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Towards a comprehensive understanding of alexithymia

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Summary

The main goal of this dissertation is to gain a comprehensive understanding of alexithymia and how well the original definition conceptualizes the difficulties related to alexithymia, using a large representative sample of mentally healthy people. The research this dissertation is based on consists three separate studies. First, to understand latent structures shaping the alexithymic population and whether psychological distress differs among the possible latent subgroups, we have conducted a latent profile analysis. In order to gain insight into alexithymia's relation to stress-related psychiatric disorders, we investigated hypothalamic-pituitary-adrenal (HPA) system functioning through cortisol awakening response. Furthermore, we have looked at empathic ability as a key process in social interaction. The study consisted of tasks related to the cognitive and emotional components of empathy and subjective arousal, and captured related brain activity and skin conductance response. The main findings are:

- There are three distinct subgroups of high alexithymic individuals: the group with overall high scores but lower scores in externally oriented thinking style and in fantasizing proved to be distinct with much higher levels of psychological distress.
- Alexithymic individuals showed a reduced cortisol awakening response, which is an indicator of a dysfunction in the basic stress-response of the organism.
- In the brain imaging study, alexithymic individuals showed lower emotional empathy and subjective arousal. Lower emotional empathy was accompanied by a higher activation of ventrolateral prefrontal cortex (VLPFC) and left inferior frontal gyrus (IFG) and lower subjective arousal was accompanied by a lower skin conductance response.

These findings support the hypothesis that alexithymia is not only related to difficulties in identifying and describing emotions but also related to a dysfunction in basic emotional processes. Alexithymic individuals have altered HPA-system function, lower empathy towards others in distress, lower subjective arousal and these all are accompanied by higher levels of psychological distress. Finally, the dissertation discusses the implication of these findings on the original definition of alexithymia and psychotherapy of alexithymic individuals with mental disorders.

Deutsche Zusammenfassung

Hauptziel dieser Arbeit ist es, anhand einer großen, psychisch gesunden und für die Bevölkerung repräsentativen Stichprobe ein umfassendes Verständnis von Alexithymie zu erlangen. Darüber hinaus wird untersucht, wie gut die ursprüngliche Definition von Alexithymie die Schwierigkeiten im Zusammenhang mit Alexithymie zu konzeptualisieren vermag.

Die Forschungsarbeit, auf der diese Dissertation basiert, besteht aus drei verschiedenen Studien. Erstens wurde eine latente Profilanalyse zum Verständnis latenter, die alexithyme Bevölkerung prägender Strukturen durchgeführt sowie zur Untersuchung der Frage, ob die psychische Belastung sich bei den möglichen latenten Untergruppen unterscheidet. Um zweitens Einsicht in das Verhältnis von Alexithymie zu stressbedingten psychischen Störungen zu erlangen, wurde die Funktionsfähigkeit des Hypothalamus-Hypophysen-Nebennieren-(HPA)-Systems durch Cortisol-Aufwach-Reaktion untersucht. Darüber hinaus wurde drittens die Empathiefähigkeit als Schlüsselprozess von sozialer Interaktion betrachtet, wobei die entsprechende Studie aus Aufgaben zu kognitiven und emotionalen Komponenten von Empathie und subjektiver Erregung bestand und die damit verbundene Hirnaktivität und Hautleitfähigkeit erfasste.

Die wichtigsten Ergebnisse sind:

- Es gibt drei verschiedene Untergruppen von hoch-alexithymen Personen: Vor allem die Gruppe mit insgesamt hohen Alexithymie-Werten, dafür aber niedrigeren Werte in extern orientiertem Denkstil und beim Fantasieren erwies sich als wesentlich höher psychisch belastet.
- Alexithyme Personen zeigten eine reduzierte Cortisol-Aufwach-Reaktion, was ein Indikator für eine Funktionsstörung der elementaren Stress-Reaktion des Organismus ist.
- In der bildgebenden Studie ließen alexithyme Individuen geringere emotionale Empathie und subjektive Erregung erkennen. Geringes emotionales Einfühlungsvermögen wurde von einer höheren Aktivierung im ventrolateralen präfrontalen Kortex (VLPFC) und linken inferiorfrontalen Gyrus (IFG) begleitet und geringe subjektive Erregung von schwacher Hautleitfähigkeit.

Die Ergebnisse unterstützen die Hypothese, dass Alexithymie nicht nur mit Schwierigkeiten bei der Identifizierung und Beschreibung von Emotionen verbunden ist, sondern auch mit einer Funktionsstörung grundlegender emotionaler Prozesse in Beziehung steht. Die alexithymen Menschen weisen veränderte HPA-Systemfunktion, niedrigere Empathie gegenüber anderen wie auch geringere subjektive Erregung auf, was alles mit höherer psychischer Belastung einhergeht. Schließlich werden in der Dissertation die Auswirkungen dieser Befunde auf die ursprüngliche Definition von Alexithymie sowie auf die Psychotherapie alexithymer Personen mit psychischen Störungen diskutiert.

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1

Introduction

It has been almost half a century since alexithymia has emerged as a distinct construct in the fields of psychology, psychosomatics and psychiatry. It was Sifneos (1973) who first introduced the old-Greek word “alexithymia,” which literally means “no words for feeling” to describe the specific deficits in verbal expression of emotions in psychotherapy resistant psychosomatic patients. Today alexithymia is seen as a personality trait with a high clinical relevance and it is a growing field of research.

1.1. The primary definition of alexithymia

Sifneos and Nemiah (1970, 1977) coined the term Alexithymia during their observations and therapies with psychosomatic patients and they defined alexithymia as the following:

- a) the difficulty to identify subjective feelings, i.e. the inability to differentiate between different feelings and to distinguish feelings from bodily sensations of emotional arousal
- b) the difficulty describing feelings, i.e. a compromised capacity to use language to symbolize the emotions
- c) a limited capacity of imagination and fantasy life
- d) and a utilitarian way of thinking with a stimulus bound, externally oriented cognitive style (Nemiah, Freyberger, Sifneos, & others, 1976; Taylor, Bagby, & Parker, 2003).

1.2. Various definitions of alexithymia and its measurement

Scientific studies on alexithymia do not always employ the original definition of Sifneos (1973). For example, the definition employed by the research group of Bagby, Taylor and Parker (Taylor, Bagby, & Parker, 1991; Taylor, 2004) and the definition developed by Bermond (Bermond et al., 2007; Vorst & Bermond, 2001) have shaped the field of research much more than the primary definition of Sifneos. Thus, it is important to discuss various instruments used to measure alexithymia and the definitions they employed.

The Beth Israel Hospital Psychosomatic Questionnaire (BIQ; Sifneos, 1973, Sriram, Pratap, & Shanmugham, 1988) is the only questionnaire that was based on Sifneos' (Sifneos et al., 1977) own definition. The instrument has 17 forced choice items to be decided by the interviewer after completing a structured interview with the client. The instrument covers all domains of the original alexithymia definition but only eight out of 17 items of the questionnaire actually measure alexithymia. It has been highly criticized for a lack of internal consistency, dichotomous answer structure and being highly time consuming (Lolas, de la Parra, Aronsohn, & Collin, 1980). Therefore, the BIQ could not establish itself as a good instrument for research.

Taylor, Bagby and Parker developed an instrument called Toronto Alexithymia Scale (Bagby, Parker, & Taylor, 1994a; Bagby, Taylor, & Parker, 1994b) which has shaped this research field more than any other instrument. It was originally based on Sifneos' definition of alexithymia however it has been modified over time. The Toronto Alexithymia Scale (TAS-20; Bagby, Parker & Taylor, 1994a; German by Bach, Bach, de Zwaan, & Serim, 1996) is a valid and reliable self-report 20-item instrument, which has been validated in many languages. TAS-20 (Bagby, Taylor, Parker and Loisselle, 1990) now consists of only three components of the original alexithymia construct of Sifneos (Sifneos et al., 1977), namely difficulty identifying feelings (DIF), difficulty describing feelings (DDF) and externally oriented thinking (EOT). The original TAS-26 (Bagby, Taylor, Parker and Loisselle, 1990) used to capture all four components of Sifneos' definition of alexithymia. The questionnaire has been changed twice and in order to gain a better factorial structure, the authors have eliminated the component of paucity of fantasies. This fundamental mismatch between the original definition and the definition TAS-20 employs has been criticized by (Sifneos, 2000). However, Parker and colleagues (Parker, Taylor, & Bagby, 2003) argue that constricted fantasy life is not completely disregarded in the questionnaire but assessed through the EOT subscale indirectly, since they have found a negative correlation between this factor and the scores in an independent questionnaire assessing fantasy and imaginative ability (Bagby et al., 1994b, Parker et al., 2003). Authors of TAS-20 later on developed the Toronto Structured Interview for Alexithymia (Bagby, Taylor, Parker, & Dickens, 2006), which once again covers all of the original

components of alexithymia construct. This also makes it clear that the authors agree on Sifneos' original alexithymia construct but adapted TAS-20 in a different way because of the benefits in psychometric properties.

The second widely used measurement instrument is the Bermond-Vorst Alexithymia Questionnaire (BVAQ; Vorst and Bermond, 2001). According to Bermond (Bermond et al., 2007), alexithymia is not only characterized through difficulties in identifying and describing feelings, but also through a reduced ability to experience emotional feelings (emotionalizing). This view contrasts with Sifneos' (1973), who has never openly suggested differences in the physiological experience of emotions in alexithymia, but only a difference in the awareness of emotions, or just in their verbal expression. BVAQ (Vorst & Bermond, 2001) consists of five subscales: Emotionalizing, the degree to which someone is emotionally aroused by emotion inducing events; fantasizing, the tendency towards reduced imagination; identifying; analyzing; and the verbalizing of emotions. BVAQ correlates significantly with TAS-20 (Taylor & Bagby, 2004) and has good psychometric properties.

It is a matter of debate how well alexithymia can be assessed through self-report, since alexithymic individuals, by definition, have a limitation in self-observing and depicting abilities. Based on this argument, Haviland and colleagues have made a Q-sort study and developed Observer Measurement of Alexithymia (OAS; (Haviland, Warren, & Riggs, 2000) which is not based on Sifneos' definition but consists of the characteristics of alexithymic individuals evaluated by clinical experts. OAS is filled out by a close friend or relative and has good statistical quality but correlates only moderately with TAS-20 (Meganck, Inslegers, Vanheule, & Desmet, 2011). According to OAS the extremely characteristic features of alexithymia are: bland emotionality, flattened affect, anxiety and tension finding outlet in bodily symptoms, concerns about bodily functions, distanced relationships, and communication through action.

Although the present research does not engage in depth with his theories, it is important to mention that Lane (Lane, Ahern, Schwartz, & Kaszniak, 1997; Lane, Weihs, Herring, Hishaw, & Smith, 2015) has approached alexithymia from a

different angle. He argues that alexithymia cannot be measured through self-report, since the highly alexithymic individuals have dysfunctional ability of introspection and developed Levels of Emotional Awareness Scale (LEAS; Lane et al, 1990) as an objective measure of emotional awareness, which includes short vignettes of events and requires the participant to write their own possible reaction.

1.3. Alexithymia as a personality trait

Although it has been first documented in patients with severe psychosomatic symptoms, alexithymia has been seen as a personality trait rather than a psychopathological symptom. A trait is a personality structure, which is relatively stable over time and differs among individuals (Matthews, Deary, & Whiteman, 2009, p. 63) In what follows, I will discuss how alexithymia fulfills the criteria of being a personality trait.

The first important criterion for a psychological trait is dimensionality. In their pioneering texts, Nemiah and Sifneos (Nemiah et al., 1976; Nemiah & Sifneos, 1970) did not clearly state whether alexithymia was a dichotomous or a dimensional construct. A dichotomous construct defines a distinct type of a personality, whereas a dimensional construct is a trait that differs gradually among individuals. The measurement instrument developed by Sifneos, the BIQ (Beth-Israel Psychosomatic Questionnaire; Sifneos, 1973) was based on a categorical view of alexithymia, in which 6 positive answers out of 8 lead to the qualification of an individual as alexithymic. Later on, in the 1980s Nemiah (1982) stated that alexithymia could be approached as an all-or-none concept, therefore rejecting the possibility of dimensionality. The first empirical study to clear this controversial dispute has been conducted by Parker (Parker, Keefer, Taylor, & Bagby, 2008) with a sample of over 4,000 individuals. In that study Parker employed a taxometric analysis. The results of the study provide strong support that alexithymia is a dimensional construct.

Further supporting the dimensionality thesis, alexithymia shows a normal distribution in general population. (Franz et al., 2008), worked with 1,800

participants and showed that alexithymia is normally distributed in German general population, with a median of 49 out of 100. Alexithymia has been shown to be normally distributed also in a large Finnish sample (Salminen, Saarijärvi, Äärelä, Toikka, & Kauhanen, 1999).

A second important criterion for a personality trait is temporal stability. Tolmunen and colleagues (2011) have demonstrated, in an 11-year follow up with 700 Finnish men based on TAS-26 scores, that alexithymia has high relative and absolute stability. The results point to alexithymia as a stable personality trait.

Another important aspect in deciding upon using the term personality trait is the relationship of a new personality factor to the Five Factor Model of personality (McCrae & Costa, 1987). The Five Factor Model (Costa & McCrae, 1996; Digman, 1990; McCrae & John, 1992) has, so far, been the most influential personality theory and there have been several studies investigating FFM's relevance to alexithymia. In an early study by Bagby et al. (1994b) alexithymia has been shown to correlate positively with Neuroticism ($r=.27$) and negatively with Openness ($r=-.49$). In a later study, Zimmermann et al. (2005) demonstrated that TAS-20 scores are positively associated with Neuroticism and negatively associated with Extraversion. Highly alexithymic individuals tend to load high on neuroticism, and low on openness and extraversion, which is congruent with the general understanding on alexithymia.

1.4. Etiology of alexithymia and its relation to psychological well-being

In line with a dimensional understanding of alexithymia and the research evidence, in the etiology of alexithymia I consider an interaction of both genetic and environmental factors. In the study with 8,785 Danish twin pairs, Jørgensen et al. (2007) have shown 30-33% contribution of shared genetics on alexithymia. Shared and non-shared environmental factors explained respectively 12- 20 % and 50 - 56 % of the variance. Some of the environmental factors that influence the development of alexithymic tendencies are emotional neglect, quality of early parent-child interaction and attachment relationships (Aust, Alkan Härtwig, Heuser, & Bajbouj, 2012; Berenbaum, 1996; Frewen, Dozois, Neufeld, & Lanius,

2008; Lumley, Mader, Gramzow, & Papineau, 1996; Montebanocci, Codispoti, Baldaro, & Rossi, 2004; Zlotnick, Mattia, & Zimmerman, 2001).

Alexithymia as a construct was coined after clinical observations of patients resistant to clinical psychotherapy in Boston and Paris in the late 1960s (Sifneos, 2000). Those patients had massive difficulties in talking about their feelings and psychosomatic symptoms. At that time without detailed scientific examination, the first authors on alexithymia argued that this deficit in verbal expression of feelings and severely restricted ability to imagine and to fantasize made individuals prone to psychosomatic symptoms. However, somatization has not been specifically found to be related to alexithymia (De Gucht & Heiser, 2003). On the other hand, several psychiatric disorders are very highly represented in the alexithymic population. Several studies have demonstrated alexithymia's coexistence with several psychiatric conditions such as eating disorders, substance dependence, posttraumatic stress disorder, functional gastrointestinal disorders, pain syndromes and somatoform disorders (De Gucht & Heiser, 2003; Frewen et al., 2008; Huber, Suman, Biasi, & Carli, 2009; Lumley, Beyer, & Radcliffe, 2008; Lumley et al., 1996; Porcelli et al., 2003; Speranza, Loas, Wallier, & Corcos, 2007). However, there is not enough evidence to conclude that alexithymia is a factor leading to higher prevalence of psychiatric disorders. Any of the genetic and environmental factors contributing to the development of alexithymia might also contribute to the development of a psychiatric condition concurrently. Today alexithymia is regarded as a possible vulnerability factor for wide range of stress related psychiatric and physical disorders (Berthoz, Ringuenet, Corcos, Martinot, & Jeammet, 2002; Frewen et al., 2008; Porcelli, Taylor, Bagby, & De Carne, 1999; Zimmermann et al., 2005).

1.5. Emotion or feeling?

In the literature on alexithymia, the terms "emotions" and "feelings" are often inadequately defined or not defined at all (e.g. Lumley & Sielky, 2000) In many texts, authors use them interchangeably, however the term "feeling" is employed more often. Literally, "alexithymia" means a lack of words for feelings, but it is not clear how Sifneos and other researchers define feelings and how do they

distinguish them from emotions. Even in relatively theoretical studies looking at the overlap between emotional intelligence and alexithymia, such as that of Parker and colleagues (Parker, Taylor, & Bagby, 2001), many authors do not define their basic understanding of emotions and feelings.

As explained above, as the first to study alexithymia Sifneos focused on the impairments to recognizing feelings and expressing them through verbal communication. Although it is not openly stated, one gets the impression from his early texts (Nemiah & Sifneos, 1970; Sifneos et al., 1977; Sifneos, 1973) that Sifneos argued that alexithymia patients have a normal functioning of emotional process except for the feeling component.

Although they are used interchangeably in general language, feelings and emotions are psychologically not the same phenomena and are not synonyms for each other. There are different theoretical models defining what emotions and feelings are and the differences between them. For example, Scherer's (2005) component process model of emotions is one such model. He distinguishes between emotions and other affective phenomena such as feelings and moods. According to Scherer, an emotional process has five components:

Cognitive component (appraisal)

Neurophysiological component (bodily symptoms)

Motivational component (action tendencies)

Motor expression component (facial and vocal expression)

Subjective feeling component (emotional experience)

All five components can occur independently any time, but during an emotional process they all should be present. In this model, feelings are seen as the subjective appraisal of emotional process (subjective emotional experience), which integrates the patterns of cognitive appraisal with a motivational and somatic response. According to Scherer, one is mistaken to call feeling the synonym for emotion, since it is only a single aspect of the whole emotion process.

In this dissertation, following Scherer (2005) I will use the term "feeling" to denote the subjective appraisal component of emotions and the term "emotion" to refer to

the whole process of emotional experience, from bodily symptoms to subjective experience. This distinction will prove useful since research (Kano et al., 2003; Luminet, Rimé, Bagby, & Taylor, 2004; Graeme J. Taylor & Bagby, 2004b) points to the possibility of a dysfunctional emotional processing in alexithymia, rather than to an independent impairment in the subjective experience of emotions, namely feelings.

1.6. Research objectives and questions

The main goal of this dissertation is to gain a comprehensive understanding of alexithymia with a large mentally healthy population representative sample of highly alexithymic individuals and to assess how well the original definition of alexithymia conceptualized alexithymia independent of mental disorders.

The present dissertation has three specific research objectives, with research questions below:

First, to understand the latent structures shaping some possible subtypes of alexithymia on its higher end we employ a latent profile analyses of alexithymia. Researchers have not yet studied whether certain combinations of alexithymic features (e.g. identifying, fantasizing etc.) render an individual more or less susceptible to psychiatric disorders. This dissertation examines the possible subtypes of alexithymia and asks if any of these subtypes are more prone to psychiatric disorders than others in order to gain an understanding into the assumed relationship between alexithymia and stress related diseases.

Research Questions:

Is alexithymia a one-dimensional construct or are there subtypes of alexithymia?

What are the differences of subtypes of alexithymia based on subscales of TAS-20 and BVAQ?

Does alexithymia per se makes people prone to psychiatric disorders or does a specific combination of its subfactors play a bigger role?

Do these possible subtypes of alexithymia have distinct patterns of personality?

Do the possible subtypes differ on experiencing and understanding emotions?

Does psychological distress differ among the subtypes?

Second, this dissertation aims to understand how alexithymia is related to stress related psychiatric disorders by looking at the primary function of the hypothalamus-pituitary-adrenal (HPA) system with the means of measurement of Cortisol awakening response (CAR) in samples of highly alexithymic individuals and non-alexithymic individuals. The HPA system regulates the basic stress responses of the body and helps it to adapt to changes in the environment. Many stress-related disorders (Fries, Dettenborn, & Kirschbaum, 2009) are found to coexist with an HPA-dysfunction. Understanding the role of a primary stress-related bodily function in alexithymia might help us to gain insights on its relation to stress related disorders.

Research Questions:

Do alexithymic individuals have normal psychoendocrinological response of the hypothalamic-pituitary-adrenal system (HPA)?

Are there differences in their cortisol awakening response?

The third aim of the dissertation is to shed light on the question of whether highly alexithymic individuals only have problems on the feeling level, namely in the subjective appraisal of the emotional process, or whether they have an underlying impairment in other components of emotional process, such as emotional experience, bodily symptoms, as well as underlying cerebral function through brain imaging and measurement of skin conductance response. Moreover, we will examine empathy as the basic emotion in social interaction. Highly alexithymic individuals are known to have diminished empathic ability (Moriguchi et al., 2007, 2006). Studying empathy gives us the possibility to reflect on the emotional experience of alexithymic individuals from the other-directed perspective.

Research Questions:

What are the neural mechanisms underlying emotional experience in alexithymia?

Are there differences in the skin conductance response as a cue of basic emotional reaction?

Are there differences in ratings and reaction times of emotional stimuli?

How do alexithymic individuals experience empathy while watching images of individuals experiencing negative emotions?

Are there differences when alexithymic individuals name emotions?

Do the differences first emerge when the participants are forced to introspect in order to report their own arousal based on stimuli?

In order to achieve these research objectives, I have conducted three separate studies in collaboration with the alexithymia research group in the Excellence Cluster Languages of Emotion and published (another of them is submitted for publication) articles to be found on the following pages. By bringing these separate aspects together, the thesis aims to contribute to the understanding of alexithymia and its relation to overall mental health.

2

Collection of
a high-alexithymic
mentally healthy
sample

2.1. Sample of the present investigation

Many of the studies on alexithymia have been conducted with small student samples or psychiatric inpatients. Research articles presented in this dissertation project studied a community-based and representative sample of physically and mentally healthy high-alexithymic individuals and compared them with strictly gender-, age-, education- and income-matched low alexithymic individuals. In the following chapter we describe the recruitment of the sample of our research group thoroughly. Characteristics of samples participated in each study will be explained in detail in respective method sections.

At this point I want to make it clear how I will describe individuals with high scores on alexithymia related questionnaires throughout this manuscript. I prefer to use highly alexithymic individuals," since alexithymia is a personality trait rather than a psychiatric disorder. Similarly, in the politically and ethically correct way one does not call a person with schizophrenia a schizophrenic person. However, it is different for personality factors such as extraversion. It is not stigmatizing to call a person extrovert or introvert; furthermore, it is peculiar to call someone a person with extraversion. Therefore, I will name the participants of these studies high-alexithymic individuals or abbreviated as h-ALEX.

2.2. Recruitment of high-alexithymic sample

The sample was recruited via poster advertisements on public transportation in Berlin. Posters with an eye catcher "Do you have difficulties in talking about your feelings?" were hanging in the Berlin S-Bahn-trains for one month on 3 different lines. Interested candidates were asked to take a look at our webpage. Exclusion criteria were physical and mental disorders and a native language other than German. About 1,000 individuals have completed TAS-20 (Bagby, Parker, & Taylor, 1994) online and fulfilled the criteria. The individuals with TAS-20 scores over 55 (Franz et al., 2008) were invited to a group session in our institute.

217 individuals participated in the group sessions. All scales were adapted to a digital version and were assessed on a PC. The Measurement instruments in the group session were:

Beck Depression Inventory (BDI; Beck, Ward, Mendelson, & undefined, 1961; Hautzinger, Bailer, Worall, & Keller, 1994)

Symptom Checklist (SCL-90; Derogatis, 1977; Franke, 1995)

Multidimensional Mood Scale (MDBF; Heinrichs & Nater, 2002)

German Vocabulary Test for Crystalline Intelligence (WST; Schmidt & Metzler, 1992)

Bermond-Vorst Alexithymia Questionnaire (BVAQ; (Vorst, 2001))

Emotional Clarity and Emotional Self-Attention (KLA & ESA; Lischetzke, Eid, Wittig, & Trierweiler, 2001)

Scales for Experience of Emotions (SEE; Behr & Becker, 2004)

Balanced Inventory of Desirable Responding (BIDR; Paulhus, 1988)

Personality (NEO-PI-R; Borkenau & Ostendorf, 1993; Costa & McCrae, 1992)

In the second step we invited the participants to an interview session. Since alexithymia is related to mental disorders, the goal was to carefully sort out the participants with a present or past mental disorder. Therefore, each participant was interviewed by a trained clinical psychologist with the Mini-International Neuropsychiatric Interview (M.I.N.I.; Ackenheil, Stotz, Dietz-Bauer, & Vossen, 1999). M.I.N.I. is an instrument for DSM-IV and ICD-10 and has good statistical and clinical properties. 89 h-ALEX participated in the interview session and 52 of the participants were free of past and present mental disorders. Figure 2-1 shows the distribution of mental disorders in our initial high alexithymic sample.

2.3. Recruitment of the control sample

For the recruitment of the matching control sample (abbreviated as l-ALEX), we made a new advertisement in the public transportation system of Berlin. The posters announced that Excellence Cluster Languages of Emotion was looking for participants for several scientific investigations. From more than 2,000 individuals who participated in our online survey, we included the ones with TAS-20 scores lower than 40 and suitable for and willing to participate in a magnetic resonance brain imaging study. The subjects were invited to testing according to their sociodemographic variables: unless they are mentally unhealthy, only the participants who could be a possible match for our highly alexithymic subjects

were invited to clinical interview sessions and the participants were strictly matched to highly alexithymic individuals according to their gender, age (± 5 years), levels of education and income.

In the one-on-one sessions in our institute, participants first filled out the questionnaire battery on the PC (same as the high-alexithymic subjects filled out) and were interviewed with M.I.N.I. 67 l-ALEX participated in the interview session and 50 of the participants were free of past and present mental disorders. Figure 1 also shows the distribution of mental disorders in the initial l-ALEX group.

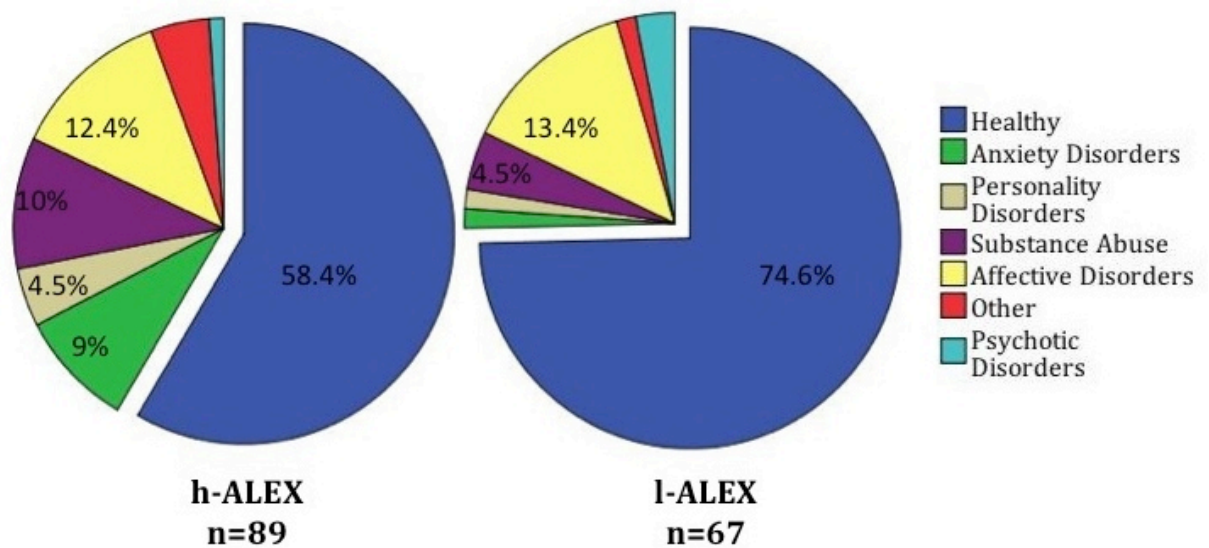


Figure 2-1: The distribution of mentally healthy participants in the initial samples of h-ALEX and l-ALEX.

3

It's in the mix: Psychological distress differs between combinations of alexithymic facets*

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Abstract

Background: Alexithymia is a personality trait characterized by difficulties in identifying, describing, and communicating one's emotions. It is a risk factor for several stress related mental disorders. The aim of the present study was to examine the distinct combinations of alexithymic features as risk factors for psychological distress within a population of high-alexithymic German adults (N=217).

Methods: Latent profile analysis (LPA) was employed to test for possible underlying subgroups on the basis of the Toronto Alexithymia Scale (TAS-20) and the Bermond-Vorst Alexithymia Questionnaire (BVAQ).

Results: A 3-profile solution showed the best fit. The different latent profiles of Alexithymia were labeled as (1) "low load on all facets of alexithymia", (2) "specific problems on identifying emotions", and (3) "high load on all facets of alexithymia". Logistic regression revealed that Profile 2 shows the highest level of psychological distress. One reason for this is hypothesized to be that this group of high alexithymic individuals has a remarkable pattern of high attention to their feelings accompanied by low emotional clarity.

Conclusions: The present study indicates the importance of a specific combination of alexithymic features, rather than total alexithymia scores, as a risk factor for psychological distress.

Introduction

Alexithymia is a personality trait that is associated with some psychiatric disorders (Lumley, Ovies, Stettner, & Wehmer, 1996; Taylor & Bagby, 2004) such as eating disorders (Speranza, Loas, Wallier, & Corcos, 2007), pain syndromes (Huber, Suman, Biasi, & Carli, 2009), somatoform disorders (De Gucht & Heiser, 2003). In turn, patients with psychiatric disorders often show state-dependent alexithymic features (Honkalampi, Hintikka, Tanskanen, Lehtonen, & Viinamäki, 2000; Zeitlin & McNally, 1993). Sifneos (1973) introduced the term alexithymia in an attempt to explain his observations on “psychosomatic” patients, who had deficits in verbal expression of emotions. The original alexithymia construct included four components: a) difficulty identifying subjective feelings, i.e. the inability to differentiate between different feelings and to distinguish feelings from bodily sensations of emotional arousal; b) difficulty describing feelings, i.e. a compromised capacity to use language to symbolize emotions; c) a limited imaginative capacity and fantasy life; d) a utilitarian way of thinking with a stimulus bound, externally oriented cognitive style (Nemiah, Freyberger, Sifneos, & others, 1976; Taylor, Bagby, & Parker, 2003).

The most frequently used psychometric instrument for alexithymia is the self-report 20-item Toronto Alexithymia Scale (Bagby, Parker, & Taylor, 1994a). It consists of three components of the original alexithymia construct of Sifneos (1973) only: Difficulty identifying feelings (DIF), difficulty describing feelings (DDF) and an externally oriented thinking (EOT) style. The original facet of a restricted fantasy life has not been included in TAS-20. (Parker, Taylor, & Bagby, 2003) later on demonstrated that it is part of the EOT subscale (Bagby, Taylor, & Parker, 1994b).

Vorst and Bermond (Vorst and Bermond, 2001) constructed a questionnaire based on a broader operationalization of alexithymia. The Bermond-Vorst Alexithymia Questionnaire (BVAQ; Vorst and Bermond, 2001) consists of five subscales, one of which is *Emotionalizing*, i.e. the extent to which someone is emotionally aroused by emotion inducing events. They also included *Fantasizing* explicitly into their questionnaire.

Originally, Sifneos (1973) argued that alexithymia predisposed individuals to “classical psychosomatic” disorders. Recent studies showed that psychiatric patients tend to score high on alexithymia scales (Frewen, Dozois, Neufeld, & Lanius, 2008; Porcelli et al., 2004). Although these studies point to a relationship between alexithymia and psychiatric disorders, they do not provide information on the extent to which alexithymia predisposes individuals to psychiatric disorders in normal population. Recently Liang and West (2011) and Leising, Grande, & Faber (2009) provided evidence that alexithymia is highly correlated with psychological distress in healthy population. Alexithymia is a broad concept, which embodies several dysfunctions in emotional communication. Therefore it is important to understand whether alexithymia per se is a risk factor to psychological distress or there are subgroups of alexithymic individuals who are more or less susceptible to psychological distress.

In the present study our goal was to explore alexithymia as a risk factor for psychological distress in more detail. In order to do this, it is essential to differentiate subgroups within the population of high-alexithymic individuals with reference to TAS-20 and BVAQ and to quantify the risk for psychological health accordingly for these subgroups. This approach might allow us to see if certain alexithymic features are linked closer to psychological distress than others. Liang and West (2011) have already reported that difficulty identifying and describing feelings correlates with psychological distress, while externally oriented thinking style does not. In the present study similar to research before (Leising et al., 2009; Liang & West, 2011) the frequency of reported psychiatric symptoms will be used as a marker of psychological health.

To examine potential subgroups of alexithymia, we employed latent profile analysis. Recently, Moormann et al. (2008) proposed the idea of alexithymia subtypes. They created these subtypes based on factor scores (high vs. low) on two higher order-factors that underlie the BVAQ: A cognitive factor (*Identifying, Verbalizing*) and an affective factor (*Emotionalizing, Fantasizing*), with *Analyzing* loading on both factors. The study of Bagby et al. (2009), using CFA and cluster analysis in a large sample, did not support the two higher-order factor structure of the BVAQ and the proposed subtypes by Moormann and colleagues (2008). No

study to date has used latent profile analysis (LPA) for a refinement of the discussion on alexithymia subtypes. However, as the present study attests latent profile analysis provides more information about the group-membership of the individuals than the factor analysis, which is a measure for the grouping of items of a questionnaire rather than individuals. The aim of the present research is to detect different latent subgroups (profiles) of alexithymia, to explore whether these subgroups differ in psychological distress and other variables such as personality traits and measures of emotional experience.

3.2. Methods

3.2.1. Measures

Measures of alexithymia

TAS-20

The 20-Item Toronto Alexithymia Scale is a self-report instrument with replicated validity and reliability (Bagby et al., 1994a; Bagby et al., 1994b; Taylor et al., 2003). It gives a total score that is derived from three subscales; Difficulty Identifying Feelings (DIF; seven items), Difficulty Describing Feelings (DDF; five items), and External Oriented Thinking (EOT; eight items). The items are rated on a Likert Scale ranging from 1 to 5, resulting in a maximum score of 100 points. Higher scores indicate a higher load of alexithymia. The factorial structure of TAS-20 has been shown to be stable and valid in the English version (Parker et al., 2003) and other European and non-European languages (Taylor et al., 2003). The first two factors (DIF and DDF) of the German version were found to have satisfactory internal consistencies (Cronbach's α s from .69 to .81) (Bach, Bach, De Zwaan, & Serim, 1996). It has been repeatedly found that the third factor (EOT) has lower α scores (.55 to .61), although it is the scale with the highest number of items (Bach et al., 1996; Parker et al., 2003). The average inter-item correlations of the whole TAS-20 and each subscale are also acceptable (0.23 for TAS-20, .37, .40, .24 for the subscales DIF, DDF, EOT respectively (Parker et al., 2003).

BVAQ

The Bermond-Vorst-Alexithymia-Scale (Vorst & Bermond, 2001) consists of five subscales, each scale comprising eight items. It is a self-report questionnaire of alexithymia with a high statistical quality. It was developed in Dutch but has been validated in many other languages including German (Müller, Bühner, & Ellgring, 2004). The five subscales of the BVAQ are 1) difficulty in *Emotionalizing*: the degree to be emotionally aroused by emotion inducing events 2) difficulty in *Fantasizing*: The degree to which someone tends to fantasize, imagine, day-dream, 3) *Identifying*: difficulty to define one's own arousal states, 4) *Analyzing*: the restrained tendency to seek explanation for one's own emotional reactions, and 5) *Verbalizing*: the extent to which someone is able to communicate one's own emotional states and reactions (Vorst & Bermond, 2001). Each item is rated on a 1 to 5 point Likert scale. The maximum score possible is 200. Higher scores indicate a higher load of alexithymia. The total BVAQ score has a Cronbach's α coefficient of .83, which is highly satisfactory although the α scores of the subscales range from .54 to .80, with *Emotionalizing* having the lowest internal consistency (Müller et al., 2004).

Measure of personality dimensions

NEO-Five Factor Inventory (NEO-FFI)

This inventory consists of 60 self-report items rated on a 0 to 4 point Likert scale. Higher scores indicating higher levels on that personality dimension: Neuroticism (N), Extraversion (E), Openness (O), Agreeableness (A) and Conscientiousness (C). The German translation by Borkenau and Ostendorf (1993) was used in the present study. The NEO-FFI is a condensed form of the NEO-Personality Inventory (Costa & McCrae, 1992) and has an adequate internal consistency (α of each scale ranging from .64 to .80; (Müller et al., 2004), temporal stability, and construct validity.

Measure of emotional experience

The scale for attention to feelings and clarity of feelings

The scale for the assessment of attention to feelings and clarity of feelings

(Lischetzke, Eid, Wittig & Trierweiler, 2001) consists of 12 items that are rated on a 1 to 4 point Likert scale. The instrument was developed in German and has strong psychometric properties with a stable two-factor structure and high internal consistencies of .87 for attention to and .88 for clarity of feelings (Lischetzke et al. 2001).

Measure of psychological distress

Symptom Check List-90-Revised

The SCL-90-R (Derogatis, 1977; Franke, 1995) is widely used internationally for the assessment of psychological distress. It consists of 90 items with nine subscales and has demonstrated adequate reliability and satisfactory construct validity. The subscale scores were not included in the following analysis because the subscales were highly intercorrelated (Hessel, Schumacher, Geyer, & Brähler, 2001). The PST (*Positive Symptom Total*, absolute number of exhibited symptoms) will be used in the analysis as an indicator for general psychological distress.

3.2.2. Sample

Subjects were recruited via an announcement in the public transport system. They filled out the TAS-20 online. Those who had a score equal to or above 60 at least in two subscales of TAS-20 (subscale scores have been transformed to 1-100 to enable this) were invited for further investigation. Thus the sample included high-alexithymic individuals (h-ALEX) only. Since alexithymia is a stable trait only after late adolescence (Mattila, Salminen, Nummi & Joukamaa, 2006), subjects younger than 22 years of age were excluded from the analysis. Mean age of the sample was 35.5 (SD = 11.4). The sample included 96 women (44.2%) and 98.3% of all participants had at least a secondary school degree. The final sample consisted of 217 individuals who all reported German to be their first language. Participants received an information leaflet and €30 each for their participation. The study was compatible to the requirements of the Helsinki Agreement and approved by the institutional ethics committee.

Table 3-1: Means and SDs of the applied instruments ($N=217$)

	No. of Items	Range	Mean	SD
TAS-20 total	20	56 - 96	68.2	7.0
Difficulty identifying feelings	7	10-35	24.41	4.3
Difficulty describing feelings	5	14-25	20.40	2.6
Externally oriented thinking	8	14-38	23.37	4.3
BVAQ Total	40	91-174	131.3	15.9
Verbalizing	8	21-40	33.5	4.4
Identifying	8	16-40	28.9	5.1
Analyzing	8	9-39	22	6.7
Fantasizing	8	8-38	21.5	7.4
Emotionalizing	8	17-35	25.3	3.5
NEO-FFI				
Openness	12	0.58-3.58	2.46	.61
Neuroticism	12	0.17-4.00	2.28	.80
Extraversion	12	0.50-3.25	1.80	.62
Agreeableness	12	0.25-3.67	2.29	.58
Conscientiousness	12	0.67-4.00	2.51	.69
Attention to feelings		1.00-4.00	2.17	.68
Clarity of feelings		1.00-3.83	1.86	.55
SCL-90-R PST		0-81	41.18	16.97

Note. TAS-20 = Toronto Alexithymia Scale (with a 1-4 point Likert Scale, 80 is the maximum total score), BVAQ = Bermond-Vorst Alexithymia Scale, NEO-FFI = NEO-Five Factor Inventory, SCL-90-R = Symptom Check List-90-Revised, PST = Positive Symptom Total.

3.2.3. Procedure

The 217 individuals who had qualified for further evaluation were invited to attend a group session to complete the research questionnaires. After reading and

signing the consent form, subjects filled out the questionnaires on a personal computer.

In the group session the BVAQ, the NEO-FFI, the scales for attention to and clarity of feelings, the SEE, and the SCL-90-R were administered. The means and standard deviations of all instruments can be found in Table 3-1.

3.2.4. Statistical analyses

All analyses were conducted using the software Mplus (Version 7; Muthén & Muthén, 1998). First, a latent profile analysis (LPA; Lazarsfeld & Henry, 1968) was conducted and distinct mean score profiles within the high alexithymic (h-ALEX) sample were identified. LPA is distinct from latent class analysis in the traditional sense because of its use of continuous indicators. Common to both mixture approaches is the assumption of population heterogeneity or qualitatively different subtypes underlying the observed data structure. In LPA, subtypes are characterized by their distinct profile of mean scores on the indicator variables.

Second, following the procedure suggested by (Vermunt, 2010) and implemented in Mplus 7 (Asparouhov & Muthén, 2012), sets of external variables were related as covariates to the identified latent profiles in a modified three-step method. This method avoids two problems commonly associated with the prediction of latent classes: On the one hand, the measurement model that is used to decide on the number of mixture components is not influenced by the covariates as it would be in a simultaneous estimation. This has particular importance in studies such as the present one, where the number of covariates is large and the relationships between covariates and profiles are investigated in a more exploratory manner. On the other hand, the common approach to assign each individual to his or her most likely profile and treating profile membership as a manifest variable in a multinomial logistic regression model reintroduces classification error. As a result, regression coefficients would be biased. In contrast, the modified three-step method links the assigned profile membership to the latent profile by using the classification error probabilities as weights. The estimates for the effects of covariates on these reconstructed latent profiles are hardly biased. For all analyses

a significance level of $\alpha = .05$ is considered.

Latent Profile Analysis

The aim of LPA is to determine the number and character of unobserved subtypes to account for the mean and covariance structure found in the dataset. In this study, indicators for the LPA were the individual sum scores of the five BVAQ subscales *Identifying*, *Verbalizing*, *Analyzing*, *Fantasizing* and *Emotionalizing*. The TAS-20 subscales were treated as external variables instead of indicators, because they had already been used in the process of sample selection and had been assessed in a non-laboratory (online) setting. As a baseline, the model served as a saturated model that perfectly reproduced the sample's mean and covariance structure. Different LPA models, with the number of profiles ranging from two to five were then compared to the baseline model and each other. The assumption of conditional independence was kept; none of the subscales were allowed to correlate within each latent profile. All models were estimated using maximum likelihood with robust standard errors. The Mplus syntax for the model setup is available from the second author.

There is still some disagreement concerning the rules in determining the number of groups in LPA models (e.g., Lubke & Muthén, 2005; Marsh, Lüdtke, Trautwein, & Morin, 2009). One possibility is to compare models by information criteria (Read & Cressie, 1988). These statistics take model parsimony into account, so that smaller index values indicate a better fit in relation to model complexity. There is evidence that the Bayesian Information Criterion (BIC) performs best in mixture models (Nylund, Asparouhov & Muthén, 2007). We thus gave the BIC priority in interpreting our results. We will also report the results of the Vuong-Lo-Mendell-Rubin likelihood ratio test (VLMR-LRT; Lo, Mendell & Rubin, 2001) that tests the null hypothesis that a model having one class less than the model considered has generated the data. A significant result means that the model considered should be favoured over a model with one class less.

Logistic Regression Analyses

In order to get a more detailed picture of the character of the obtained profiles, multinomial logistic regression models were specified to predict profile membership in the context of the modified three-step-method. Three sets of predictors were specified and tested in separate models: (A) the TAS-20 subscales and the number of positive symptoms (PST of SCL-90-R) as an indicator of psychological distress; (B) the five NEO-FFI personality dimensions, and (C) attention to feelings and clarity of feelings.

3.3. Results

3.3.1. Latent Profile Analysis

Information criteria and additional goodness-of-fit measures for the baseline model and the LPA models can be found in Table 3-2. According to BIC, the 3-profile-model should be considered. Further support for the 3-profile-model comes from the VLMR-LRT. The small p -value $< .05$ for the 3-profile-model indicates that a 2-profile model should be rejected. The larger p -value for the 4-profile-model indicates that a 3-profile model should not be rejected. In addition, all three profiles in the 3-profile solution show substantial sizes and high mean classification probabilities ($> .84$), which provide information on how well individuals can be assigned to the profiles.

Table 3-2: Goodness-of-fit measures for different numbers of profiles

	Baseline model	No. of extracted profiles			
		2	3	4	5
BIC	6692	6691	6681	6692	6705
p (VLMR- LRT)		.0003	.0456	.1318	.1394
Smallest group (%)	100	28	25	8	7

Note. BIC = Bayesian Information Criterion. VLMR-LRT = Vuong-Lo-Mendell-Rubin Likelihood-Ratio-Test

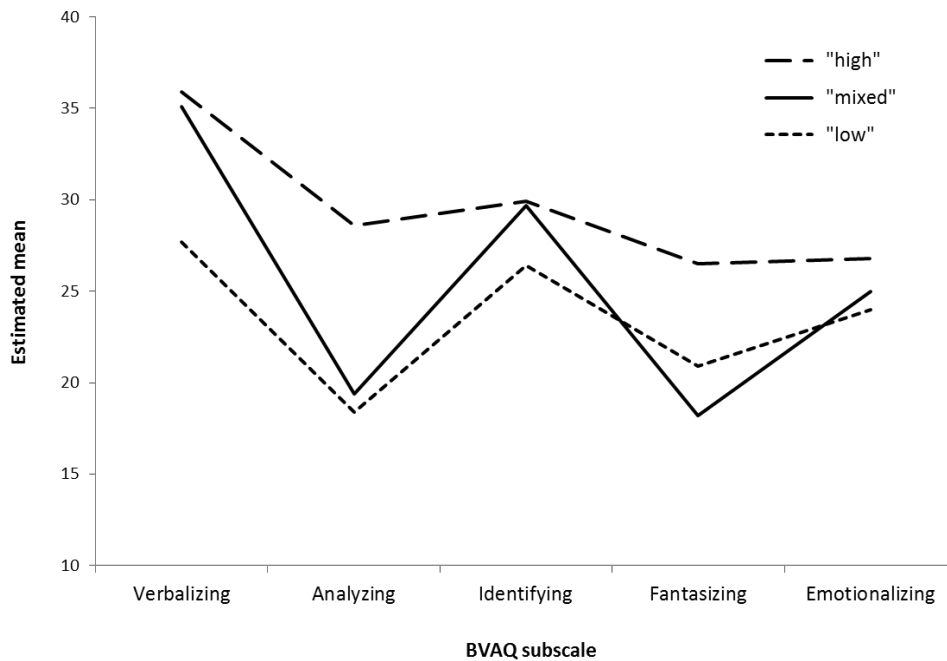


Figure 3-1. Estimated means of the 3-profile solution. Possible score range on BVAQ subscales is 8-40.

The patterns of the estimated means on the BVAQ subscales for the three profiles are depicted in Figure 3-1. High mean levels imply high difficulties in the corresponding domain. The different profiles can be characterized as follows: One profile is distinguished by high mean levels on all subscales and comprises about 32% of the sample (dashed line in Figure 3-1). Within the population of h-ALEX, the individuals belonging to this profile report high levels of difficulty in all domains represented by the BVAQ subscales. This will be referred to as the “high” profile. In contrast, there’s another profile that consists of 25% of the sample and exhibits considerably lower mean levels on all BVAQ subscales (dotted line in Figure 3-1). Besides “low” and “high” profiles, there is a third profile that comprises the remaining 43% of the sample (solid line in Figure 3-1). This profile does not simply show intermediate mean score levels, but reveals a distinct pattern with profound differences depending on the subscales: On the subscales *Verbalizing* and *Identifying*, it matches the level of the “high” profile. On the subscales *Analyzing* and *Fantasizing*, it matches the level of the “low” profile. The mean for *Emotionalizing* lies in between the other two profiles. This will be referred to as the “mixed” profile. It represents a particularly interesting subgroup of h-ALEX individuals, because the corresponding participants report severe

difficulties in identifying and describing feelings, that are typical for alexithymia, but do not feel equally restricted in their fantasy life or describe their thinking style to be strongly externally oriented. In the next section, different sets of external variables are linked to the profiles in order to explore how these aspects of alexithymia are embedded and intertwined with broader constructs of personality, emotional experience and psychological distress.

3.3.2. Logistic Regression

In this section, we will relate certain non-alexithymia measures to the identified profiles and see which characteristics allow us to predict that someone is assigned to one particular profile rather than another. In choosing the “mixed” profile as reference group in the multinomial logistic regression, we put emphasis on contrasting the “mixed” profile with the general “low” and general “high” profiles. The “high” and “low” profiles are already well distinguishable by their BVAQ mean scores and measures known to be associated with it. The regression coefficients for the three predictor-sets in separate multinomial logistic regression models can be found in Table 3-3. Note that all coefficients are in logit form and interpreted as partial regression coefficients, adjusted for all other effects in the same model.

(A) TAS-20 subscales and the number of positive symptoms. As the EOT scores increase, the probability of being assigned to the “high” profile rather than the “mixed” profile increases. This is not surprising, given the strong overlap of the TAS-EOT scale with the BVAQ *Analyzing* scale that these two profiles differ in. Similarly, to be assigned to the “low” profile compared to the “mixed” profile becomes less likely with higher DDF (difficulties in describing feelings) scores. DIF has no significant effect, which corresponds to Figure 1, where it can be seen that the differences between the profiles on the *Identifying* scale are not as pronounced. The fourth predictor in this model, number of positive symptoms on the SCL-90-R has an interesting effect. When number of reported symptoms increase, it becomes less likely to be assigned to either the “high” or the “low” profile. To illustrate the magnitude of this effect, imagine a h-ALEX individual with an average number of positive symptoms (41, see Table 3-1) compared to an extremely distressed h-ALEX individual with the maximum reported number of 81 symptoms. Let both

have equal scores on the TAS subscales. The chances for the extremely distressed h-ALEX individual to be assigned to the “mixed” profile rather than to the “high” profile are about seven times higher than for the moderately distressed h-ALEX individual ($B_{\text{pst}} = -.05$; $OR = e^{(B_{\text{pst}})} = 0.95$; Difference of 40 symptoms gives $.95^{40} = .14$; Inverse for “mixed” compared to “high” is $1/.14 = 7.14$). In short, the individuals assigned to the “mixed” profile seem to exhibit more psychological distress than the individuals assigned to the other two profiles. We will elaborate on this point in the discussion.

(B) Of all personality dimensions (NEO-FFI) only neuroticism and openness have an effect. The negative logits for neuroticism and openness indicate that higher levels of these dimensions involve an increasing probability of being assigned to the “mixed” profile compared to the other two profiles.

(C) Attention to feelings and clarity of feelings. This model reveals an interesting pattern of effects. There are differential effects for the “high” and “low” profiles. The “high” profile is distinguishable from the “mixed” profile by a strongly decreased level of attention to feelings, whereas the “low” profile is distinguishable from the “mixed” profile by an increased, but not significantly different level of clarity of feelings. The combination of high attention to feelings and low clarity of feelings strikes us as the peculiarity of the “mixed” profile.

In summary, the “mixed” profile seems to be characterized by higher psychological distress, neuroticism and openness compared to the remaining two profiles. It can be distinguished from the “high” profile by a higher level of attention to feelings and from the “low” profile by lower clarity of feelings.

Table 3-3: Logistic regression coefficients for predictor sets A to C.

Set	Scale	<i>Non-reference profiles</i>							
		<i>“high”</i>				<i>“low”</i>			
		<i>B</i>	<i>SE</i>	<i> z </i>	<i>p</i>	<i>B</i>	<i>SE</i>	<i> z </i>	<i>p</i>
A									
	TAS-DIF	-0.09	0.09	1.01	.311	0.18	0.15	1.18	.237
	TAS-DDF	-0.12	0.16	0.79	.432	-0.81	0.19	4.20	<.001
	TAS-EOT	0.30	0.09	3.41	.001	-0.10	0.11	0.93	.352
	Positive symptoms	-0.05	0.02	2.67	.008	-0.06	0.03	2.45	.014
B									
	Neuroticism	-1.82	0.81	2.27	.024	-0.33	0.39	0.85	.393
	Extraversion	-0.49	0.61	0.81	.417	0.88	0.56	1.57	.116
	Openness	-4.03	1.59	2.53	.011	-0.69	0.72	0.96	.335
	Agreeableness	0.01	0.61	0.01	.994	1.05	0.58	1.80	.071
	Conscientiousness	0.20	0.52	0.39	.696	0.47	0.44	1.07	.283
C									
	Clarity of feelings	-0.68	0.70	0.98	.327	2.70	0.73	3.70	<.001
	Attention to feelings	-5.42	1.13	4.80	<.001	0.38	0.57	0.67	.503

Note. The “mixed” profile serves as reference group. $|z|$ is the absolute value of the ratio B/SE . B =the coefficient on the independent variable, SE =Standard Error.

3.4. Discussion

The aim of the present study was to explore a specific combination of alexithymic features as a risk factor for psychological distress by means of latent profile analysis. LPA revealed a 3-profile solution. Each profile was characterized by a distinct mean score pattern on alexithymia subscales as well as on external measures of personality (NEO-FFI), emotional processing (attention, clarity), and psychological distress (PST).

Contrary to general expectations, this study shows that individuals with the highest alexithymia scores had the lowest levels of psychological distress. However, higher levels of alexithymia have been repeatedly found to be related to many psychiatric disorders (Taylor & Bagby, 2004). The present study highlights the importance of considering the scores on the alexithymia subscales and their specific combination rather than using the total score in these analyses. Apparently, the combination of distinct difficulties in identifying and describing feelings paired with a rather low tendency to externally oriented thinking plays a role in the relation commonly found between alexithymia and psychological distress. Two other dimensions that seem to be useful in distinguishing this “mixed” group from “high” and “low” alexithymic individuals are attention to and clarity of feelings. Whereas attention and clarity are both relatively high in the “low” group, and the “high” group exhibits low attention to and clarity of feelings, the “mixed” group is characterized by high attention and low clarity at the same time. In the following, we will discuss why this “mixed” group is more prone to psychological distress than the “high” group with the highest total scores.

The present study points to a mismatch between attention to one’s own feelings and the clarity of feelings in the “mixed” group. These individuals reported paying attention to their feelings but were still unclear about them. This discrepancy between the need to understand and failing in understanding one’s feelings will most likely lead to frustration and might be the reason why the “mixed” group has a higher tendency toward psychological distress. On the other hand, “high” profile individuals pay less attention to their unclear feelings, so that the proposed mismatch is absent in this group. Another facet of alexithymia that “mixed” and “high” profile individuals differ in was *Fantasizing*. The “high” group had a distinct impairment in fantasizing. On the contrary, the “mixed” individuals reported fewer difficulties in fantasizing, and they showed higher values on openness to experiences. Impaired ability to fantasize is one of the main facets of the original alexithymia construct (Nemiah et al. 1976). Bagby and colleagues (Bagby, Taylor, et al., 1994a) did not include this dimension in the TAS-20 because of its relation to social desirability (Parker et al. 2003), and they argue that EOT already measures fantasizing, albeit indirectly (Bagby et al. 1994b). Although not being included in their instrument, the authors of the TAS-20, however, argue similar to Vorst and

Bermond (2001) that fantasizing belongs to the core concept of alexithymia. Our results indicate that fantasizing, as a core component of alexithymia has to be reconsidered. Aside from *Fantasizing* the main difference between “mixed” and “high” profile individuals seems to lie in the difficulty in *Analyzing* (understanding and decoding) one’s own emotions and the externally oriented thinking style. Externally oriented thinking style is one of the main facets of the original alexithymia definition (Nemiah & Sifneos, 1970) and part of both self-report instruments. It represents the concept of *pensée opératoire* (Marty & M’uzan, 1963), which defines the tendency to have a cold, technically oriented thinking style. In our sample, the typical alexithymic individuals with high scores on all dimensions including *Analyzing* experience significantly less psychological distress than the group of alexithymic individuals, who score particularly low in *Analyzing* and *Fantasizing*.

Our findings are somewhat contradictory to the direct link commonly drawn between alexithymia and psychiatric symptoms. Especially the notion that alexithymia per se may lead to psychosomatic disorders because of the failure to interpret physical arousal that accompanies emotional experiences (Taylor, Bagby, & Parker, 1991; Taylor et al. 2004; De Gucht & Heiser, 2003; Mattila et al., 2008) has to be revised. Alexithymia is conceived as a multidimensional construct and is measured as such by the TAS-20 and the BVAQ; it is only consistent to test hypotheses regarding risk factors for psychiatric diagnoses on the level of the distinct subscales. In addition to general scores of psychological distress, we find it is important to point out that “mixed” profile individuals have much higher somatization and depressive symptom-frequency than the “high” profile individuals (see Figure 3-2).

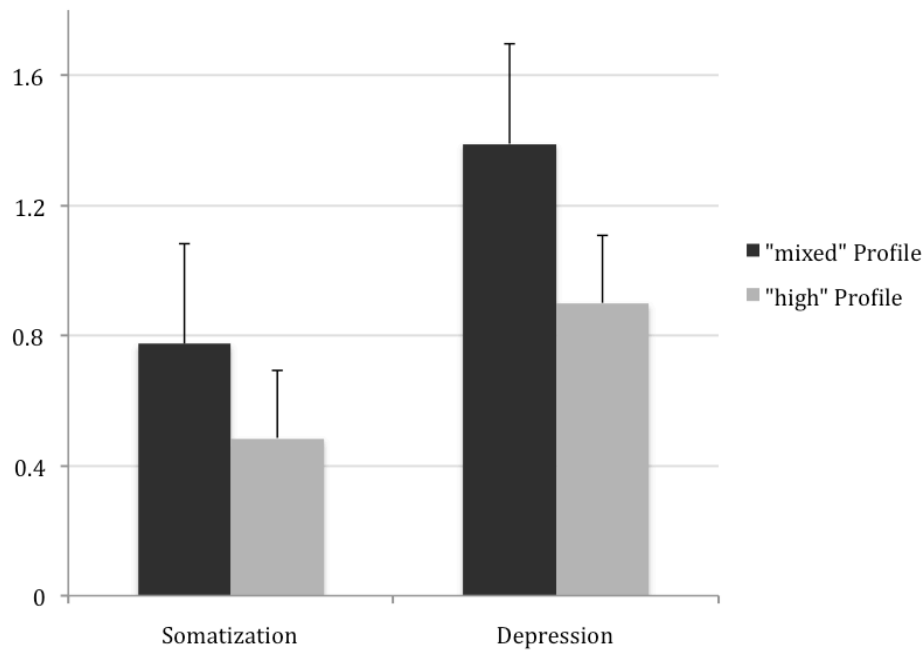


Figure 3-2. Scores from Somatization and Depression subscales of SCL-90-R. High-distressed individuals have significantly higher number of somatization $t(102):2.3317$; $p= 0.0217$ and depressive symptoms $t(102):2.8812$; $p= 0.0048$.

The present study has been conducted with a sample of high-alexithymic individuals. Since alexithymia is a dimensional, not a categorical construct, one might argue against the use of a group of individuals over a specific cut-off score. The present study was designed this way because of the acknowledged risk of high-alexithymic individuals to develop psychiatric disorders. For that reason, we specifically sampled from the far right end of the normal distribution of alexithymia in order to enrich the sample accordingly. We are aware that there might be other latent profiles underlying the total spectrum. Yet the focus was on the differentiation within high-alexithymic individuals. A representative sample may have clouded these specific differences within h-ALEX individuals, since the latent profiles extracted would be dominated by profiles differentiating between the more common medium levels of alexithymia facets. Future studies are needed to explore the latent profiles underlying the whole spectrum of the ability to identify and describe emotions.

Positive aspects of the current study are the use of a large community based sample with a wide age range and the application of both of the commonly used

questionnaires for alexithymia. A limitation of the study is that the study depended solely on self-report instruments. Because of the impairments of alexithymic individuals in the domains of emotional self-awareness and verbal expression, using this method for determining the levels of alexithymia might be problematic (Meganck, Vanheule, Desmet, & Inslegers, 2009; Stingl et al., 2008). Future research is needed to explore the alexithymia construct as a risk factor for psychiatric disorders using objective measures of alexithymia, such as the Toronto Alexithymia Interview (Bagby et al., 2006), and the Observer Alexithymia Scale (Haviland, Warren, & Riggs, 2000).

In conclusion, our results point to the heterogeneity of the alexithymia construct. Dynamics between subscales of alexithymia are shown to be crucial for psychological distress. Our study indicates that the commonly held notion that high alexithymia scores are necessarily a risk factor for psychological distress needs to be revised. Quite to the contrary, two facets of the alexithymia construct, mainly high EOT and low *Fantasizing*, might actually have a protective value for alexithymic individuals, because these characteristics shield them from psychological distress. The underlying mechanisms of this phenomenon cannot be revealed by the current study and remain subject to further research.

4

HPA System Activity in Alexithymia: A Cortisol Awakening Response Study*

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Contributions: E.A.H., I.H. designed research, E.A.H., S.A. collected data, E.A.H. analyzed data, E.A.H. wrote the article, I.H. supervised.

5

No words for feelings, not only for my own: Diminished emotional empathic ability in Alexithymia*

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Contributions: Elif Alkan Härtwig, H.R. Heekeren and Isabella Heuser designed research; E.A.H. and Sabine Aust collected data; E.A.H. analyzed data and wrote the article. H. R. H and I.H. supervised.

Abstract

Objectives and Methods: The present study has been designed to disentangle cognitive and emotional dimensions of empathy in a group of mentally healthy and highly alexithymic individuals (h-ALEX, n=24) and well-matched controls (l-ALEX, n=26) with Interpersonal Reactivity Index (IRI) as questionnaire measure, and Multi Faceted Empathy Task (MET) used during the fMRI and after the fMRI. Simultaneously, Skin Conductance Response (SCR) has been acquired as an implicit measure of emotional reaction.

Results: Results show an impaired emotional empathic ability in alexithymic individuals, with lower levels of SCR and higher activation in prefrontal brain regions such as VLPFC and IFG. Cognitive empathy was not impaired in the alexithymic group and the results were accompanied by a higher activation left-IFG.

Conclusions: The study leads to the conclusion that alexithymia does not only involve a diminished ability to identify and describe one's own emotions. Furthermore, it is related to a deeper disability of emotion regulation, which becomes visible in impaired emotional concern for others and higher levels of personal distress.

Keywords: Alexithymia, fMRI, cognitive empathy, emotional empathy, subjective arousal

5.1. Introduction

Understanding each other, cognitively as well as emotionally, is one of the marks of the human. However, humans are differently equipped with the ability to understand others and oneself. Some of these inabilities might stem from a mental disorder, while others can be attributed to differences in personality. Some personality traits lay on the border of personality accentuation and disorder and have yet to be researched. Alexithymia is one such trait.

Alexithymia (Sifneos, 1973) is a personality trait associated featuring impairments in identifying and describing one's own emotions, an externally oriented thinking style and restricted ability to fantasize. 10% of the general population has been estimated to be highly alexithymic (Franz et al., 2008). Alexithymia has been associated with many psychiatric disorders and is considered a risk factor for mental health (Conrad, Wegener, Imbierowicz, Liedtke, & Geiser, 2009; Taylor, 2004).

Since the understanding of one's own emotional states is impaired in alexithymia, there has been growing interest in alexithymia's implications for social cognition (Grynberg, Luminet, Corneille, Grèzes, & Berthoz, 2010; van der Velde et al., 2013). A core aspect of social cognition, empathy, has been reported to be reduced in alexithymic individuals (Grynberg et al., 2010; Moriguchi et al., 2007). Moriguchi et al. (2006) reported lower levels of emotional concern, poorer ability of theory of mind (ToM) and higher levels of personal distress in highly alexithymic individuals.

Empathy is an isomorphic affective state arising from the affective state of another individual, in which the observer is aware that the origin of the emotion is within the other (Engen & Singer, 2013). It is a multi-dimensional concept (Davis, 1983; Davis et al., 1980; Dziobek et al., 2008) with cognitive and emotional dimensions, both separable yet related to each other. According to Dziobek et al. (2008) cognitive empathy (CE) encompasses the capacity to infer affective states of others and to be able to take the perspective of others, and as a result of this process, to be able to name those emotions, a concept similar to Theory of Mind (ToM). Emotional empathy (EE), on the other hand, is one's emotional response to the emotional states of others, e.g. feeling concern.

Alexithymia has been found to be a determining variable of empathic functioning in high-functioning autistic individuals (Bird et al., 2010). In a population of autistic spectrum disorders, Dziobek and colleagues (2008) demonstrated that high-functioning autistic individuals showed lower levels of cognitive empathy but equal levels of emotional empathy compared to people without autism. While it was long assumed that autistic individuals have diminished empathic ability (Gillberg, 1992), research in the last two decades has shown that ToM ability is diminished in high-functioning autistic individuals, but not emotional empathic ability (Dziobek et al., 2008). In an earlier fMRI study focusing on interoceptive awareness in individuals with an autism spectrum condition with and without alexithymic symptoms, Silani et al. (2008) suggested that it was the degree of alexithymia, not the autism spectrum condition, which was a stronger predictor of the brain activity in the interceptive cortex (i.e. anterior insula) and reduced levels of empathy. Bird and colleagues (2010) confirmed this when they found an increased activation in the left anterior insula during empathizing to the suffering of others. The signal in the left anterior insula was predicted by the level of alexithymia in both autism spectrum and control groups, hence their suggestion that the level of alexithymia is a predicting factor for level of empathic ability, not solely autism.

The assumption of the two distinct ways of social cognition also find support in brain research, with different neural routes for its two components. The Theory of Mind has been shown to be associated with medial prefrontal cortex, superior temporal sulcus and adjacent temporoparietal junction (Frith & Frith, 2006; Mitchell, 2008). Emotional empathy has been shown to be associated to insular, anterior cingulate and somatosensory cortices (Bird et al., 2010; Lane et al., 1998). Core regions for empathy such as the temporal parietal junction, temporal pole, orbitofrontal cortex, and inferior frontal gyrus have rarely been reported in studies on alexithymic samples (Kano et al., 2003; Kano, Fukudo, & undefined, 2013; Moriguchi et al., 2007). As a rare evidence, in correlational studies, Moriguchi et al. (2009, 2006) reported impaired IFG and MPFC activity related to alexithymia in a Theory of Mind task (Moriguchi et al., 2006).

The current study has been designed to get a deeper understanding of alexithymia and cognitive and emotional components of empathy in a mentally healthy sample.

As stated above, many studies to date used alexithymia as a correlational variable or used clinical or samples that were not screened. Mental illnesses and their etiological backgrounds are highly complicated. It is a challenge to discern if the ability to identify and describe one's own emotions is altered due to a previous mental illness or if the alexithymic personality accentuation makes one prone to developing mental disorders. For these reasons, the present study eschews a correlational approach. It is rather based on two extreme groups of high-alexithymic and low-alexithymic individuals, both free of current and past mental illness. This attention to the subjects was not only a methodological issue, but is essential to understanding the true relationship between alexithymia and any related human ability, without the confounding effects of mental disorders.

Based on Bird et al. (2010) and Moriguchi (2006), our first hypothesis is, that high alexithymic mentally healthy individuals have an impairment of the emotional dimension of empathy. Guided by the common definition of alexithymia (Sifneos, 1972), alongside an inability of identifying emotions of one's own, our second hypothesis is that subjects with alexithymia suffer from an impairment on the cognitive dimension of empathy.

Research on alexithymia and human brain function has been frustratingly inconsistent. Despite numerous neuroimaging studies on alexithymia (SPECT, fMRI, EEG; PET; see for details: Moriguchi & Komaki, 2013; van der Velde et al., 2013), after more than 20 years of research on brain function in alexithymia, researchers have failed to identify a common pattern of brain function related to altered empathic ability in alexithymia. Thus, our study applies a whole-brain approach without specific ROI-analyses with the aim to explore the differences in brain activation between two dimensions of empathy in alexithymic individuals and controls.

5.2. Methods and materials

5.2.1. Sample

A group of 24, mentally healthy and highly alexithymic individuals (h-ALEX) from a community based healthy sample and 26 strictly matched control subjects (l-ALEX) participated in the study. All subjects were recruited via an announcement in the public transport system. They filled out an online version of the TAS-20. Those that had a score above 56 and lower than 40 were invited for further investigation (the Cut-offs has been decided based on Bagby, Taylor, & Parker, 1994b and Taylor, Bagby, & Parker, 2003). In the next session participants have filled out a set of questionnaires including the Bermond and Vorst Alexithymia Questionnaire (BVAQ; (Vorst & Bermond, 2001). Later on, the participants who were interested in participating and suitable for magnet resonance imaging were interviewed with M.I.N.I. (Sheehan et al., 1998) clinical interview. All participants with past or current psychiatric disorders and substance abuse and with severe medical conditions were excluded from the study (see Table 5-1 for demographics). The local ethics committee of Charité Universitätsmedizin Berlin, Germany approved the study.

5.2.2. Procedure

fMRI study was a part of boarder investigations on alexithymia, which have been conducted in several sessions. Assessment of alexithymia and psychiatric interview were employed in the sessions before. On the day of experiment, current depressive mood and state and trait anxiety have been assessed before the experiment. Participants have been informed thoroughly about the experiment and magnet imaging. A demo version of the experiment (with other stimuli than in the original experiment) has been shown on a PC. Participants gave written consent prior to the experiment and were reimbursed with 20 Euros at the end of the session.

After the acquisition of imaging data, subjects participated in a post-experimental rating on a PC. Post-Experimental rating was identical to the experiment (see 5.2.4.1.) but with a Likert scale of 1-9 and additionally there was also an additional a block

for „the experienced clarity of the seen emotion“ with the question: “How well this picture depicts the emotion X?”.

5.2.3. Psychometric assessment

Level of alexithymia was measured thoroughly by TAS-20, BVAQ and OAS. Alexithymia has been found to be associated with anxiety (Espina Eizaguirre, Ortego Saenz de Cabezón, Ochoa de Alda, Joaristi Olariaga, & Juaniz, 2004) and depression, therefore The Spielberger State-Trait-Anxiety-Inventory (STAI, Spielberger, Gorsuch, Lushene, Vagg, & Jacobs, n.d, 1983; Laux, Glanzmann, Schaffner, & Spielberger, 1991) and Beck Depression Inventory (BDI; Beck, Ward, Mendelson, Mock, & Erbaugh, 1961) were examined in order to control for possible confounding variables. Participants with a BDI score over 18 were excluded from further analysis (Beck, Steer, & Carbin, 1988).

5.2.3.1 Measures

TAS-20

20-Item Toronto Alexithymia Scale is a self-report instrument with replicated validity and reliability (Bagby et al., 1994a, 1994b). It gives a total score and scores from three subscales; Difficulty Describing Feelings (DDF), Difficulty Identifying Feelings (DIF) and External Oriented Thinking (EOT); i.e. focusing on external and technical dimension of a theme, rather than focusing on feelings or other aspects of inner experience.

BVAQ

Bermond-Vorst-Alexithymia-Scale (Vorst and Bermond, 2001) consists of 5 scales, each scale comprising 8 items, is one of the measures of alexithymia with high statistical characteristics. It was developed in Dutch and meanwhile validated in many other languages including German. Scales of BVAQ are Emotionalizing, Fantasizing, Identifying, Analyzing and Verbalizing.

Observer Alexithymia Scale (OAS)

Observer Alexithymia Scale (OAS, Haviland, Louise Warren, & Riggs, 2000) is a third personal rating of alexithymic dimensions by a close friend or relative of the person. OAS has been developed based on Q-Sort technique, based on adjective descriptions of scientific and clinical experts of alexithymia. It has good internal consistency and high correlations with self-report alexithymia scales (M. G. Haviland, Warren, Riggs, & Gallacher, 2001). It reveals a total score and 6 subscores.

Interpersonal Reactivity Index (IRI)

Empathic ability was assessed using Interpersonal Reactivity Index (IRI, Davis, 1980, 1983), which consists of four subscales: Perspective Taking; *i.e. cognitively taking the perspective of the other*, Empathic Concern; *i.e. being emotionally concerned for the other*, Personal Distress; *i.e. experiencing negative feelings in response to other people's distress* and Fantasy; *i.e. emotional identification with fictional figures*.

5.2.4. fMRI Study

5.2.4.1. Stimuli and task

A modified fMRI adaptation of the Multifaceted Empathy Task (MET) (Dziobek et al., 2008) was used as experimental task. The task included 40 pictures of faces with a negative valence. For each block 10 pictures were presented randomly. There were five experimental conditions, namely: cognitive empathy, emotional empathy, subjective arousal, high level baseline gender and high level baseline age.

In all conditions a question was presented with a dichotomous answer.

Cognitive empathy (naming the emotion of the other): How is this person feeling? (with two emotion adjectives as answer choices)

Emotional Empathy (emotional concern for the other): How concerned are you for this person? (rather high / rather low)

Arousal (subjective arousal): How much does this picture arouse you? (rather high / rather low)

High-level-baseline gender: Is this person male or female? (female/ male)

High-level-baseline age: Is this person young or old? (young / old)

Extra Block for the post-experimental-rating (the experienced clarity of the seen emotion): “How well this picture depicts the emotion X?”.

5.2.4.2. Experimental Procedure

Each block started with the block question (8 s). Each stimulus was presented for 4.5 seconds. Inter trial interval was jittered (minimum 2s, maximum 16 s, mean 4 s) using OptSeq2 (OptSeq; www.surfer.nmr.mgh.harvard.edu). Stimuli was pseudo-randomized within a block and equally distributed across the blocks. The experiment consisted of two runs with 10 blocks in each and the order of the blocks was counterbalanced according to the odd and even ID-Numbers. Each run lasted 13.5 minutes. There was a short break between the runs. If the participant desired, s/he could wait for several minutes before the second run started. Stimuli were displayed using the experimental control software Presentation (Neurobehavioral Systems Inc., Albany, CA, <http://www.neurobs.com>).

The experimental stimuli were presented on the goggles, worn by the subjects. The sight was corrected individually for the subjects, who needed eyeglasses.



Figure 5-1: Example for the tasks of the experiment (A modified version of MET, Dziobek et al., 2008)

Note: HLB: High level Baseline. HLB Gender is not depicted here.

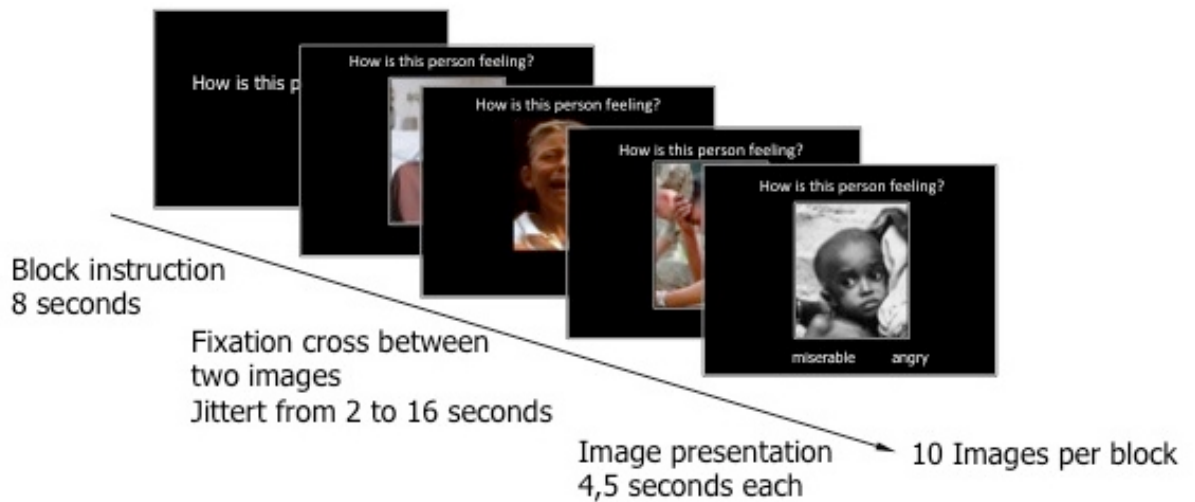


Figure 5-2: Presentation of an experimental block. Cognitive Empathy as an example.

5.2.4.3 Data acquisition

Whole brain MRI Data was collected on 3 Tesla Siemens Tim Trio (Erlangen, Germany) Scanner with a standard head coil. Head movement was minimized with foam rubber pads. A sagittally oriented T1-weighted structural volume (TE: 2.52ms; TR: 1900 ms; flip angle: 9°; FoV: 256 ; voxel size, 1 × 1 × 1 mm) was acquired for the registration of functional images. Echoplanar data (T2*) was acquired using the standard parameters (TE: 30ms; TR: 2000 ms, flip angle: 90°, FOV: 256 mm; matrix: 64 × 64; voxel size, 3 × 3 × 3 mm; 37 slices).

5.2.4.4 Data analysis

The pre-processing of the data was carried out using FEAT from FMRIB's Software Library (FSL, <http://www.fmrib.ox.ac.uk/fsl>; (Smith et al., 2004). After the slice-time correction using Fourier-space time-series phase shifting, slice-motion correction using MCFLIRT (Jenkinson, Bannister, Brady, & Smith, 2002) and non-brain removal using BET (Smith, 2002), the normalized images were smoothed using 8mm FWHM Gaussian Kernel and were high-pass filtered (sigma=50.5 s).

FLIRT (Jenkinson & Smith, 2001; Jenkinson et al., 2002) was used for the registration of functional images to subject's own high-resolution and high resolution image

to a standard image implemented by the program (MNI-152). These two transformations were used for the registration of functional image to the standard image. This third transformation was also used during the group analysis.

fMRI data was analyzed in a general linear model implemented by FEAT of FSL. Time series were modeled for each individual using event-related regressors for five conditions, instruction and response (pressing the button) and convolved with the gamma-variate of hemodynamic response function. High-level-baseline conditions for gender and age were aggregated for further analyses and named as HLB. Contrast images for Cognitive Empathy (Cognitive Empathy vs. HLB), Subjective Arousal (s.Arousal vs. HLB), Emotional Empathy (Emotional Empathy vs. HLB) were computed for each participant and spatially normalized and transformed into standard space (Jenkinson et al., 2002). We reported the activations of a priori regions of interest of cluster-corrected ($z > 2.7$, $p < .05$) higher level analyses of whole-brain data. A priori regions of interest were IFG, ACC, Insula, PCC, OFC, Amygdala, Hippocampus, temporal pole, STS, TPJ, prefrontal cortex. A priori regions of our focus are based on previous research on alexithymia and empathy (see for reviews e.g. (Frith & Frith, 2006; Moriguchi & Komaki, 2013)).

5.2.5. Psychophysiological data acquisition and analyses

Electrodermal activity (EDA) was measured as skin conductance response (SCR) with constant-voltage-technique. We applied electrode paste and placed silver-silver chloride MR capable electrodes (Brain Products GmbH, Gliching Germany) at the palmar middle phalanges of index and middle fingers of the left hand. The SCR signal was recorded in DC mode by means of a bipolar BrainAmp ExG MR amplifier (Brain Products GmbH, Gliching Germany).

EDA data was analyzed using BrainVision Analyzer 2 (Brain Products GmbH, Gliching Germany). Mean amplitude (Max-Min) over all stimuli was used as the main parameter for EDA analyses. First of all, high-pass (5 Hz, 24 dB/oct) and low-pass (0.016 Hz, time constant: 9.947, 24 dB/oct) filters were applied. Then we applied local DC detrend and baseline correction beginning 500ms before the stimulus

presentation. Min and Max markers were put automatically for each stimulus segment and corrected manually by a research assistant, who was blind to the knowledge alexithymia level of the subjects. The absolute difference between the lowest point and highest point of an SCR-curve was transported into SPSS for further analyses. Mean of amplitude from each stimuli of a block was calculated and used for group comparisons.

5.3. Results

5.3.1. Descriptive Statistics

The mean age of the 50 participants was 34.8 (SD=10.17). The high alexithymic (h-ALEX) participants (n=24, 11 females) had TAS-20 and the low alexithymic (l-ALEX) participants (n=26, 11 females) (the groups has been built according to TAS-20 scores. See 5.2.1. for details) differed significantly on all subscales and total score of BVAQ. (see Table 5-1 for the details)

h-ALEX had significantly higher scores on OAS-Total and on all subscales but somatizing: OAS-Total [h-ALEX=1.16(.40), l-ALEX=.77(.19), $T(39)=3.920$, $p<.001$], Distant [h-ALEX=1.58(.42), l-ALEX=.94(.40), $T(39)=4.935$, $p<0.001$], Insightful [h-ALEX=.98(.51), l-ALEX=.66(.32), $T(39)=2.420$, $p=0.021$], Humor [h-ALEX=.95(.50), l-ALEX=.57(.47), $T(39)=2.475$, $p=0.018$] and Rigid [h-ALEX=1.22 (.70), l-ALEX=.71(.49), $T(39)=2.479$, $p=0.009$].

There were no differences between the groups with regard to age, years of education (see Table 5-1 for details) and gender ($X^2(1)=.063$; $p=.513$).

h-ALEX had higher scores on BDI and STAI-T than l-ALEX. Therefore, all further analyses were controlled for depressivity and trait anxiety. The groups didn't differ on state of anxiety (See Table 5-1 for details). It is noteworthy that no participant had a current or past psychiatric disorder.

h-ALEX had significantly lower scores on all empathy related subscales of IRI (corrected for depressivity and anxiety): Fantasy [h-ALEX=22.38(5.1), l-

ALEX=26.31(4.4), $F(3,46)=4.165$, $p=0.011$], Empathy [h-ALEX=22.88(5.5), l-ALEX=27.54(4.7), $F(3,46)=7.686$, $p<0.001$] and Perspective Taking [h-ALEX=24.71(3.8), l-ALEX=27.58(3.7), $F(3,46)=2.862$, $p=0.047$]. h-ALEX scored significantly higher than l-ALEX on Personal Distress [h-ALEX= 18.71(5.3), l-ALEX=15.35(3.6), $F(3,46)=2.892$, $p=0.045$, corrected for depressivity and anxiety].

Table 5-1: Descriptives and TAS-20 and BVAQ scores of h-ALEX and l-ALEX

	h-ALEX	l-ALEX	T-test	
	n=24	n=26	T (df)	p
	Mean (SD)	Mean (SD)		
Age	34.96 (10.52)	34.69 (10.05)	.091(48)	.928
Years of Education	12.83 (.63)	12.46 (1.33)	1.271(48)	.221
TAS-20 Total	64.73 (6.12)	37.54 (4.49)	18.00(48)	<.001
DIF	62.20 (10.83)	34.42 (7.55)	10.58 (48)	<.001
DDF	80.41 (11.02)	39.00 (8.12)	15.20 (48)	<.001
EOT	57.16 (2.65)	40.12 (7.32)	5.76 (48)	<.001
BVAQ Total	133.20 (14,80)	84.73 (13.38)	12.16 (48)	<.001
Verbalizing	33.58 (4.35)	15.96 (4.05)	14.82 (48)	<.001
Fantasizing	22.41 (6.73)	19.19 (6.68)	1.69 (48)	<.001
Identifying	28.20(5.16)	13.96 (4.19)	10.74 (48)	<.001
Emotionalizing	26.08 (3.32)	21.15 (3.36)	5.20 (48)	<.001
Analyzing	22.91 (7.05)	14.46 (4.34)	5.14 (48)	<.001
BDI	5.58 (5.76)	2.46 (2.10)	4.12 (48)	<.001
STAI-State	34.87(5.76)	31.80(6.31)	1.78 (48)	0.80
STAI-Trait	37.16 (6.48)	30.26 (4.57)	4.37 (48)	<.001

Note: TAS-20: Toronto Alexithymia Scale, DIF: Difficulty Identifying Feelings, DDF: Difficulty Describing Feelings, EOT: Externally Oriented Thinking, BVAQ: Bermond Vorst Alexithymia Questionnaire.

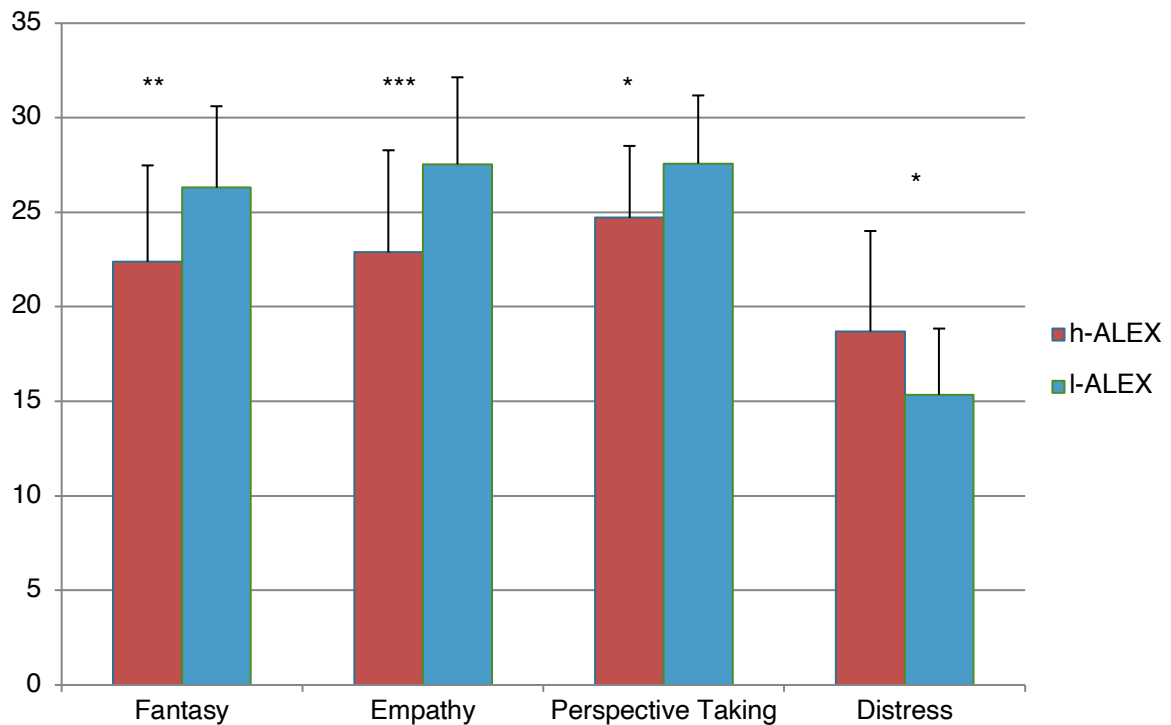


Figure 5-3: Scores of Interpersonal Reactivity Index IRI

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

5.3.2. Results from fMRI experiment

5.3.2.1. Subjective Ratings of emotional experience

h-ALEX rated their feelings of empathy and arousal significantly lower than the l-ALEX, which has been seen in the main effect of group [$F(1,46)=8.248, p=.006$] (controlled for BDI and STAI-T) and in post-hoc t-tests of Empathy-condition [$T(48)=-2.585; p=.012$] and Arousal-condition [$T(48)=-3.154; p=.003$]. (See Figure 5-4 for details). Main effect of task and the interaction between group and task were not significant.

When reaction times were taken into consideration, there appeared to be a significant main effect of task [$F(3,138)=7.725; p<.000$], indicating that subjects reacted faster in the HLB-condition than in any other condition (controlled for BDI and STAI-T). Main effect of group and group task interaction were not significant, showing that h-ALEX were not slower or faster than l-ALEX.

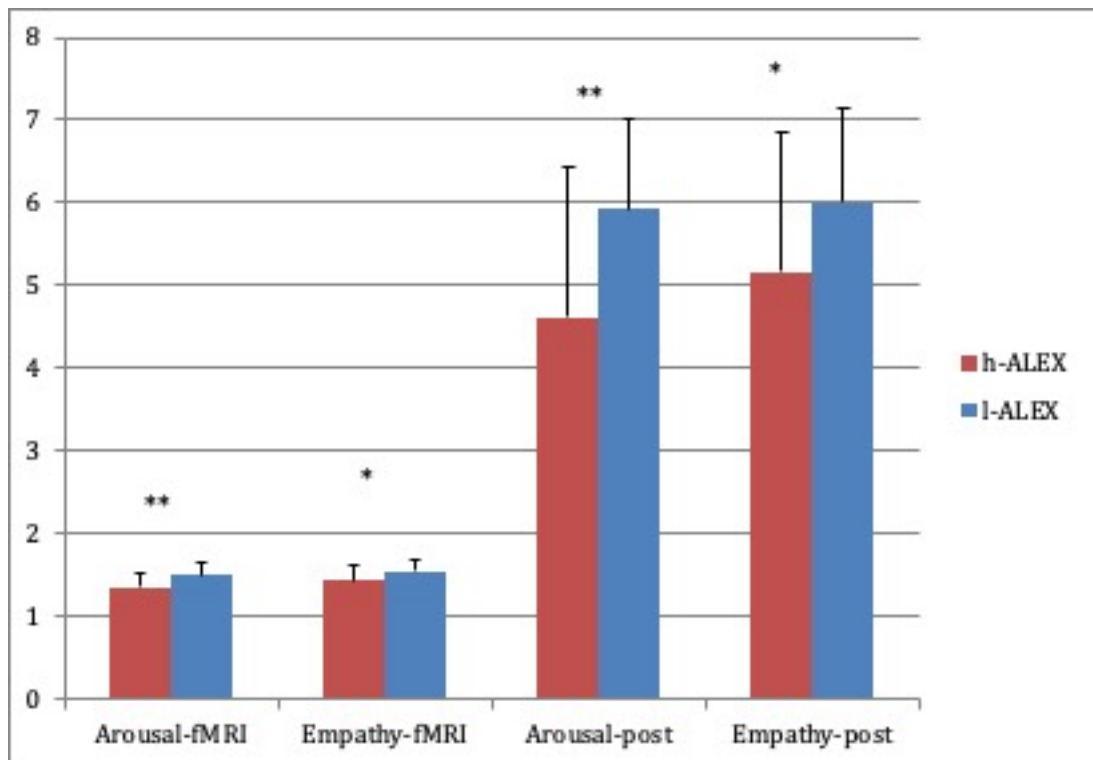


Figure 5-4: Differences in subjective Arousal and Emotional Empathy during fMRI experiment and in the post-experiment.

Note: Arousal-fMRI: Ratings of subjective arousal during fMRI experiment Range: 1-2, Empathy-fMRI: Ratings of emotional empathy during fMRI experiment Range: 1-2, Arousal-Post: Ratings of subjective arousal in post-experiment Range: 1-9, Empathy-Post: Ratings of emotional empathy in post-experiment Range: 1-9. ** $p < .005$, * $p < .05$

5.3.2.2. Electrodermal activity

EDA data from only 9 h-ALEX and 13 l-ALEX are reported. Due to a technical problem (mistakenly usage of false electrodes during the half of the sample) with the electrodes during data collection, data of 28 subjects had to be eliminated from further analysis. The remaining individuals were representatives of the original h-ALEX and l-ALEX samples. The remaining samples of h-ALEX and l-ALEX didn't differ on depressivity ($p < .103$) but on trait-anxiety ($p < .000$). For this reason, further analyses on EDA have been controlled only for trait-anxiety.

In arousal condition there was a group difference $p = .014$ (Mann-Whitney- $U = 22.000$; $Z = -2.437$), indicating to lower SCR in h-ALEX.

5.3.2.3 fMRI results

5.3.2.3.1 Main effects

5.3.2.3.1.1. Cognitive empathy

Separate mixed effects analysis for groups of h-ALEX and l-ALEX for the cognitive empathy condition compared to HLB revealed activation in both groups in areas related to social cognition such as left STS, left TPJ, left IFG, left OFC and left temporal pole. In right Insula, right IFG, right OFC, right Temporal Pole and bilateral thalamus signal change was only detected in h-ALEX.(see Table 5-2 for abbreviations, cluster sizes and coordinates).

Table 5-2: Main effect of cognitive empathy in h-ALEX

Brain region	H	MNI coordinates			z-score	Volume,mm ³
		x	y	z		
STS, extending to TPJ, OFC, IFG, TP	L	-56	-50	4	7.59	602,532
TP, IFG, MTG, OFC	R	50	-26	-8	5.81	117,072
Superior Frontal Gyrus	L	2	10	60	5.1	59,940
Precentral Gyrus	R	46	2	50	4.23	12,987

Brain region	H	MNI coordinates			z-score	Volume,mm ³
		x	y	z		
IFG, OFC, STS	L	-46	18	26	5.53	126,765

Note: Abbreviations; STS: superior temporal sulcus; TPJ: temporal parietal junction; OFC: orbitofrontal cortex ; IFG: inferior frontal cortex ; TP: temporal pole; MTG: middle temporal gyrus

5.3.2.3.1.2. Emotional empathy

Separate mixed effects analysis for groups of h-ALEX and l-ALEX revealed different patterns of activation in this contrast. Signal change was observed in l-ALEX only in left MFG, in left IFG and left frontal operculum cortex. h-ALEX in addition to those areas above had activation in bilateral ACC, bilateral temporal pole, right OFC, left OFC, right IFG, bilateral thalamus, bilateral putamen, left TPJ. (see Table 5-3 for abbreviations, cluster sizes and coordinates).

Table 5-3: Main effect of emotional empathy in h-ALEX

Brain region	H	MNI coordinates			z-score	Volume,mm ³
		x	y	z		
OFC, IFG, Precentral Gyrus, VLPFC	L	-48	28	-8	6.02	160,623
SFG	L/R	-10	28	56	5.25	141,264
OFC	R	34	22	-18	4.75	54,621
Angular Gyrus, TPJ	L	-42	-60	18	4.57	53,325
Posterior STS	R	52	-28	-10	4.62	26,946
IFG	R	48	22	18	4.64	13,446
Precentral Gyrus	R	44	4	42	4.2	11,070

Main effect of emotional empathy in l-ALEX

Brain region	H	MNI coordinates			z-score	Volume,mm ³
		x	y	z		
OFC, IFG	L	-48	18	8	3.77	14,688

Note: Abbreviations: OFC: orbitofrontal cortex; IFG: inferior frontal cortex; VLPFC: ventrolateral prefrontal gyrus; SFG: superior frontal gyrus; TPJ: temporal parietal junction; STS: superior temporal sulcus

Table 5-4: Main effect of subjective arousal in h-ALEX

Brain region	H	MNI coordinates			z-score	Volume,mm ³
		x	y	z		
Superior Frontal Gyrus, OFC, IFG	L/R	2	10	62	4.92	174,555
Posterior Cingulate Cortex, Precuneus	L/R	10	-72	8	3.96	54,189
TPJ	L	-48	-60	20	4.13	20,088
IFG pars opercularis, In- sula	R	52	22	-4	3.9	17,955
Middle Frontal Gyrus	L	-44	8	40	3.96	9261

Main effect of subjective arousal in l-ALEX

Brain region	H	MNI coordinates			z-score	Volume,mm ³
		x	y	z		
MFG, IFG, OFC, TP	L	-46	6	48	5.68	96,093
STS extending to TPJ	L	-54	-46	4	4.86	37,395
Superior Frontal Gyrus extending to ACC	L/R	0	16	54	4.38	30,105
PCC	L/R	-2	-16	32	3.72	11,178
MTG extending to TP	R	52	-10	-16	3.47	10,692
Superior Frontal Gyrus	L	-2	54	28	4.06	8,856

Note: Abbreviations: OFC: orbitofrontal cortex; IFG: inferior frontal cortex; VLPFC: ventrolateral prefrontal gyrus; SFG: superior frontal gyrus; TPJ: temporal parietal junction; STS: superior temporal sulcus; ACC: anterior cingulate cortex; MTG: middle temporal gyrus, PCC: posterior central cortex

5.3.2.3.1.3. Subjective Arousal

The contrast subjective arousal compared to HLB revealed higher BOLD signal change in each group in left TPJ, left IFG, left OFC, left ACC. There were higher activation in right IFG, right OFC, right ACC in h-ALEX only. Bilateral PCC has higher signal change only in l-ALEX in this contrast. (see Table 5-4 for abbreviations, cluster sizes and coordinates).

5.3.2.3.2 Group effects

5.3.2.3.2.1. Cognitive Empathy (vs. HLB)

h-ALEX had higher activation than l-ALEX in right VLPFC, right TP, right OFC, right MFG and left opercular IFG. (see Table 5-5 for abbreviations, cluster sizes and coordinates and Figure 5-5 for brain activation).

Table 5-5: Group effects h-ALEX > l-ALEX

Cognitive Empathy

Brain region	H	MNI coordinates			z-score	Volume,mm ³
		x	y	z		
VLPFC, TP, OFC, MFG	R	36	54	-2	4.45	51,651
MTG, temporooccipital part	R	56	-30	-8	4.27	17,604
MTG, temporooccipital part	L	-64	-52	-2	3.57	12,258
Opercular IFG	L	-50	16	14	3.81	10,881
Precuneous Cortex	L	-2	-74	28	3.27	8,397

Emotional Empathy

Brain region	H	MNI coordinates			z-score	Volume,mm ³
		x	y	z		
VLPFC	R	34	60	-4	3.89	12,717
OFC	L	-40	22	-16	3.68	9,720

Note: Abbreviations: OFC: orbitofrontal cortex; IFG: inferior frontal cortex; VLPFC: ventrolateral prefrontal gyrus; SFG: superior frontal gyrus; TP: temporal pole; STS: superior temporal sulcus; MFG: medial frontal gyrus; MTG: middle temporal gyrus, PCC: posterior central cortex

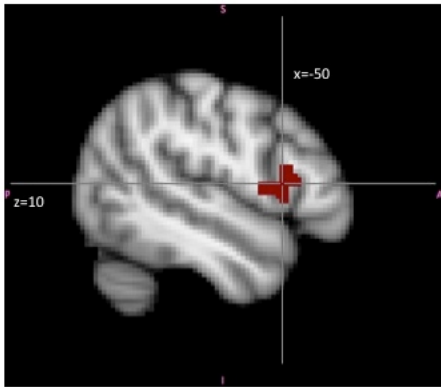


Figure 5-5: Higher activity in left opercular IFG in h-ALEX > l-ALEX

Note: Note: the contrast Cognitive Empathy vs. HLB in Group analysis h-ALEX vs. l-ALEX (cluster corrected $z > 2.7$, $p < .05$)

5.3.2.3.2. Emotional empathy (vs. HLB)

In empathic concern condition (contrasted to HLB) h-ALEX had higher activation in right VLPFC, left OFC, left precuneus, left temporal pole, bilateral cerebellum. (see Table 5-5 for abbreviations, cluster sizes and coordinates and Figure 5-6 for brain activation).

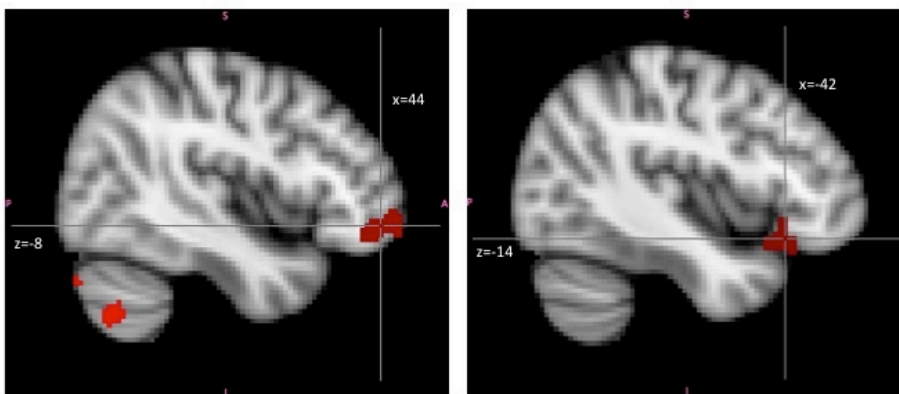


Figure 5-6: Higher activity in right VLPFC (image on the left) and left OFC (image on the right)

Note: the contrast Emotional Empathy vs. HLB in Group analysis h-ALEX vs. l-ALEX (cluster corrected $z > 2.7$, $p < .05$)

5.3.2.3.2.3. Subjective Arousal (vs. HLB)

There were no significant group differences in brain activation in subjective arousal condition compared to HLB in a priori regions of focus. Only significant cluster was in right cerebellum.

5.3.2.3.3. Task x Group Interactions

There was no statistically significant activation in all Task x Group Interactions.

5.3.2.4.4. Contrast Cognitive Empathy vs. Subjective Arousal

In the contrast emotion recognition vs. subjective arousal h-ALEX showed higher activation in r-DLPFC, r-triangular IFG, l-opercular IFG and bilateral thalamus.

5.3.3. Post-experimental ratings

There was a significant main effect of task [$F(3,135)=5.155;p=.002$]. The group task interaction was significant [$F(3,135)=6.470;p=.004$]. Post-hoc t-tests revealed lower arousal [$T(47)=-3.000;p=.004$] and empathy ratings [$T(47)=-2.165;p=.035$] in h-ALEX.

Main effect of group was not significant. In reaction times, there was a significant main effect of task [$F(3,135)=2.907;p=.049$] indicating slowest responses in the condition of "experienced clarity of the seen emotional expression". Main effect of group and task group interaction were not significant. (All results have been controlled for depressivity and trait anxiety).

5.4. Discussion and conclusion

In this study we aimed to achieve a deeper understanding of empathic ability in a highly alexithymic sample. Our first hypothesis, that h-ALEX has an impaired ability of emotional empathy has been supported by the results of the current study. In the behavioral results of MET, high alexithymic individuals (h-ALEX) showed an impairment of emotional empathy, both in the explicit measure of emotional concern for others and in the implicit measure of being aroused by the emotional states of others.

The results did not support our second hypothesis that h-ALEX has an impaired ability of cognitive empathy. Cognitive empathy has been measured by MET, which implemented the cognitive empathy as an ability to be able to name the emotional states of others. The present task of cognitive empathy was based on affect labeling, which is crucial for interpersonal communication though is only one aspect of it. Theory of mind (ToM), which was not measured in the current study, is another crucial aspect of cognitive empathy and Moriguchi et al. (2006) reported lower ToM in h-ALEX accompanied by lower activation in medial prefrontal cortex (MPFC). Hence, our study, by showing less significance of difference in cognitive empathy, highlights the importance of other aspects of interpersonal communication such as ToM. It is important to note that the equal levels of cognitive empathy in the current samples of h-ALEX and the control group was accompanied by higher activation in several prefrontal brain structures in h-ALEX, which will be discussed later in this paper.

In accordance with our first and second hypotheses, we expected diminished brain activity in core regions of empathy such as inferior frontal gyrus (IFG), Insula, MPFC and orbitofrontal cortex (OFC). It is important to note that in our study the control never showed a significant higher activation than h-ALEX in any region of the brain throughout the tasks, although alexithymia has been associated with diminished brain activity (Taylor & Bagby, 2004; van der Velde et al., 2013; Wingbermühle, Theunissen, Verhoeven, Kessels, & Egger, 2012). On the contrary, both in cognitive and emotional empathy conditions, there have been higher right ventrolateral prefrontal cortex (VLPFC) and OFC activation in h-ALEX. In a task very similar to our cognitive empathy paradigm, (Lieberman et al., 2007) found that right VLPFC specifically down-regulated amygdala activity during affect labeling. Enhanced activity

in VLPFC might lead to diminished activity of amygdala, which in turn might be related to declined emotional experience. Further, there is evidence linking VLPFC to social cognition (Pinkham, Hopfinger, Pelphrey, Piven, & Penn, 2008) and emotion regulation (Lieberman et al., 2007; Townsend et al., 2013).

Although it is known to be related to several other cognitive functions, OFC is also related to the recognition of significance of emotional stimuli (Golkar et al., 2012; Levens & Phelps, 2010), to emotion regulation (Decety, 2011) and to emotional empathy (Cox et al., 2012). Until now, only one study reported altered OFC functioning in alexithymia (Kano et al., 2003; decreased right OFC activity in reaction to negative emotional stimuli). According to our findings, in h-ALEX there has been higher temporal pole activation in both cognitive and emotional empathy tasks. Temporal pole is known to be a region involved in social cognition (Olson, Plotzker, & Ezzyat, 2007) and specifically in empathy network (Frith & Frith, 2011; Shamay-Tsoory, 2011; Singer, 2006).

h-ALEX had a higher activity in left IFG only in cognitive empathy but not in emotional empathy task. Also, in the contrast of cognitive empathy vs. subjective arousal as an implicit measure of emotional empathy, there has been a higher activation in left IFG in ALEX. There is strong evidence showing opercular IFG as a core structure for empathic ability (Moriguchi, 2006, Shamay-Tsoory, Aharon-Peretz, & Perry, 2009), and also for language production (Liakakis, Nickel, & Seitz, 2011). IFG's co-existing contribution to language and emotional processes is coherent with left IFG's specific involvement in a task with more language related components than emotional empathy task. Brain areas involved in cognitive and emotional empathy tasks in ALEX were almost the same prefrontal areas, except IFG, which we observed only for cognitive empathy. Prefrontal areas are crucial for the cognitive control of emotion processing (Ochsner & Gross, 2005) and emotion regulation (Lieberman et al., 2007). We assume that the extensive involvement of prefrontal areas may have allowed h-ALEX compensate their deficits in emotion processing on cognitive empathy but insufficiently for a positive functioning in emotional empathy, which prerequisites the ability to feel for the other and to be able to recognize congruent feelings in one's own self.

On the questionnaire measure of IRI (Davis, 1980, 1983) h-ALEX reported lower levels of EE (empathic concern) and cognitive empathy (perspective taking), but higher personal distress when they were confronted with others' discomfort. This result is in accordance with the findings of Moriguchi et. al. (2006). According to Decety (2011) and Eisenberg and Eggum (2009), several different reactions can result from observing another distressed person, such as sympathy (also called empathic concern), emotional contagion, or fear, avoidance and personal distress. Personal distress is self-directed and aversive, and is not directed to relieve the other from uncomfortable feelings but merely one's own. In contrast, sympathy is an other-directed prosocial feeling. Decety & Lamm, (2009) argue that if not regulated, this distress might intervene with an individual's ability to react and resolve the stressful situation. h-ALEX reported lower levels of subjective arousal during the experiment, which was also supported by implicit physiological measure of lower SCR. Also, in a previous study of ours, h-ALEX participants have already shown lower HPA-System function (Alkan Härtwig, Aust, & Heuser, 2013). Taken together these results suggest that h-ALEX is less able to feel when confronted with others' distress; but more importantly, due to their specific impairment at processing their own emotions, the recognition of others' distress does not evolve into empathy but to personal distress.

To our knowledge this has been the first neuroimaging study that has examined cognitive and emotional empathy simultaneously in alexithymia. The large sample of physically and mentally healthy high alexithymic participants, who were closely matched demographically to their l-ALEX, contributed to the strength of the study. In addition, the assessment of alexithymia did not only depend on self-report measures but was supported by an observer measurement. Finally, in order to eliminate all possible interactions with depressivity and anxiousness, all results have been controlled for these two dimensions. Therefore, we are confident that the results of this study reflect alexithymia in and of itself and are not confounded with other psychological problems and disorders.

The current results indicate a specific impairment of alexithymic individuals in experiencing emotions but not in naming them, since the h-ALEX sample showed a similar level of competence in naming emotions as the control group. Experiencing

the emotional states is precursory of naming the emotions. Still, the current results indicate an impairment in the basic emotional experience which does not lead to an impairment in naming of emotions. We propose that higher prefrontal activation overcomes the impairments in emotional functioning in h-ALEX in basic tasks such as affect labeling. Thus, h-ALEX participants manage to score similar to l-ALEX in cognitive empathy task. But this prefrontal activation is insufficient, when the tasks involve more complicated functions such as emotional empathy. Another explanation might be that extensive cognitive effort to regulate the higher levels of personal distress leads to a dysfunction in feeling of emotions due to possible down-regulation of limbic structures by prefrontal activity. The relationship between limbic and prefrontal areas in h-ALEX should be examined via functional and structural connectivity in future studies.

6

General Discussion

6.1. The Summary of main findings

The main goal of this dissertation project was to gain a comprehensive understanding of alexithymia at its highest end in the absence of mental disorders. To this end, I have conducted three studies with different methodologies.

In order to achieve the first objective of this dissertation, that is to understand the latent dynamics between the subfactors of two famous alexithymia scales TAS-20 and BVAQ, we have employed a latent profile analysis (LPA). The other goal of this particular study was to clarify whether alexithymia itself or some of its subfactors make individuals more susceptible to psychological distress. The LPA showed three distinct subtypes of highly alexithymic individuals: extreme high on all subscales, lower scores on all subscales (still above the means of general population [Franz et al., 2008]) and very high scores on identifying and describing/ verbalizing but lower scores on externally oriented thinking style and fantasizing. Higher levels of alexithymia have been related to psychiatric disorders in many correlational studies. However, in the latent profile analysis study we have found that it is not the main score of TAS-20 or BVAQ that builds up the risk for psychological distress but rather the combination of subscores in a distinct manner. Highly alexithymic individuals with a pronounced difficulty in identifying and describing their feelings and a lower tendency to externally oriented thinking appear particularly prone to psychological distress. This group of high-alexithymic individuals are distinguishable by intensive attention to their feelings accompanied by a recognizably low clarity about their feelings, and thus by the contrast created by these two counter processes. This mismatch between the urge to understand their feelings and the inability to do so seems to be one of the factors which makes this subgroup of high-alexithymic individuals prone to psychological distress. Among high-alexithymic individuals, having an enhanced tendency for externally oriented thinking style and paucity of fantasies seems to be a protective factor against psychological distress. These individuals have apparently found a way to process the emotional input in a distinct cognitive way, which seems to be adaptive in comparison to the individuals who have the same lack of understanding of their emotions but a less pronounced externally oriented thinking style.

The second aim of this dissertation was to gain insight into the relationship of alexithymia to stress related disorders by investigating a basic function of the hypothalamus-pituitary-adrenal system (HPA). In order to explore this relationship, we have looked at the cortisol awakening response (CAR). The HPA system is essential for the stress-related activity of our organism and CAR is an important marker of its well-functioning. We have found a diminished CAR in highly alexithymic individuals, which was accompanied by higher levels of perceived distress. This study is the first to depict the way alexithymia is related to basic physiological dysfunctions even in mentally healthy adults. Alexithymic individuals experience high levels of distress in their everyday social interactions but their bodies' anticipatory reaction to the upcoming day is much lower than non-alexithymic individuals.

The last major goal of this dissertation project was to gain an understanding into how well alexithymic individuals experience their own emotions and how it contributes to their social cognition, namely cognitive and emotional empathy. For this purpose, we have employed a multi-method brain imaging study. Skin conductance response was measured simultaneously with the fMRI experiment. Alexithymic individuals reported being less aroused in reaction to the pictures of others in distress, accompanied by a lower skin conductance response and a higher activation in prefrontal brain structures such as ventrolateral prefrontal cortex (VLPFC), orbitofrontal cortex (OFC) and inferior frontal gyrus (IFG.) These findings also support the findings of the CAR study and the assumption that alexithymia is related to an altered basic stress-related functioning.

Furthermore, highly alexithymic individuals reported significantly lower levels of emotional empathy on a questionnaire measure. In the cognitive empathy task, they scored just the same as the control group but also with a higher activation in IFG and OFC. Furthermore, as VLPFC is known to downplay amygdala reactivity (Lieberman et al., 2007), in highly alexithymic individuals higher VLPFC activity may have reduced amygdala activity and in turn may be responsible for the lack of emotional body response. The second possibility is that highly alexithymic individuals might be trying to overcompensate the lack of bodily sensations and true experience of emotions with higher prefrontal cognitive activation to succeed in the emotional

empathy task but still cannot do so. Further research is needed to clarify how prefrontal and limbic areas cooperate in case of alexithymia. Present findings still give a hint about a possible dysfunction. Our brain imaging results are quite contrary to previous research, which almost always found lower brain activity in alexithymia. In our study with highly alexithymic mentally and physically healthy adults, we have not seen lower activation compared to controls in any brain structure. Thus, it appears that being not able to identify or describe feelings does not need to be related to reduced brain activity.

The present investigation did not find impairments in cognitive empathy but only in emotional empathy. So alexithymia might be not only related to difficulties in identifying and describing emotions but also to an impairment in a core emotional function. Highly alexithymic individuals are able to name the emotions in an experimental setting but they have difficulties in feeling for others. This finding is quite striking and supports the findings of Grynberg (Grynberg, Luminet, Corneille, Grèzes, & Berthoz, 2010) and Moriguchi et al. (2007) that alexithymia is not only related to understanding one's own emotional experience but also of others'.

6.2. Implications of the present findings on the original definition of alexithymia

To sum up the results, alexithymia is related to reduced CAR accompanied by higher levels of personal distress, lower skin conductance response during introspection of one's own arousal, and lower arousal and empathy in response to others' distress, which was accompanied by a higher prefrontal brain activation, which might in turn down regulate crucial limbic activity.

Taken together, all those findings suggest that alexithymia is not only related to differentiating and identifying feelings but also to an impairment in basic emotional experience. In the following I will discuss the original definition of alexithymia based on the findings of these three studies.

As explained in the introduction, feelings and emotions are not synonyms for one another. This research points to a general impairment in emotions and bodily

functions underlying emotional processes. Therefore, positioning alexithymia in the more general research field of emotional experience and reconsidering its general definition might be meaningful.

Difficulty to identify subjective feelings

The findings of this dissertation project point to a dysfunction in basic emotional functioning in alexithymia, which might reflect itself in difficulties identifying one's feelings and differentiating them from bodily sensations. Highly alexithymic individuals have lower CAR, which is the anticipatory function of the HPA system for the upcoming day. Cortisol secretion is a fundamental part of our body's reaction to stress. Research indicates to lower CAR by individuals, who are subjected to prolonged stress (Fries, Hesse, Hellhammer, & Hellhammer, 2005; Fries, Dettenborn, & Kirschbaum, 2009). A higher CAR is seen in individuals who are coping with acute stress (de Timary, Roy, Luminet, Fillée, & Mikolajczak, 2008). It is important to note that this result was seen in the absence of past and present psychiatric disorders. Lower CAR might indicate an altered coping with environmental stimuli.

Moreover, highly alexithymic individuals report lower levels of arousal in reaction to others in distress, which was accompanied by lower skin conductance response. All these findings indicate a possible dysfunction of fundamental emotional experience in alexithymia. Alexithymic individuals have impaired bodily sensations during an emotion process, which makes it harder for them to identify these vague perceptions of their bodily changes as concrete feelings. Our results support that difficulty identifying feelings is a core domain of alexithymia but it probably results from the less pronounced bodily changes during the emotion process.

Difficulty describing feelings

In the fMRI study, highly alexithymic individuals showed an equally good performance on labeling emotions as the control group, however they reported a lower clarity of their own emotions on a questionnaire measure (see Chapter 3 for details). Choosing the matching emotion word to an image (see Chapter 5 for

details) is of course much less complicated than describing one's own emotions in everyday life. Further results of a linguistic study conducted by our research group (Wotschack & Klann-Delius, 2013) showed that highly alexithymic individuals use a lower number of different words and synonyms for emotions in spoken language, indicating a narrower conceptualization of verbal expression of emotions in highly alexithymic individuals. Describing feelings requires at least two things as prerequisites: the existence of emotions and the ability to introspect. In alexithymia literature the inability to introspect was highlighted. In addition to that, our results indicate an impairment in emotional experience. Due to the shortfall of bodily sensations, alexithymic individuals do not experience emotions to the extent non-alexithymic individuals do. This might be leading to an impairment in subjective appraisal (feelings), which in turn manifests itself in difficulty describing feelings.

At this point it is important to address the blind feel and affective agnosia hypothesis of alexithymia by Lane (Lane 1997a, Lane et al 2015). Lane (1997) made a famous analogy between alexithymia and blindsee, a neurological disorder in which patients have intact eyes and visual cortex but they are not aware of their sight and coined the term "blindfeel" for alexithymia. Later on he adapted his theory and named it affective agnosia, which assume a normal emotional functioning in bodily and subcortical levels in highly alexithymic individuals but dysfunction in the transmission of that information to the cortical brain areas which detects the emotional response and name them. However, our results point to the opposite and indicate to a dysfunction in the basic emotional functioning.

Limited imaginal capacity and fantasy life

In the LPA study (Chapter 3) the capacity to fantasize has come out as a very distinct and important factor in defining alexithymia. The paucity of fantasies is a part of original definition of alexithymia, however it was eliminated during the transformation of TAS-26 to TAS-20 due to problems in factorial structure. In 2006, authors of TAS-20 included it to Toronto Structured Interview of Alexithymia (Bagby et al. 2006). In our study, highly alexithymic individuals with pronounced impairments in identifying and describing emotions, lower impairments in the ability to fantasize (measured by BVAQ, Vorst & Bermond, 2001) and low scores on

externally oriented cognitive style experienced higher levels of psychological distress. More research evidence is needed to clarify how well the impairments in the ability to fantasize belong to the core concept of alexithymia.

A utilitarian way of thinking with a stimulus bound, externally oriented cognitive style

As explained above, lower levels of externally oriented cognitive style accompanied by higher levels of difficulty in identifying and describing emotions poses a higher risk to psychological well-being than generally higher scores on alexithymia scales. Why might that be so? Are the externally oriented thinking style and paucity of fantasies protective factors among highly alexithymic individuals? If a person has difficulties in identifying his own emotions, differentiating them from bodily sensations and describing them, it is plausible that the person does not develop an emotion-focused way of thinking and communication but a stimulus bound, externally oriented cognitive style. In the context of alexithymia this might even be a factor of resilience, saving these individuals from further psychological distress accompanying the feelings.

In future research, it is important to identify the differences between different loads of subfactors of alexithymia. Unfortunately, due to decline in the sample size over the period of our studies it was not possible for us to look at the effects of subtypes on CAR and brain activity. It may be meaningful to design future studies of alexithymic individuals with high and low levels of externally oriented cognitive style to identify the distinct effect of externally oriented thinking style in alexithymia.

6.3. Implications for psychotherapy

We have not conducted a longitudinal study to explore the impact of alexithymia on the development of psychiatric disorders. However, the observation that more than half of our highly alexithymic core sample had past or present psychiatric disorders and had to be excluded from our experimental sample, was very striking. It was just an auxiliary finding yet significant to show, once again, the extent to which

alexithymia is related to psychiatric disorders. Alexithymia seems relevant to psychiatric disorders in both ways: first as a temporary symptom during a psychiatric disorder; second, predisposing individuals to psychiatric disorders. This has of course major implications for psychotherapy and psychological counseling. If we perceive alexithymia as a problem in understanding and communicating existing emotions, the psychotherapy would focus on developing the expressive abilities. If we perceive alexithymia as a problem based on basic emotional processing, including core emotion related physiology, the psychotherapy needs a different focus. In the first case, therapy might aim to increase the emotional competencies; in the second, therapy would have a focus on acceptance of one's own resources and boundaries. If we accept alexithymia as a personality trait, rather than a disorder, we would expect it to be stable over time and changing personality traits is not an aim of psychotherapy.

Alexithymia has drawn the attention of psychiatrists due to highly alexithymic individuals' resistance against psychodynamic psychotherapy employed in the late sixties. Ogrodniczuk and colleagues (2011) have shown in several psychotherapy studies that alexithymia is associated with poor outcome both in descriptive and supportive psychodynamic psychotherapy. Many approaches to psychotherapy, especially the psychodynamic approach, assume that individuals have access to their emotional experience. Alexithymic individuals, however, are known to have a limited access to their own emotions. Moreover, the present research shows that alexithymic individuals not only have impaired introspection but also limited emotional experience and impaired empathic ability. Therefore, it might be more beneficial to employ a psychotherapy approach that is not focused on emotions for the treatment of alexithymic individuals with a mental disorder. For example, Rufer and colleagues (2010) provides evidence that alexithymic individuals benefit from a cognitive behavioral psychotherapy for the treatment of panic disorder. Further research and meta-analyses are needed to understand how well alexithymic patients react to cognitive behavioral therapy.

It might be important for highly alexithymic individuals to have an effective psychoeducation about their personality characteristics. Understanding and accepting the fact that they cannot identify and express their emotions as much as

socially desired due to their personality trait might lessen the psychological distress they experience.

It is also crucial to spread the information about alexithymia among psychotherapists and psychiatrists. Surprisingly Ogrodniczuk et al. (2011) report that psychotherapists have negative reactions to their alexithymic patients due to limited amount of positive emotions the alexithymic patients express. Unfortunately, it is not widely known that there is such a personality trait called alexithymia which makes individuals' work with their own emotions hard, even impossible. Acceptance by psychotherapists of their alexithymic patients, no matter which disorder they suffer, might positively affect the therapy outcome.

6.4. Merits, Limitations and Future Research

The large community dwelling sample of mentally and physically healthy highly alexithymic individuals is the most important merit of the reported studies. It is also noteworthy that we have not used a student sample as the control group but found matching low alexithymic individuals for each highly alexithymic subject (according to age, gender, education and income) to overcome the effects of socio-economical status on our data. Unfortunately, not every member of the sample participated in each session, which made investigation of the interactions of different findings complicated. It was also not possible to follow up in further studies on the effects of subtypes of alexithymia, which were identified via LPA, due to the decline in sample size. It might have been interesting to see if the subgroup with highest psychological distress had a distinct cortisol awakening response or a pattern of brain activity. Future studies are also needed on the highly alexithymic population with and without externally oriented thinking style and paucity of fantasies.

Looking at HPA system function via CAR is a novel aspect of this dissertation. There has been no study investigating CAR in alexithymia until now and only one study looked at pre- and post-stress exposure cortisol responses (de Timary, Roy, Luminet, Fillée, & Mikolajczak, 2008). Cortisol and alexithymia's relationship was an untouched field, despite the fact that it is essential to understanding the basic physiological dysfunctions related to alexithymia.

This is also the first study looking at cognitive and emotional empathy in high alexithymia with a brain imaging study. It was a limitation, though, that we have used a design only with facial images. The pictures were ecologically valid and did not only include the facial expression but also the context. However, it might have been valuable to use a stimuli combining other senses, such as music or videos.

The biggest merit of the current investigation is that it provides support for alexithymia being a distinct personality trait, with significant characteristics even in the absence of psychiatric disorders.

6.5. Conclusion

This research delivers results from a mentally healthy highly alexithymic sample. Though it is a dimensional construct, looking at the higher end of alexithymia gives us more information about how it might have affected emotion processing and regulation.

The present research indicates that alexithymia is not only a dysfunction identifying and describing feelings but a deeper dysfunction at the core of emotional experience, which manifests itself in lower emotional empathy, lower CAR and SCR, lower levels of arousal to aversive stimuli accompanied with similar levels of cognitive empathy. These findings are important for a better conceptualization of alexithymia, as well as for the clinical practice.

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LEBENS LAUF*

*Der Lebenslauf ist in der Online-Version aus Gründen des Datenschutzes nicht enthalten.

List of Publications

*These publications are a part of this dissertation.

Journal Articles (peer reviewed)

- 2014 *Alkan Härtwig E, Crayen C, Heuser I and Eid M (2014) It's in the mix: psychological distress differs between combinations of alexithymic facets. *Front. Psychol.* 5:1259.
- 2014 Aust, S. , Stasch, J. , Jentschke, S. , Alkan Härtwig, E. , Koelsch, S. , Heuser, I. and Bajbouj, M. (2014), Differential effects of early life stress on hippocampus and amygdala volume as a function of emotional abilities. *Hippocampus*, 24: 1094-1101.
- 2013 *Elif Alkan Härtwig, Sabine Aust, Isabella Heuser (2013). HPA-System activity in Alexithymia: A cortisol awakening response study. *Psychoneuroendocrinology*. Volume 38, Issue 10 , 2121–2126
- 2013 Sabine Aust, Elif Alkan Härtwig, Stefan Koelsch, Hauke R. Heekeren, Isabella Heuser & Malek Bajbouj (2013). How emotional abilities modulate the influence of early life stress on hippocampal functioning. *Social Cognitive and Affective Neuroscience*.
- 2013 Sabine Aust, Elif Alkan Härtwig, Isabella Heuser, Malek Bajbouj (2013). The Role of Early Emotional Neglect in Alexithymia. *Psychological Trauma: Theory, Research, Practice, and Policy*, Vol 5(3), May 2013, 225-232.

Journal Articles (under review)

- 2019 * Elif Alkan Härtwig, Sabine Aust, Hauke R. Heekeren, Isabella Heuser (2019). No Words for Feelings? Not only for my own. Diminished empathic ability in Alexithymia. Submitted to *Frontiers Behavioral Neuroscience*.

Congress Contributions

- 2017 Elif Alkan Härtwig, Özgür Cengiz, Norbert Mönter (2017) Psychiatric counseling in mosques and other religious communities. WPA XVII World congress of Psychiatry, Berlin, 12.10.2017.
- 2012 Elif Alkan Härtwig, Claudia Crayen, Michael Eid, Isabella Heuser (2012). It's in the mix: Psycho-

- logical distress differs between combinations of alexithymic facets. Oral presentation at International Congress of Psychology, Cape Town, South Africa, 26.07.2012.
- 2011 Elif Alkan Härtwig, Hauke R. Heekeren, Isabella Heuser (2011). Experiencing emotions in alexithymia: subjective, psychophysiological and neuroimaging parameters. Oral presentation at European Congress of Psychology, Istanbul, Turkey, 07.07.2011.
- 2010 Elif Alkan Härtwig, Hauke R. Heekeren, Isabella Heuser (2011). Experiencing emotions in alexithymia: subjective, psychophysiological and neuroimaging parameters. Symposium at Berlin Alexithymia Conference, Berlin, Germany, 11.11.2010.

Erklärung

Hiermit versichere ich, dass ich die vorgelegte Arbeit selbstständig verfasst habe. Andere als die angegebenen Hilfsmittel habe ich nicht verwendet. Diese Arbeit ist in keinem früheren Promotionsverfahren angenommen oder abgelehnt worden.

Berlin, 02 Dezember 2019

Elif Alkan Härtwig