-appraisal model of alexithymia*. Secondly, we conduct a study whereby we factor analyse multiple psychometric measures in order to examine the latent structure of the alexithymia construct, and in so doing, test some important predictions of our model.

Developmental history and empirical research

The dominant contemporary work in developing the alexithymia construct has been done by two groups of researchers who we will refer to as the Toronto and Amsterdam groups. These two groups have proposed different definitions of alexithymia, and almost all contemporary researchers select between these definitions when describing the construct. Below, we outline each of these models and detail the results of empirical work that has tested their specifications.

Toronto model. The Toronto group (Taylor et al., 1999) developed a model of alexithymia building on the work of pioneers in the area (Marty & M'Uzan, 1963; Nemiah, 1977; Nemiah & Sifneos, 1970; Sifneos, 1973) who used psychoanalytic concepts to explain their observations. Marty and de M'Uzan (1963), for example, proposed that alexithymia was due to disturbance in the early child-mother relationship that disrupted childhood development of the ability to experience feelings or use fantasy as a means to satisfy instinctual drives. Proponents of this psychoanalytical approach, therefore, believed that people with high levels of alexithymia were prone to experiencing somatic symptoms because they were unable to use fantasy and psychic elaboration to regulate the energy of

their instinctual drives (see also, McDougall, 1974; Nemiah, 1977).

The Toronto group built on this psychoanalytic theorising by also applying cognitive theories of emotion processing (e.g., Bucci's [1997] *multiple code theory*, and Lane and Schwartz's [1987] *cognitive-developmental theory of levels of emotional awareness*) to the understanding of alexithymia, whilst still retaining the multidimensional structure of the construct originally described by Nemiah and Sifneos (1970). The Toronto model, therefore, specifies that alexithymia is comprised of four interrelated (positively correlated) components: difficulty identifying feelings in the self (DIF); difficulty describing feelings (DDF); an externally orientated thinking (EOT) style whereby one tends to focus excessively on the details of the external world rather than focusing attention on their internal states; and constricted imaginal processes (difficulty fantasising; DFAN), marked by the absence or scarcity of daydreams and fantasies. The Toronto model further specifies that the DIF and DDF components are closely linked to form a broader *affect awareness* component, and the EOT and DFAN components form a broader *operative thinking* component (see Figure 5.1) (Bagby et al., 2006; Taylor et al., 1999). This model is presently the most widely used definition of alexithymia within the literature (Watters, Taylor, Quilty, & Bagby, 2016).

The Toronto group developed two measures of alexithymia based on their model, the 20-item Toronto Alexithymia Scale (TAS-20; Bagby et al., 1994) and the Toronto Structured Interview for Alexithymia (TSIA; Bagby et al., 2006). The TSIA is an observer-rated measure with items designed to measure DIF, DDF, EOT and DFAN, and the TAS-20 is a self-report questionnaire with items designed to measure DIF, DDF and EOT. The earliest version of TAS-20, known as the TAS (Taylor et al., 1985), also included DFAN items, however the Toronto group removed the DFAN items in later revisions (Taylor Bagby, & Parker, 1992).

Empirical support. Subsequent empirical work using these measures has allowed for

the latent structure of the alexithymia construct to be tested. This work has supported much of the Toronto model. Examinations of the TAS-20's psychometric structure consistently find that scores on the DIF, DDF and EOT subscales correlate significantly and positively, and load on the same higher-order factor in factor analysis (e.g., Bagby et al., 1994; Gignac et al., 2007; Meganck et al., 2008). Similarly, to our knowledge, in all studies the DIF, DDF and EOT subscales of the TISA correlate positively (Bagby et al., 2006; Caretti et al., 2011; Grabe et al., 2009; Inslegers et al., 2013), suggesting that these components could be part of the same latent construct. The Toronto model's specification that DFAN is part of the same construct as DIF, DDF and EOT has, however, garnered less psychometric support.

To the best of our knowledge, all psychometric studies using the original TAS have found that the DFAN subscale is uncorrelated or negatively correlated with the DIF and DDF subscales (e.g., Taylor et al., 1985; Haviland, Hendryx, Cummings, Shaw, & MacMurray 1991); the Toronto group cite these results as a reason the DFAN subscale was removed from revisions of the measure (Taylor et al., 1992). Conversely, all studies using the TSIA have found that its DFAN subscale does correlate coherently (positively) with its DIF, DDF and EOT subscales (Bagby et al., 2006; Caretti et al., 2011; Grabe et al., 2009; Inslegers et al., 2013), however, cross-correlations with other alexithymia measures suggest that this may primarily be due to shared method variance (Podsakoff et al., 2003). Namely, of the five samples where correlations between the TSIA and TAS-20 have been examined (Bagby et al., 2006; Caretti et al., 2011; Grabe et al., 2009; Inslegers et al., 2013), in most (three) samples, the TSIA DFAN subscale did not correlate significantly with the TAS-20 total scale score (Bagby et al., 2006; Caretti et al., 2011), and in Caretti et al. (2011) the TSIA DFAN subscale was negatively correlated with the TAS-20 DIF subscale. Similarly, we know of one study (Rosenberg et al., 2016) that has compared the TSIA to the Bermond-Vorst Alexithymia Questionnaire (BVAQ; Vorst & Bermond, 2001), and in this case, the TSIA

DFAN subscale correlated strongly with the BVAQ DFAN subscale, but did not correlate with the BVAQ DIF, DDF or EOT subscales. Indeed, in the one study to conduct a network analysis of the TSIA, Watters, Taylor and Bagby (2016) found that the DFAN items did not fit well within the same network as the DIF, DDF and EOT items. Most experimental studies have documented similar findings. In most experimental work, people with high or low levels of alexithymia (grouped based on TAS-20 total scale scores) are found to not differ with respect to imaginal efficiency (Czernecka & Szymura, 2008) or the vividness of visual imagery (Bausch et al., 2011; Golena, 2014; Mantani, Okamoto, Shirao, Okada, & Yamawaki, 2005; but see Campos, Chiva, & Moreau, 2000; Friedlander, Lumley, Farchione, & Doyal, 1997). This collection of empirical findings has, consequently, led some authors to recently question the extent to which DFAN is a feature of alexithymia (e.g., Bausch et al., 2011; Morera, Culhane, Watson, & Skewes, 2005; Watters, Taylor, & Bagby, 2016; Watters, Taylor, Quilty, & Bagby, 2016).

        Amsterdam model. The Amsterdam group (Vorst & Bermond, 2001) propose an alternate definition of alexithymia. The Amsterdam group built on the four components of alexithymia delineated by the Toronto group (DIF, DDF, EOT, DFAN) and added a fifth component, reduced emotional reactivity (or difficulty emotionalising; DEMO). Vorst and Bermond (2001, p. 417) define emotional reactivity as "the degree to which someone is emotionally aroused by emotion inducing events", which is a narrower definition than is typically used within the emotional reactivity field (see Becerra & Campitelli, 2013), but raises the possibility that alexithymic people do not experience emotions (i.e., along the subjective-experiential channel of the emotion system) as intensely as other people. The Amsterdam group justify the inclusion of these five components within their definition of alexithymia based on their interpretation that they were described by Nemiah and Sifneos (1970). The Amsterdam group, further, organise these five components according to a

different higher-order structure, whereby they are subsumed within two broader components that are orthogonal to each other; *cognitive alexithymia*, composed of DIF, DDF and EOT, and *affective alexithymia*, composed of DFAN and DEMO (see Figure 5.1). Vorst and Bermond (2001) specify that there are subtypes of alexithymia; *type I alexithymia*, where people have difficulties in both cognitive alexithymia and affective alexithymia, and *type II alexithymia*, where people have difficulties only in cognitive alexithymia.

The Amsterdam group developed a self-report measure of alexithymia based on their model, the aforementioned BVAQ (Vorst & Bermond, 2001), which includes items designed to assess DIF, DDF, EOT, DFAN and DEMO. Bermond et al. (1999) originally specified that these five components should be positively correlated, thus, the separation of these components into an orthogonal structure seems, in our interpretation of their work, to be psychometrically driven.

Empirical support. Psychometric studies of the BVAQ have found that it conforms to this orthogonal structure in factor analyses. The DIF, DDF and EOT subscales load together onto a higher-order factor (cognitive alexithymia), and the DFAN and DEMO subscales load on a separate higher-order factor (affective alexithymia); these higher-order factors are largely uncorrelated (e.g., Bermond et al., 2007; Vorst & Bermond, 2001; Zech, Luminet, Rimé, & Wagner, 1999). Factor analytic work with the BVAQ has therefore been consistent with the Amsterdam model, and the body of TAS-20 work described earlier can also be seen as supportive of the cognitive alexithymia construct. Other empirical work has, however, been inconsistent with some specifications of the Amsterdam model.

We are aware of only one cluster analysis study that has examined whether the type I and type II alexithymia subtypes exist statistically, and in this case (using BVAQ data), no such subtypes were found (Bagby et al., 2009). Moreover, with respect to the inclusion of DEMO within the Amsterdam model, most empirical work not using the BVAQ DEMO

subscale to operationalise emotional reactivity has found that cognitive alexithymia is *not* orthogonal to emotional reactivity. Namely, most experimental studies have found that individuals with high DIF, DDF and EOT report feeling significantly *higher* levels of negative affect in response to stressful stimuli or laboratory tasks (e.g., Eastabrook et al., 2013; Connelly & Denney, 2007; Newton & Contrada, 1994; Pollatos et al., 2011; but see Luminet, Rimé, Bagby, & Taylor, 2004), and elevated levels of cognitive alexithymia are commonly present in clinical groups whose symptoms are characterised by hyper-reactivity within the emotion system (e.g., borderline personality disorder; New et al., 2012). Studies using psychometric measures of psychological distress or personality, similarly, find that cognitive alexithymia is associated with significantly higher levels of self-reported negative affect (e.g., Baily & Henry, 2007; Leising, Grande, & Faber, 2009; Li, Zhang, Guo, & Zhang, 2015; Lundh & Simonsson-Sarnecki, 2001; Morera et al., 2005) and neuroticism (a personality trait characterised by emotional instability and proneness to negative affect; e.g., Muller et al., 2004; Morera et al., 2005).

We think these inconsistencies between the BVAQ literature and other literature with respect to DEMO might be accounted for by the manner in which the BVAQ operationalises DEMO. Earlier, we noted that Vorst and Bermond's (2001) definition of emotional reactivity is narrower than that typically used in the emotional reactivity field. In that field, the construct is usually defined as the *ease of activation*, *intensity* and *duration* of one's emotional responses, and a distinction is further made between *negative reactivity* (reactivity with negative emotions) and *positive reactivity* (reactivity with positive emotions) (Becerra et al., 2017; Becerra & Campitelli, 2013; Davidson, 1998). Emotional reactivity researchers consider the distinction between negative reactivity and positive reactivity to be of particular import, as statistically they are separate dimensions that are negatively correlated with each other (Becerra et al., 2017). Vorst and Bermond (2001), however, do not make a distinction

between positive and negative reactivity in their definition, and this is reflected their BVAQ

DEMO subscale; four items refer to negative emotions, one refers to positive emotions, and

three do not specify a valence. In our view, not specifying valence in a DEMO item may be

problematic as the respondent must guess what type of emotion was meant, and the

combining of negative and positive valence items into a single score is not theoretically

supported due to the negative correlation between these reactivity dimensions (see Becerra et

al., 2017). In our view, three of the BVAQ DEMO items also appear to measure empathy

rather than emotional reactivity. These three items are specific to whether an emotion is

elicited by compassion or care for others (e.g., item 9 "When I see somebody crying

uncontrollably, I remain unmoved"), and are therefore inseparable from the personal distress

facet of empathy delineated by Davis (1983) in his popular model of empathy. Empathy, as a

construct, is negatively correlated with alexithymia (Grynberg, Luminet, Corneille, Grèzes, &

Berthoz., 2010), and most authors consider empathy and emotional reactivity to be separable

constructs (Becerra & Campitelli, 2013; Davidson, 1998). The BVAQ DEMO items have,

indeed, been found to be inconsistent in the direction of their correlations with other

constructs (Watters, Taylor, Quilty, & Bagby, 2016) and the subscale has displayed low

internal consistency in some samples (e.g., Muller et al., 2004). We, consequently, place

more weight in the findings of those studies that did not use the BVAQ DEMO subscale to

operationalise emotional reactivity, and most of these findings indicate that cognitive

alexithymia is not orthogonal to emotional reactivity.

Summary of empirical findings. The weight of the empirical literature, therefore,

appears to support most (but not all) specifications of the Toronto and Amsterdam models.

Both models agree that DIF, DDF and EOT are interrelated components of a common latent

construct, and on this point there is strong empirical support. The weight of the empirical

literature, however, suggests that some parts of these models may be misspecified, in that

DFAN and DEMO do not, statistically, appear to be part of this same

construct. **The attention-appraisal model of alexithymia**

The empirical findings summarised above suggest that the alexithymia construct

might be better defined as consisting of only DIF, DDF and EOT. To provide an empirically

credible framework for future research and explain why only these three components

statistically cohere, we hence propose a new theoretical model of alexithymia; the attention-

appraisal model of alexithymia. In formulating this model, we also use this opportunity to

incorporate recent advances in the broader emotion regulation field (Gross, 2015a) into

alexithymia theory, because we believe these advances might provide a useful theoretical

framework for conceptualising alexithymia. We specifically use Gross's (2015a) recently

introduced extended process model of emotion regulation as a framework for our model of

alexithymia, because many authors consider it to be at the forefront of emotion regulation

theory and it has been successfully applied to a multitude of emotional phenomena (e.g.,

Aldao & Christensen, 2015; Diaz & Eisenberg, 2015; Giuliani & Berkman, 2015; Kuppens &

Verduyn, 2015; Schmader & Mendes, 2015). Within this framework, we also seek to

integrate Lane and Schwartz's (1987) cognitive-developmental theory of levels of emotional

awareness. Lane and Schwartz's theory has been discussed and accepted previously by the

Toronto group (Taylor et al., 1999), but we think integrating it within Gross's (2015a) model

will provide some more clarity.

The core tenet of Gross's (2015a) extended process model of emotion regulation is

that people generate, process, and regulate emotions via valuation systems. All valuation

systems are comprised of a four stage *situation-attention-appraisal-response*[8] sequence,

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[8] In Gross's (2015a) extended process model of emotion regulation, these stages are actually labelled the *world-perception-valuation-action* stages, respectively. We, instead, use the original labels for these stages (i.e., the labels used in the earlier modal model of emotion [Gross, 1998] and process model of emotion regulation [Gross, 1998]) because we consider these alternate labels to be more intuitively descriptive for the purpose of conceptualising alexithymia.

whereby a stimulus is valuated (evaluated) in terms of its meaning for the individual. Emotions are considered to be generated via a valuation system where: an emotion inducing stimulus is present (situation stage; e.g., a snake is in the room), the individual focuses their attention on the stimulus (attention stage; e.g., looking at the snake), they appraise the stimulus in terms of what it is and what it means for their goals (appraisal stage; e.g., this snake in the room is bad for the goal of staying alive), and an emotional response results (response stage; e.g., fear). This emotional response can itself then become the focus of valuation, whereby it is valuated in terms of whether it is a desired state. Specifically, to valuate an emotional response (situation stage) the individual must focus attention on the emotion (attention stage), appraise the emotion in terms of what it is and what it means for their goals (appraisal stage), and they then might activate a goal to engage in action that reduces the discrepancy between the current state of the world and their desired state of the world (response stage; e.g., the feeling of fear is not a desired state so the individual runs away from the snake in an attempt to reduce the feeling). The response stage of this latter valuation system represents *emotion regulation* within Gross's (2015b, p. 130) model, defined as "the activation of a goal to modify an unfolding emotional response".

In the attention-appraisal model of alexithymia, we propose that it is within this same valuation system that alexithymia manifests. We posit that EOT can be conceptualised as difficulty at the *attention* stage of this valuation system. That is, an emotional response has occurred, but the individual has difficulty focusing their attention on it. Similarly, DIF and DDF can be conceptualised as difficulties at the *appraisal* stage of this valuation system. That is, an emotional response has occurred, but the individual has difficulty accurately appraising what the emotional response is and what it means. There is a subtle shift in emphasis here when describing EOT relative to early descriptions from psychoanalytic commentators (e.g., Nemiah, 1984); the pertinent point is not that the alexithymic individual

focuses excessively on external objects or events, but rather, from the reverse perspective, that they do not properly focus their attention on their emotions. Consequently, whilst we agree with the close clustering of DIF and DDF within the Toronto model, we propose *difficulty appraising* as a label for this grouping rather than *affect awareness*, because we think EOT also represents an affect awareness problem (one at the attention stage of emotion valuation). Alexithymia is, therefore, conceptualised as a closely clustered set of difficulties during the emotion valuation process described by Gross (2015a).

The degree of difficulty people experience at the attention and appraisal stages of emotion valuation, we believe, can be understood in terms of the levels of emotional awareness specified by Lane and Schwartz (1987). Based on Piaget's (1981) theory of cognitive development, Lane and Schwartz delineate five developmental levels (or stages); ranging from level one and two, where the individual can experience emotions only as global bodily sensations or diffuse unpleasant/pleasant states, to levels three, four and five, where the perception of discrete and specific emotions becomes possible and gradually more nuanced. Lane and Schwartz posit that people's level of emotional awareness depends on the degree of development in their *emotion schemas*, which Lane and Schwartz define as those cognitive structures that guide the processing of emotions. Based on interpersonal interactions, people's emotion schemas are thought to develop and become hierarchically organised, more complex, integrated, and differentiated. Experimental researchers have, indeed, since found evidence suggestive of impaired emotion schema functioning in people with high levels of alexithymia (e.g., Lane et al., 1996; Luminet, Vermeulen, Demaret, Taylor, & Bagby, 2006; Lundh, Johnsson, Sundqvist, & Olsson, 2002; Suslow & Junghanns, 2002; Vermeulen, Luminet, & Corneille, 2006).

We, therefore, follow Lane and Schwartz's (1987) theorising when positing in our model that difficulties at the attention and appraisal stages of emotion valuation can occur

due to what we call *ability deficit alexithymia*, that is, people's emotion schemas being underdeveloped (i.e., poorly organised, differentiated, and integrated). People's schemas guide the manner in which they attend to the world (e.g., Markus, 1977) and if their emotion schemas are underdeveloped, they may be *unable* to focus on the most pertinent aspects of the emotional response during the attention stage of emotion valuation. People also use their schemas during the appraisal stage, and if these emotion schemas are underdeveloped they may be *unable* to accurately, or with sufficient degrees of differentiation, interpret patterns of input information about the emotion to enable valuation at a specific (e.g., "I am feeling *embarrassed*" or "I am feeling *angry*"), rather than a broad or diffuse (e.g., "I am feeling *bad*"), level (Lane & Schwartz, 1987).

Ability deficit alexithymia by itself, however, fails to explain why some people's overall levels of alexithymia often increase during periods of distress (e.g., Luminet, Bagby, & Taylor, 2001; Luminet, Rokbani, Ogez, & Jadoulle, 2007), or recent findings that the association between alexithymia and psychiatric symptoms is sometimes mediated by experiential avoidance (e.g., Bilotta, Giacomantonio, Leone, Mancini, & Coriale, 2015; Panayiotou et al., 2015). Recent findings, thus, suggest that some difficulties at the attention and appraisal stages of emotion valuation may also be caused by what we call *avoidance alexithymia*. We hypothesise that avoidance alexithymia represents an avoidant emotion regulation strategy (attentional deployment; see Gross, 2014) whereby at the attention stage, people may *avoid* properly focusing their attention on the emotional response, and at the appraisal stage, people may *avoid* linking available input information about the stimulus (i.e., the emotion) to their emotion schemas. As we illustrate in Figure 5.2, in our model, avoidance alexithymia is activated at the response (i.e., emotion regulation) stage of a valuation system that is valuating an emotion, but the result of this avoidance response then ultimately manifests at the attention and appraisal stages of subsequent valuation systems;

that is, the avoidance behaviour that is activated as an emotion regulation strategy causes the individual to regress to operating at a lower developmental level at the attention and appraisal stages of subsequent emotion processing.

In sum, alexithymia is conceptualised as a set of difficulties during the attention (EOT) and appraisal (DIF, DDF) stages of emotion valuation. The overall extent of these difficulties is determined by the developmental level of people's emotion schemas (i.e., ability deficit alexithymia) and the degree to which they are using experiential avoidance of emotions as a regulation strategy (i.e., avoidance alexithymia).
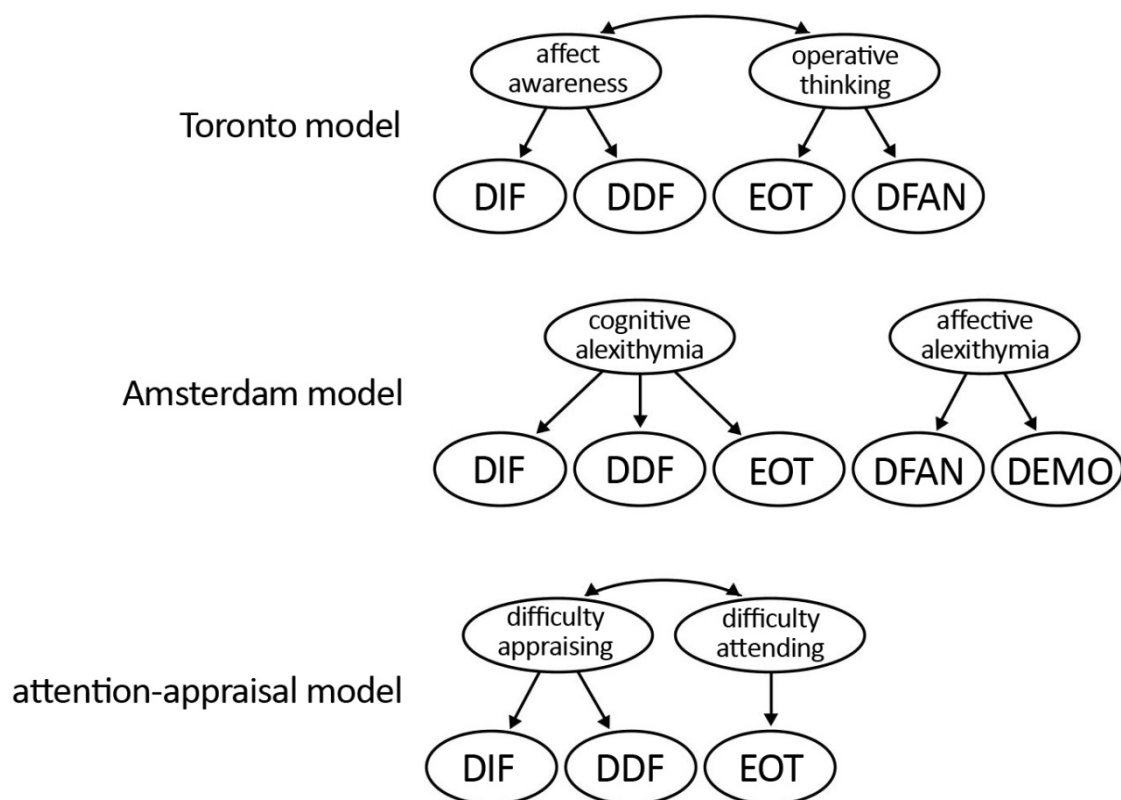
Figure 5.1. A visual representation of the different theoretical models that attempt to describe the structure of the alexithymia construct; the Toronto model, the Amsterdam model, and the attention-appraisal model. Double headed arrows indicate that the constructs are conceptualised as being positively correlated. DIF = difficulty identifying feelings, DDF = difficulty describing feelings, EOT = externally orientated thinking, DFAN = difficulty fantasising, DEMO = difficulty emotionalising (low emotional reactivity).

Figure 5.2. A visual representation of where, according to the attention-appraisal model of alexithymia, alexithymia manifests during the emotion valuation process. EOT = externally orientated thinking, DIF = difficulty identifying feelings, DDF = difficulty describing feelings. All valuation systems are comprised of four sequential stages; a *situation* (S), *attention* (At), *appraisal* (Ap) and *response* (R) stage (Gross, 1998, 2015a). Valuation system 1 represents an emotion being generated, whereby 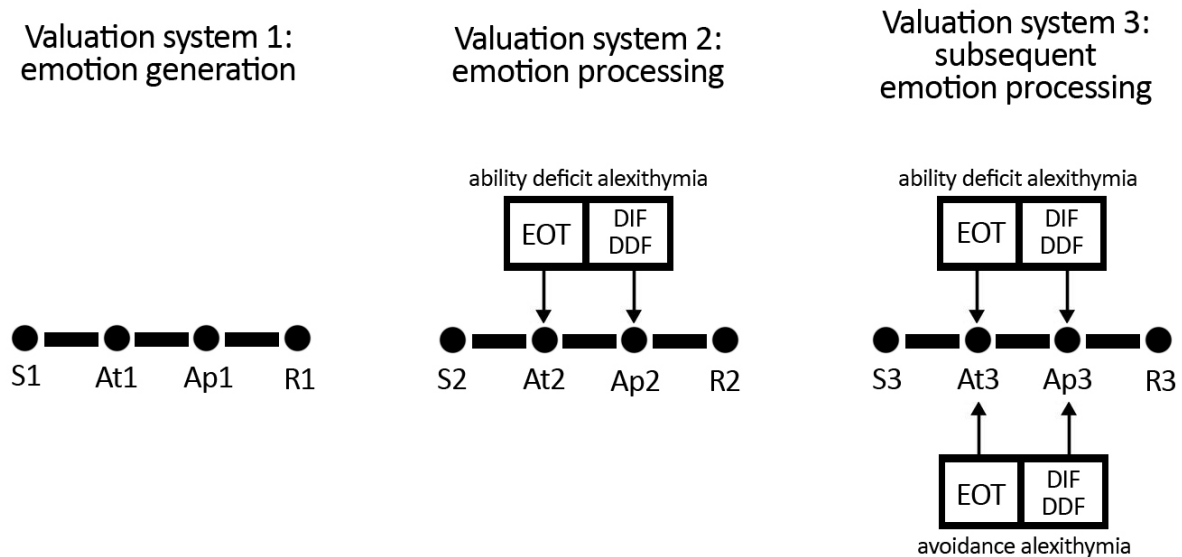an emotion inducing stimulus is present (S1), attention is focused on the stimulus (At1), the stimulus is appraised in terms of what it is and what it means for the individual's goals (Ap1), and an emotional response results (R1). In valuation system 2, this emotional response can itself become the stimulus that is the target of valuation (S2), whereby attention is focused on the emotion (At2), it is appraised in terms of what it is and whether it is a desired state (Ap2), and then a goal might be activated to modify the unfolding emotional response (R2, i.e., emotion regulation). Some degree of *ability deficit alexithymia* (whether that be a high or low amount of difficulties) is present in all valuation systems with an emotion at the S stage, and manifests as difficulties at the At (EOT) and Ap (DIF, DDF) stages. Such difficulties reflect the developmental level of one's emotion schemas. Valuation system 3 represents subsequent emotion processing, after valuation system 2 has finished. In valuation system 3, the individual might have additional difficulties at the At3 and Ap3 stages attributable to *avoidance alexithymia*. These additional difficulties will occur if, in the R2 stage of valuation system 2, the individual activated a goal to modify the emotion (i.e., an emotion regulation strategy) by using experiential avoidance; that is, attempting to avoid focusing attention on (EOT) or appraising (DIF, DDF) the emotional response in subsequent emotion processing.

Statistical comparison of the available models

The attention-appraisal model, Toronto model, and Amsterdam model all make testable and different predictions about the latent structure of the alexithymia construct. Whilst we consider the existing body of psychometric work to be consistent with the notion that alexithymia is comprised of three components, we also think that some further work is needed before a three component definition is accepted. Specifically, existing studies have factor analysed *single* measures in isolation, and as a result, whilst informative, their results are more vulnerable to being influenced by the intricacies of that specific test. In this study, we therefore seek to advance the literature base by administering *multiple* self-report measures of alexithymia and emotional reactivity, and using exploratory and confirmatory factor analyses to examine the latent structures common to all measures. Our research question being: is the latent structure of the alexithymia construct, when assessed via self-report measures, consistent with the attention-appraisal model, Toronto model, or Amsterdam model?

Method

Participants and procedure

Our data-set was comprised of 368 English speaking adults (209 females) from the general community. All participants were living in Australia at the time of the study, and their age ranged from 18 to 83 ($M = 49.56$, $SD = 16.67$). For 31.6% their highest level of completed education was high school, for 35.6% it was a technical diploma, and for 32.6% it was a university degree. Most of the sample (90.8%) were not currently studying at university. Participants were recruited via an online survey recruiting company (Qualtrics panels) or an advertisement placed on a social media website. Participants completed a battery of self-report questionnaires administered via an online anonymous survey. Some additional participants (recruited in the same manner) also completed the questionnaire

battery, but their data were excluded during screening because they failed at least one of three attention check questions and/or completed the survey impossibly quickly (suggesting inattentive responding).

Materials

Included in the questionnaire battery were four questionnaires designed to measure alexithymia or emotional reactivity. Internal reliability coefficients for all administered measures are displayed in Table 5.1.

Toronto Alexithymia Scale-20. The TAS-20 (Bagby et al., 1994) is a 20 item self-report measure of alexithymia. Items correspond to three subscales representing DIF (T-DIF subscale; 7 items, e.g., "I am often confused about what emotion I am feeling"), DDF (T-DDF subscale; 5 items, e.g., "It is difficult for me to find the right words for my feelings") and EOT (T-EOT subscale; 8 items, e.g., "Being in touch with emotions is essential" [reverse-scored]). These subscales are combined together into a TOTAL SCALE score representing overall levels of alexithymia. Because this total score only includes items assessing DIF, DDF and EOT, it is consistent with alexithymia as it is specified by the attention-appraisal model. Participants respond to each item on a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly Agree), with higher scores indicating greater levels of alexithymia. Research has supported the validity and reliability of most scores derived from the TAS-20, though the T-EOT subscale typically has low internal reliability (Kooiman et al., 2002; Meganck et al., 2008).

Bermond-Vorst Alexithymia Questionnaire. The BVAQ (Vorst & Bermond, 2001) is a 40 item self-report measure of alexithymia. Items are designed to measure DIF (D-IDENTIFYING subscale; 8 items, e.g., "When I am upset, I know whether I am afraid or sad or angry" [reverse-scored]), DDF (D-VERBALSING subscale; 8 items, e.g., "I find it difficult to express my feelings verbally"), EOT (D-ANALYSING subscale; 8 items, e.g., "I

hardly ever consider my feelings"), DFAN (D-FANTASISING subscale; 8 items, e.g., "I have few daydreams and fantasies"), and DEMO (D-EMOTIONALISING subscale; 8 items, e.g., "When friends around me argue violently, I become emotional" [reverse-scored]). Standard scoring involves calculating subscale scores for these five facets. The D-IDENTIFYING, D-VERBALISING and D-ANALYSING subscales are also combined together into a COGNITIVE ALEXITHYMIA score, and the D-FANTASISING and D-EMOTIONALISING subscales are combined together into an AFFECTIVE ALEXITHYMIA score. The COGNITIVE ALEXITHYMIA score is consistent with alexithymia as it is specified by the attention-appraisal model. Participants respond to each item on a 5-point scale ranging from 1 (this in no way applies) to 5 (this definitely applies). Higher scores indicate greater levels of alexithymia (for the D-EMOTIONALISING subscale, higher scores indicate lower levels of emotional reactivity). The validity and reliability of most scores derived from the BVAQ have been supported (Vorst & Bermond, 2001; Bermond et al., 2007), though as noted earlier, we have some concerns about the construct validity of the D-EMOTIONALISING subscale.

Difficulties in Emotion Regulation Scale. The Difficulties in Emotion Regulation Scale (DERS; Gratz & Roemer, 2004) is a 36 item self-report measure of emotion regulation and alexithymia. Two of its subscales conceptually correspond to the DIF and EOT facets of alexithymia. The CLARITY subscale (5 items, e.g., "I have no idea how I'm feeling") is a measure of DIF, and the AWARENESS subscale (6 items, e.g., "I pay attention to how I feel" [reverse-scored]) is a measure of EOT. The DERS also includes four other subscales that measure aspects of emotion regulation. Participants respond to each item on a 5-point scale ranging from 1 (almost never) to 5 (almost always), with higher scores indicating greater difficulties. For this study, we combined the CLARITY and AWARENESS subscales together to form an ALEXITHYMIA COMPOSITE score. This ALEXITHYMIA

COMPOSITE score is consistent with alexithymia as it is specified by the attention-appraisal model, though incomplete in that it does not include the DDF aspect of appraisal. The DERS subscales have demonstrated good validity and reliability (Gratz & Roemer, 2004).

Perth Emotional Reactivity Scale. The PERS (Becerra et al., 2017) is a 30 item self-report measure of emotional reactivity. It measures the typical *ease of activation*, *intensity*, and *duration* of one's emotional responses, and does so for negative and positive emotions separately. Six subscales can be derived from the PERS, each with 5 items: POSITIVE-ACTIVATION (e.g., "I tend to get happy very easily"), POSITIVE-INTENSITY (e.g., "When I am joyful, I tend to feel it very deeply"), POSITIVE-DURATION (e.g., "When I'm feeling positive, I can stay like that for a good part of the day"), NEGATIVE-ACTIVATION (e.g., "I tend to get upset very easily"), NEGATIVE-INTENSITY (e.g., "If I'm upset, I feel it more intensely than everyone else"), and NEGATIVE-DURATION (e.g., "Once in a negative mood, it's hard to snap out of it"). The three subscales within each valence domain can also be combined together into a GENERAL POSITIVE REACTIVITY scale score or GENERAL NEGATIVE REACTIVITY scale score, representing overall levels of reactivity for that valence. Items are answered on a 5-point Likert scale ranging from 1 (very unlike me) to 5 (very like me), with higher scores indicating higher levels of reactivity. The PERS has demonstrated good validity and reliability (Becerra et al., 2017).

Analytic strategy

Confirmatory factor analyses (CFAs) were conducted using AMOS 24, all other analyses were conducted using SPSS 24.

Pearson correlations and exploratory factor analysis. Pearson correlations between all administered scales/subscales were calculated; to control for type 1 error given the large number of correlations, a Bonferroni corrected alpha level of < .001 was used as the criteria for statistical significance. Subscale scores from the measures were used to perform an

exploratory factor analysis (EFA; principal axis factoring with direct oblimin rotation).

Confirmatory factor analyses. Subscale scores were also used in series of CFAs (maximum likelihood estimation based on a Pearson covariance matrix) to examine the goodness-of-fit of statistical models reflecting either the attention-appraisal model, Toronto model, or Amsterdam model. Goodness-of-fit was judged based on the pattern of factor loadings and intercorrelations within each model (Marsh et al., 2004), and three fit indices: the comparative fit index (CFI), the normed fit index (NFI), and the root mean square error of approximation (RMSEA). These three fit indices were chosen as they are considered to be among the best indicators of model fit (Byrne, 2013). CFI and NFI values around > .90 were judged to indicate acceptable fit, as were RMSEA values around < .08 and less than .10 (Bentler & Bonnet, 1980; Browne & Cudeck, 1992; Marsh et al., 2004). Models were also directly compared using the Akaike information criterion (AIC); lower AIC values indicate a better fitting model (Byrne, 2013). Factor loadings > .40 were considered meaningful loadings; this cut-off was selected because it has been endorsed by various authors (e.g., Matsunaga, 2010; Stevens, 1992) and is the most commonly used cut-off within psychometric literature (e.g., Bagby et al., 2006; Kooiman et al., 2002). When discussing the observed variables and latent factors within our CFA models, for sake of clarity, observed variables or indicators are written in capital letters and not surrounded by apostrophes (e.g., D-ANALYSING) and latent factors are surrounded by apostrophes (e.g., 'EOT').

All CFA models included five first-order factors: 'DIF', 'DDF', 'EOT', 'DFAN', and 'negative reactivity'. Each latent factor had three observed variables or indicators (subscales). As we administered only two subscales measuring 'DDF' and one subscale measuring 'DFAN', following the recommendations of Gorsuch (1983), to ensure that we had at least

three indicators for these factors we divided some subscales into parcels[9]. For 'DDF', we created two parcels of items from the BVAQ D-VERBALISING subscale; D-VERBALISING parcel 1 was composed of the first four items of this subscale, and parcel 2 was composed of the last four items. For 'DFAN', we created three parcels of items from the BVAQ D-FANTASISING subscale; D-FANTASISING parcel 1 was composed of the first three items from this subscale, parcel 2 from the middle three items, and parcel 3 from the last two items.

The five first-order factors in each model were composed of the following subscales as their indicators: 'DIF' (T-DIF, D-IDENTIFYING, and CLARITY), 'DDF' (T-DDF, D-VERBALISING parcel 1, and parcel 2), 'EOT' (T-EOT, D-ANALYSING, and AWARENESS), 'DFAN' (D-FANTASISING parcel 1, parcel 2, and parcel 3), 'negative reactivity' (NEGATIVE-ACTIVATION, NEGATIVE-INTENSITY, and NEGATIVE-DURATION)[10]. All indicators were reasonably normally distributed (maximum skewness = .84, maximum kurtosis = -.82). The tested models differed in their higher-order factor structure so as to reflect either the attention-appraisal model, the Toronto model, or the Amsterdam model (see Figure 5.3).

Model 1 was based on the attention-appraisal model. In Model 1, the 'DIF', 'DDF' and 'EOT' factors were specified to load on a higher-order 'alexithymia' factor, whilst the

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[9] The BVAQ D-VERBALISING subscale was selected for item parcelling because it had the most items of the DDF subscales, and the first and last 20 items of the BVAQ are often administered separately as parallel short versions (Zech et al., 1999). The items of those subscales selected for parcelling have demonstrated unidimensionality in various samples (e.g., Vorst & Bermond, 2001). In our sample, a single factor solution accounted for 50.96% of the variance in D-VERBALISING item scores, and 43.36% of the variance in D-FANTASISING item scores.

[10] Although Vorst and Bermond (2001) discuss DEMO as being a unidimensional construct in their theoretical model, more recent work has shown negative reactivity and positive reactivity to be separable dimensions (Becerra et al., 2017). For this reason, only negative reactivity was included within our CFA models. We chose to include negative reactivity rather than positive reactivity, because most of the BVAQ D-EMOTIONALISING items refer to negative emotions, hence we considered negative reactivity to be closer to how Vorst and Bermond (2001) conceptualised DEMO within their model. The BVAQ D-EMOTIONALISING subscale was not included as an indicator of negative reactivity in any of our CFA models, because of our theoretical concerns about this subscale's construct validity and its statistical performance in our EFA.

'DFAN' and 'negative reactivity' factors were allowed to correlate with this higher-order factor and with each other. Model 2a and Model 2b were based on the Toronto model. In Model 2a, the 'DIF', 'DDF', 'EOT' and 'DFAN' factors were specified to load on a higher-order 'alexithymia' factor, and the 'negative reactivity' factor was allowed to correlate with this higher-order factor. In Model 2b, the 'DIF' and 'DDF' factors were specified to load on a higher-order 'affect awareness' factor and the 'EOT' and 'DFAN' factors were specified to load on a higher-order 'operative thinking' factor, these higher-order factors were allowed to correlate with each other and the 'negative reactivity' factor. Model 3 was based on the Amsterdam model. In Model 3, the 'DIF', 'DDF' and 'EOT' factors were specified to load on a higher-order 'cognitive alexithymia' factor, and the 'DFAN' and 'negative reactivity' factors were specified to load on a higher-order 'affective alexithymia' factor, these higher-order factors were allowed to correlate. As a comparative baseline, we also tested the fit of a five-factor correlated model with no higher-order structure imposed (Model 4).
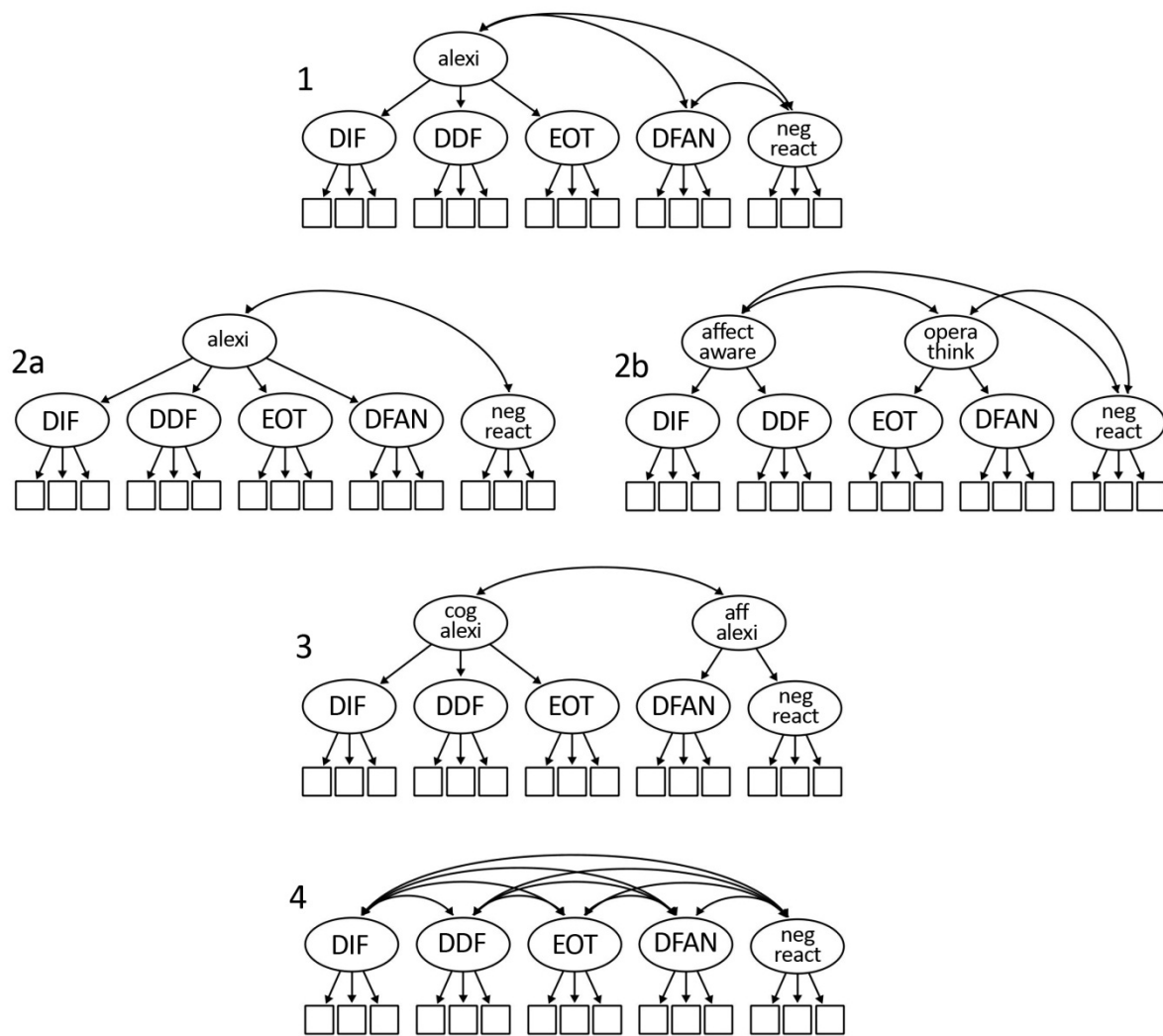
Figure 5.3. A visual representation of the tested CFA models, designed to represent either the attention-appraisal model (Model 1), Toronto model (Model 2a and Model 2b), Amsterdam model (Model 3), or a correlated model used as a comparative baseline (Model 4). Squares indicate observed variables/indicators, ellipses indicate latent variables. Each observed variable had an error term (not displayed). DIF = difficulty identifying feelings, DDF = difficulty describing feelings, EOT = externally orientated thinking, DFAN = difficulty fantasising, neg react = negative reactivity, alexi = alexithymia, affect aware = affect awareness, opera think = operative thinking, cog alexi = cognitive alexithymia, aff alexi = affective alexithymia. Latent variables were comprised of the following subscales (from the TAS-20, BVAQ, DERS, and PERS) as their observed variables: 'DIF' = T-DIF, D-IDENTIFYING, CLARITY; 'DDF' = T-DDF, D-VERBALISING parcel 1, and parcel 2; 'EOT' = T-EOT, D-ANALYSING, AWARENESS; 'DFAN' = D-FANTASISING parcel 1, parcel 2, and parcel 3; 'negative reactivity' = NEGATIVE-ACTIVATION, NEGATIVE-INTENSITY, NEGATIVE-DURATION.

Results

Pearson correlations and exploratory factor analysis

Descriptive statistics for the sample are presented in Table 5.1. All DIF, DDF and EOT subscales were significantly positively correlated (rs = .30 to .63). The BVAQ D-FANTASISING subscale, however, was uncorrelated or weakly negatively correlated with the DIF subscales (rs = -.18 to -.02), uncorrelated with the DDF subscales (rs = -.13 to -.03), and uncorrelated or weakly positively correlated with the EOT subscales (rs = .09 to .21). The BVAQ D-FANTASISING subscale was also uncorrelated with all cognitive alexithymia total scale scores (TAS-20 TOTAL SCALE, DERS ALEXITHYMIA COMPOSITE, BVAQ COGNITIVE ALEXITHYMIA; rs = -.06 to .08). When emotional reactivity was measured via the PERS, all cognitive alexithymia total scale scores were significantly associated with higher levels of negative reactivity (rs = .27 to .43) and lower levels of positive reactivity (rs = -.29 to -.35). Conversely, the BVAQ D-EMOTIONALISING subscale was uncorrelated with most cognitive alexithymia total scale scores (rs = .00 to .23). A Table containing all Pearson correlations is provided in Appendix C.

Our EFA resulted in a four factor solution (eigenvalues > 1), accounting for 71.97% of the variance (see Table 5.2). Factor 1, which we name 'difficulty appraising feelings', was comprised of all the DIF and DDF subscales. Factor 2, which we name 'negative reactivity', was comprised of all the PERS negative reactivity subscales. Factor 3, which we name 'positive reactivity', was comprised of all the PERS positive reactivity subscales. Factor 4, which we name 'difficulty attending to feelings', was comprised of all the EOT subscales.

The BVAQ D-FANTASISING and D-EMOTIONALISING subscales did not load substantially on any of the extracted factors. These two subscales loaded mostly on the 'difficulty attending to feelings' factor, but the size of their loading (< .40) was not large enough for it to be considered that this factor accounted for a meaningful amount of variance

in these subscale scores (Stevens, 1992). Of import, the BVAQ D-EMOTIONALISING

subscale did not load substantially on either of the PERS emotional reactivity factors,

suggesting that the BVAQ D-EMOTIONALISING subscale was not measuring the same

construct as the PERS. Thus, in our EFA, DFAN and DEMO were not part of the same latent

structure as DIF, DDF or EOT, nor was DFAN part of the same latent structure as negative or

positive reactivity.

Table 5.1

Descriptive Statistics and Cronbach's Alpha (α) Internal Reliability

Coefficients for the Administered Measures

Scale/subscale	*M*	*SD*	*α*
TAS-20			
Total scale	48.12	12.29	.87
T-DIF	14.98	6.11	.87
T-DDF	13.00	4.80	.83
T-EOT	20.14	4.47	.59
BVAQ			
Cognitive alexithymia	61.18	14.20	.88
Affective alexithymia	42.46	9.00	.76
D-Identifying	18.66	5.19	.75
D-Verbalising	23.57	7.12	.86
D-Analysing	18.94	5.39	.77
D-Fantasising	21.17	6.34	.79
D-Emotionalising	21.29	5.31	.71
DERS			
Alexithymia composite	25.77	7.59	.86
Awareness	15.71	5.34	.84
Clarity	10.07	3.69	.82
PERS			
General positive reactivity	51.98	8.93	.92
Positive-activation	17.41	3.65	.77
Positive-intensity	15.65	3.03	.84
Positive-duration	18.92	3.64	.83
General negative reactivity	43.98	13.23	.94
Negative-activation	14.37	4.81	.86
Negative-intensity	15.47	4.58	.86
Negative-duration	14.13	4.93	.88

Note. TAS-20 = Toronto Alexithymia Scale-20, BVAQ = Bermond-Vorst
Alexithymia Questionnaire, DERS = Difficulties in Emotion Regulation
Scale, PERS = Perth Emotional Reactivity Scale.

Table 5.2

Factor loadings from an exploratory factor analysis of the subscales of the TAS-20,

BVAQ, DERS and PERS

Subscale	Factor 1 'difficulty appraising feelings'	Factor 2 'negative reactivity'	Factor 3 'positive reactivity'	Factor 4 'difficulty attending to feelings'
BVAQ				
D-Identifying	**.616**	.171	-.034	.148
D-Verbalising	**.686**	-.113	-.109	.114
D-Analysing	.209	.166	.032	**.866**
D-Fantasising	-.199	-.103	-.033	.362
D-Emotionalising	-.076	-.232	-.305	.372
TAS-20				
T-DIF	**.640**	.270	.030	-.071
T-DDF	**.930**	-.139	-.031	-.044
T-EOT	.336	.083	.060	**.572**
DERS				
Clarity	**.749**	.130	-.016	.009
Awareness	**.417**	-.013	-.078	**.522**
PERS				
Positive-activation	-.059	-.141	**.882**	.073
Positive-intensity	.011	.136	**.721**	-.005
Positive-duration	-.118	-.352	**.720**	-.003
Negative-activation	.007	**.874**	-.029	.080
Negative-intensity	-.060	**.895**	-.025	-.075
Negative-duration	.033	**.872**	-.070	.020

Note. Factor loadings $\geq$ .40 are in boldface. Intercorrelations between the extracted factors were as follows; F1 and F2 = .46; F1 and F3 = -.20; F1 and F4 = .27; F2 and F3 = -.05; F2 and F4 = -.19; F3 and F4 = -.29. TAS-20 = Toronto Alexithymia Scale-20, BVAQ = Bermond-Vorst Alexithymia Questionnaire, DERS = Difficulties in Emotion Regulation Scale, PERS = Perth Emotional Reactivity Scale.

Confirmatory factor analyses

Of the theoretically informed CFA models, Model 1 based on the attention-appraisal model appeared to be the best fit to the data (for fit index values, factor loadings, and estimated factor intercorrelations for each model, see Tables 5.3, 5.4 and 5.5, respectively). In Model 1, the latent 'DIF', 'DDF' and 'EOT' factors all loaded strongly (factor loadings = .727-.853) on the higher-order 'alexithymia' factor, indicating that these three first-order

factors could be components of a common higher-order construct. Models based on the Toronto model exhibited poorer levels of fit. The main source of misspecification appeared to be the latent 'DFAN' factor. In Model 2a, the 'DFAN' factor loaded poorly and non-significantly (factor loading = -.102) on the higher-order 'alexithymia' factor, and in Model 2b, the 'EOT' factor loaded poorly (factor loading = .256) with the 'DFAN' factor on the higher-order 'operative thinking' factor. Thus, the 'DFAN' factor did not appear to be part of the same latent structure as 'DIF', 'DDF' or 'EOT'. Model 3, based on the Amsterdam model, similarly exhibited poorer levels of fit. The higher-order 'affective alexithymia' factor (representing difficulties fantasising and low negative reactivity) in this model was strongly negatively correlated with the higher-order 'cognitive alexithymia' factor (estimated r = -.527); thus, these two higher-order factors were *not* orthogonal or positively correlated. Indeed, an inspection of the factor intercorrelations within the correlated baseline model (Model 4) revealed that the 'negative reactivity' factor was significantly positively associated with 'DIF', 'DDF' and 'EOT', and generally correlated more so with these cognitive alexithymia components than it did with 'DFAN'. In other words, across our CFAs, cognitive alexithymia was associated with higher levels of negative reactivity, not less.

Table 5.3

Goodness-of-Fit Index Values for the Examined CFA Models

Model	χ^2 (*df*)	*p*	CFI	NFI	RMSEA (90% CI)	AIC
Attention-appraisal model						
Model 1	445.196 (85)	.000	.896	.875	.107 (.098-.117)	515.196
Model 1 (correlated error)	307.819 (79)	.000	.934	.914	.089 (.079-.099)	389.819
Toronto model						
Model 2a	458.382 (85)	.000	.892	.872	.109 (.100-.119)	528.382
Model 2a (correlated error)	330.777 (79)	.000	.927	.907	.093 (.083-.104)	412.777
Model 2b	579.531 (85)	.000	.857	.838	.126 (.116-.136)	649.531
Model 2b (correlated error)	448.075 (79)	.000	.894	.875	.113 (.098-123)	530.075
Amsterdam model						
Model 3	476.085 (86)	.000	.887	.867	.111 (.102-.121)	544.085
Model 3 (correlated error)	310.652 (80)	.000	.933	.913	.089 (.078-.099)	390.652
Baseline correlated model						
Model 4	357.153 (80)	.000	.920	.900	.097 (.087-.108)	437.153
Model 4 (correlated error)	227.055 (74)	.000	.956	.936	.075 (.064-.086)	319.055

Note. Models labelled with 'correlated error' included minor model modifications whereby some indicator error terms were allowed to correlate. These modifications were added because modification indices indicated that, across all the examined models, some error terms were substantially correlated; these error terms were between those indicators/subscales that came from the same measure (e.g., the TAS-20) and thus appeared to represent some common method variance. On these grounds, we considered these modifications to be theoretically justifiable (Podsakoff et al., 2003). The error terms of the following indicators were allowed to correlate: T-DIF and T-DDF; D-VERBALISING parcel 1 and D-VERBALISING parcel 2; D-VERBALISING parcel 2 and D-ANALYSING; D-ANALYSING and D-FANTASISING parcel 1; D-ANALYSING and D-FANTASISING parcel 3; D-FANTASISING parcel 2 and D-FANTASISING parcel 3. CFI = comparative fit index, NFI = normed fit index, RMSEA = root mean square error of approximation, AIC = Akaike information criterion, CI = confidence interval.

Table 5.4

Standardised Factor Loadings for the Indicators and Latent Factors in CFA Models Based on the

Attention-Appraisal Model, Toronto Model, and Amsterdam Model

Observed variables and latent factors	Attention-appraisal model	Toronto model		Amsterdam model
	Model 1	Model 2a	Model 2b	Model 3
	Alexithymia[a]	Alexithymia[a]	Affect awareness[a]	Cognitive alexithymia[a]
'DIF' factor	.853[b]	.953[b]	.919[b]	.861[b]
T-DIF	.767	.774	.788	.771
D-Identifying	.815	.823	.777	.816
Clarity	.862	.862	.860	.867
	Alexithymia[a]	Alexithymia[a]	Affect awareness[a]	Cognitive alexithymia[a]
'DDF' factor	.823[b]	.734[b]	.774[b]	.831[b]
T-DDF	.876	.871	.899	.881
D-Verbalising parcel 1	.855	.855	.855	.855
D-Verbalising parcel 2	.856	.850	.847	.854
	Alexithymia[a]	Alexithymia[a]	Operative thinking[a]	Cognitive alexithymia[a]
'EOT' factor	.727[b]	.659[b]	**.256**[b]	.720[b]
T-EOT	.751	.750	.741	.752
D-Analysing	.846	.847	.877	.846
Awareness	.808	.809	.783	.812
	-	Alexithymia[a]	Operative thinking[a]	Affective alexithymia[a]
'DFAN' factor	-	**-.102***[b]	.860[b]	.545[b]
D-Fantasising parcel 1	.594	.587	.596	.708
D-Fantasising parcel 2	.857	.846	.852	.848
D-Fantasising parcel 3	.778	.793	.782	.802
	-	-	-	Affective alexithymia[a]
'Negative reactivity' factor	-	-	-	-.802[b]
Negative-activation	.870	.874	.870	.875
Negative-intensity	.885	.881	.884	.895
Negative-duration	.892	.892	.883	.896

Note. *p > .05. [a]Label of higher-order factor. [b]Factor loading of first-order factor on higher-order factor.
Factor loadings <.40 are in boldface.

Table 5.5

Estimated Factor Intercorrelations for CFA Models Based on the Attention-Appraisal Model, Toronto Model, and Amsterdam Model

	Factor			
Model/factor	F1	F2	F3	F4
Attention-appraisal model				
Model 1				
F1 'alexithymia'	-	-	-	-
F2 'DFAN'	-.029	-	-	-
F3 'negative reactivity'	.449***	-.251***	-	-
Toronto model				
Model 2a				
F1 'alexithymia'	-	-	-	-
F2 'negative reactivity'	.513***	-	-	-
Model 2b				
F1 'affect awareness'	-	-	-	-
F2 'operative thinking'	-.052	-	-	-
F3 'negative reactivity'	.551***	-.261***	-	-
Amsterdam model				
Model 3				
F1 'cognitive alexithymia'	-	-	-	-
F2 'affective alexithymia'	-.527***	-	-	-
Baseline correlated model				
Model 4				
F1 'DIF'	-	-	-	-
F2 'DDF'	.667***	-	-	-
F3 'EOT'	.609***	.648***	-	-
F4 'DFAN'	-.146*	-.045	.216**	-
F5 'negative reactivity'	.558***	.290*	.141*	.253***

Note. $p < .001***, p < .01**, p < .05*.$

Discussion

One purpose of this study was to explore the latent structure of alexithymia. In our sample, we found that DIF, DDF and EOT formed a coherent latent structure, DFAN and

DEMO were not part of this same latent structure, and alexithymia was associated with higher (not lower) levels of negative reactivity. Our results were, therefore, consistent with the view that the alexithymia construct is comprised of only three components; DIF, DDF and EOT.

This pattern of findings has now emerged across multiple samples and assessment modalities (e.g., Bausch et al., 2011; Taylor et al., 1985; Vorst & Bermond, 2001; Watters, Taylor, & Bagby, 2016; Watters, Taylor, Quilty, & Bagby, 2016), and as such, we think the current body of evidence is, on balance, sufficient to warrant a refinement to the definition of alexithymia; refined to a construct comprised of only DIF, DDF and EOT. This pattern of findings is consistent with the structure specified by our attention-appraisal model of alexithymia, rather than that of the Toronto or Amsterdam models. Consequently, by aligning alexithymia theory with recent advances in the broader emotion regulation field (Gross, 2015a), we think our model might provide a useful framework for understanding and defining the alexithymia phenomenon in future work. When the alexithymia phenomenon is viewed through the lens of our model, this accounts for a number of unresolved issues within the field.

Firstly, by conceptualising alexithymia as a set of difficulties during the emotion valuation process (Gross, 2015a) and linking these difficulties to emotion schemas (Lane & Schwartz, 1987), our model can account for why most empirical work finds DFAN to not be part of the alexithymia construct; because unlike DIF, DDF and EOT, the extent to which one engages in daydreaming and fantasy would not seem to be dependent on the developmental level of one's emotion schemas (see also, Stawarczyk, Majerus, Van der Linden, & D'Argembeau, 2012).

Secondly, by positioning alexithymia within Gross's (2015a) extended process model of emotion regulation, our model can account for why empirical work commonly finds

alexithymia to be associated with high levels of negative reactivity. Namely, if one accepts that people are generally driven by hedonistic motivations to feel pleasure and avoid pain, then most emotion regulation attempts will be focused on up-regulating positive feelings and down-regulating negative feelings (Gross, 2014). Consequently, people who have poor emotion regulation skills would be expected to experience negative feelings more intensely and positive feelings less intensely than people who are adept at emotion regulation. In turn, because alexithymia constitutes difficulties during the emotion valuation process that is responsible for activating regulatory attempts, alexithymic people would be expected to have poorer emotion regulation skills and less capacity to control their negative feelings. Indeed, alexithymia has been consistently associated with maladaptive emotion regulation attempts (e.g., Swart, Kortekaas, & Aleman, 2009) and elsewhere has been described as a rate-limiting factor for successful emotion regulation (Gross, 2014). In other words, from this perspective, it is not the *absence* of affect that characterises alexithymia, but rather, the *undifferentiated structure* of the affect. This also accounts for why high levels of alexithymia are commonly observed in patients with psychopathologies characterised by emotion dysregulation and negative reactivity (New et al., 2012; Leweke, Leichsenring, Kruse, & Hermes, 2012).

Thirdly, by making a distinction between ability deficit alexithymia and avoidance alexithymia, our model informs the debate within the literature with respect to whether alexithymia should be considered a deficit (e.g., Taylor et al., 1999) or a defence (e.g., Marchesi, Ossola, Tonna, & De Panfilis, 2014). Within our model, alexithymia is both, and it is the combination of ability deficits and avoidant defences that determines one's overall level of alexithymia. Similarly, this conceptualisation informs a related debate on whether alexithymia should be considered a stable trait (e.g., Taylor et al., 1999) or a state reaction to distress (e.g., Marchesi et al., 2014). Within our model, one's level of ability deficit alexithymia should be relatively stable, but levels of avoidance alexithymia may increase as a

regulatory response to unpleasant feelings. This is consistent with the current set of findings

from longitudinal studies, which report that alexithymia levels (TAS-20 total scale scores)

usually elevate during periods of distress, but nonetheless exhibit an underlying level of

relative stability (de Timary, Luts, Hers, & Luminet, 2008; Luminet et al., 2001; Luminet et

al., 2007).

Fourthly, our model could be helpful in informing the treatment of those psychiatric

patients who present with high levels of alexithymia. Our model suggests that psychotherapy

with such patients should include a focus on developing their emotion schemas and reducing

their use of experiential avoidance as an emotion regulation strategy. From this perspective,

difficulties attending to and appraising emotions should be targeted by guiding the patient in

focusing on the most pertinent features of an emotional response, and guiding them in

mentally representing, labelling, and linking the visceral sensations, behavioural tendencies,

and eliciting events surrounding this affect. The goal is to facilitate the patient's progression

to a higher level of emotional awareness at the attention and appraisal stages of emotion

valuation (Gross, 2015a; Lane & Schwartz, 1987). Psychotherapy techniques compatible with

this approach have been described previously by several authors, including Kennedy and

Franklin (2002), Lane et al. (2015), Taylor et al. (1999), and Neumann, Malec and Hammond

(2017), and we consider mindfulness techniques (e.g., mindfulness of emotions; Harris, 2009)

to be of particular relevance. Research on the treatment of alexithymia in the context of

psychopathology is still in its relative infancy (Samur et al., 2013), and the attention-appraisal

model could provide a useful framework for the design of alexithymia focused psychotherapy

programs to be tested in future work.

Fifthly, the TAS-20 (Bagby et al., 1994) has been by far the most widely used

measure of alexithymia since its development (Taylor et al., 2016), and because the TAS-20

includes only DIF, DDF and EOT items, most of the alexithymia literature has already

operationalised the construct in a manner consistent with the three component definition we have suggested in this paper (e.g., Bankier, Aigner, & Bach, 2001; Leweke et al., 2012; Panayiotou et al., 2015; Parker et al., 2008; Subic-Wrana, Bruder, Thomas, Lane, & Köhle, 2005; for a review, see Taylor & Bagby, 2004). The introduction of our model, therefore, reduces the discrepancy that some authors had noted to exist between alexithymia theory and alexithymia measurement (Sifneos, 1996; Bagby, Taylor, Quilty, & Parker, 2007).

Limitations

Whilst we consider our paper to make a strong contribution, some limitations of our factor analytic study should be noted. Although we used multiple measures of alexithymia, we used only one measure of DFAN and all our measures were self-report questionnaires. Previous research has shown that the BVAQ DFAN subscale correlates strongly with observer-rated measures of DFAN (e.g., Rosenberg et al., 2016), but nonetheless, it would be ideal for future research of this type to also include observer-rated measures like the TSIA. Our results also only relate to an Australian adult community sample. Similar results to ours have emerged when these measures have been examined in isolation across various populations (e.g., Meganck et al., 2008; Taylor, Bagby, & Parker, 2003; Bermond et al., 2007), but more research is needed in which multiple measures are administered together. Additionally, whilst our model includes hypotheses about the role of emotion schemas and experiential avoidance in alexithymia, we did not test these mechanisms in this study. As such, from our data, we can only comment on the latent structure of the construct rather than the mechanisms underlying this structure. There is a growing body of work supporting the role of emotion schemas (e.g., Lane et al., 1996; Luminet et al., 2006; Lundh et al., 2002; Suslow & Junghanns, 2002; Vermeulen et al., 2006) and experiential avoidance (e.g., Bilotta et al., 2015; Coriale et al., 2012; Panayiotou et al., 2015) in alexithymia, but more research of this type is needed to enhance understanding of the theoretical underpinnings of the construct.

Nonetheless, despite these limitations, in terms of the latent structure of the construct, we think the current body of empirical evidence is sufficient to warrant a refinement to the definition of alexithymia; refined to a construct comprised of DIF, DDF and EOT.

Conclusions

The latent structure of the alexithymia construct, statistically, appears to be comprised of only DIF, DDF and EOT. We, therefore, recommend that the definition of alexithymia be refined so as to be consistent with the weight of the empirical literature, and include only these three components. This structure is consistent with the specifications of the attention-appraisal model of alexithymia, and by aligning alexithymia theory with recent advances in the broader emotion regulation field (Gross, 2015a), we think that this model provides a useful framework for clinicians and researchers to use and test in future work.

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Table 1C

Pearson Bivariate Correlations between Scores on the TAS-20, BVAQ, DERS and PERS

Scale/subscale	TAS-20				BVAQ							DERS		
	Total	DIF	DDF	EOT	Cognitive alexithymia	Affective alexithymia	D-Verbalising	D-Fantasising	D-Identifying	D-Emotionalising	D-Analysing	Alexithymia composite	Clarity	Awareness
TAS-20														
Total scale	-	.84**	.85**	.70**	.79**	-.06	.65**	-.08	.70**	.00	.56**	.72**	.72**	.55**
T-DIF	.84**	-	.58**	.31**	.54**	-.22**	.38**	-.18**	.65**	-.16*	.30**	.53**	.64**	.30**
T-DDF	.85**	.58**	-	.45**	.76**	-.07	.77**	-.13*	.56**	.04	.44**	.62**	.63**	.46**
T-EOT	.70**	.31**	.45**	-	.62**	.22**	.43**	.18*	.45**	.16*	.65**	.59**	.40**	.59**
BVAQ														
Cognitive alexithymia	.79**	.54**	.76**	.62**	-	.17*	.84**	.06	.76**	.23**	.80**	.78**	.66**	.69**
Affective alexithymia	-.06	-.22**	-.07	.22**	.17*	-	.06	.81**	-.01	.72**	.39**	.08	-.15*	.22**
D-Verbalising	.65**	.38**	.77**	.43**	.84**	.06	-	-.03	.42**	.14*	.48**	.57**	.48**	.50**
D-Fantasising	-.08	-.18**	-.13*	.18**	.06	.81**	-.03	-	-.02	.19**	.21**	-.02	-.15*	.09
D-Identifying	.70**	.65**	.56**	.45**	.76**	-.01	.42**	-.02	-	.00	.47**	.66**	.71**	.47**
D-Emotionalising	-.00	-.16*	.04	.16*	.23**	.72**	.14*	.19**	.00	-	.41**	.15*	-.07	.28**
D-Analysing	.56**	.30**	.44**	.65**	.80**	.39**	.48**	.21**	.47**	.41**	-	.66**	.41**	.69**
DERS														
Alexithymia composite	.72**	.53**	.62**	.59**	.78**	.08	.57**	-.02	.66**	.15*	.66**	-	.81**	.91**
Clarity	.72**	.66**	.63**	.40**	.66**	-.15*	.48**	-.15*	.71**	-.07	.41**	.81**	-	.48**
Awareness	.55**	.30**	.46**	.59**	.69**	.22**	.50**	.09	.47**	.28**	.69**	.91**	.48**	-
PERS														
General positive reactivity	-.29**	-.23**	-.26**	-.20**	-.36**	-.19**	-.30**	-.03	-.31**	-.28**	-.26**	-.35**	-.29**	-.31**
Positive-activation	-.25**	-.19**	-.24**	-.15*	-.33**	-.18*	-.30**	-.05	-.28**	-.24**	-.21**	-.30**	-.24**	-.26**
Positive-intensity	-.08	.01	-.09	-.13*	-.16**	-.26**	-.17*	-.10	-.04	-.33**	-.17*	-.17*	-.07	-.21**
Positive-duration	-.40**	-.38**	-.32**	-.23**	-.41**	-.07	-.29**	.06	-.43**	-.18**	-.28**	-.42**	-.40**	-.34**
General negative reactivity	.43**	.53**	.31**	.14*	.29**	-.34**	.22**	-.25**	.38**	-.28**	.12*	.27**	.43**	.09
Negative-activation	.44**	.52**	.30**	.19**	.31**	-.28**	.21**	-.18**	.39**	-.27**	.16*	.30**	.42**	.14*
Negative-intensity	.32**	.45**	.24**	.00	.19**	-.36**	.15*	-.28**	.29**	-.27**	.02	.15*	.32**	-.01
Negative-duration	.43**	.50**	.31**	.18*	.31**	-.32**	.24**	-.24**	.38**	-.25**	.14*	.30**	.45**	.13*

*Note. p < .001**, p < .05*. TAS-20 = Toronto Alexithymia Scale-20, BVAQ = Bermond-Vorst Alexithymia Questionnaire, DERS = Difficulties in Emotion Regulation Scale, PERS = Perth Emotional Reactivity Scale.