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The cognitive and affective alexithymia dimensions in the regulation of sympathetic responses

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ABSTRACT

Objective: The literature regarding research into alexithymia and sympathetic responses is far from consistent. An explanation might be on the way subjects are classified. Generally, subjects are diagnosed as either alexithymic or non-alexithymic on the basis of questionnaires focusing on the cognitive aspects of alexithymia. However, alexithymia, as originally defined, concerns both emotion-affective and emotion-cognitive deficits. The aim of the present paper is to study the importance of the affective and cognitive alexithymia components in the regulation of sympathetic responses.
Methods: Subjects, who scored extremely (either high or low) on both the cognitive and the affective components of alexithymia, were shown neutral and emotional pictures, while their GSR was measured.
Results: The affective alexithymia component, not the cognitive component, turned out to be an important factor in the regulation of GSR peak amplitude. The results further indicate a significant interaction of type of emotional deficit (cognitive by affective) on GSR latency times. Finally, suggestive evidence indicated that baselines values, defined by the levels during the second preceding the stimulus, are related to the cognitive component of alexithymia, in the sense that higher emotion-cognitive capacities result in higher baseline values.
Conclusions: We cautiously conclude that the classification of alexithymics on the basis of both the affective and cognitive components, rather than on the basis of the cognitive component only, might provide more consistent research results, and thus lead to a better understanding of emotional physiological responses in alexithymic subjects.

1. Introduction

As early as the late forties of the last century, MacLean (1949) observed that, in a large proportion of patients with psychosomatic complaints, the emotions do not reach the level of full conscious symbolic and verbal elaboration, resulting in problems during psychoanalysis based psychotherapy (Ruesch, 1948; Groen et al., 1951; Sifneos 1975). Nemiah and Sifneos (1970) gave the following description of the psychological features of these patients: "These patients manifested either a total unawareness of feelings or an almost complete incapacity to put into words what they were experiencing. The associations of the majority of the patients were characterized by a) a near total absence of fantasy or other material related to their inner, private mental life of thoughts, attitudes and feelings, and b) a recounting, often in almost infinite detail, of circumstances and events in their environment, including their own actions. Their thoughts, that is, were stimulus-bound rather than drive-directed." Sifneos (1973) coined the term alexithymia (a = lack, lexis = word, thymos = mood or emotion (Sifneos et al., 1977)) for this complex of features. Thus, alexithymia has been defined by deficits in as well the cognitive as affective aspects of the mental emotional responses. Alexithymia measuring devices should therefore cover both types of deficits. This is all the more important, since it has been argued that the cognitive and affective aspects of emotions are regulated by different neural modules (Bermond et al., 2006; Bermond, 2008).

Although it has been demonstrated that stress induces or enhances alexithymia (Kristal and Krystal, 1988), recent results suggest strongly that alexithymia is a relatively stable personality trait (Picardi et al., 2005; Luminet et al., 2007).

It has been proposed that alexithymia enhances the probability of (psycho)-somatic complaints, and many publications support this notion (see Taylor et al., 1997 for review). Furthermore, it has, been proposed that alexithymia results in increased emotional physiological responses, or increased autonomic baseline levels, which may explain the relationship between alexithymia and psychosomatic complaints (Gross, 2002; Thayer and Brosschot, 2005). However, the relevant literature presents conflicting results. Several studies indicated that alexithymia is related to higher baseline or relaxation-levels

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(Papciak et al., 1985; Henry et al., 1992; Wehmer et al. 1995; Infrasca, 1997; Fukunishi et al., 1999; Stone and Nielson, 2001; Gündel et al., 2004; Bagby et al., 2009). However other, though fewer, studies found lower values (Hyer et al., 1991) or failed to find effects (Newton and Contrada, 1994; Roedema and Simons, 1999; Neumann et al., 2004).

The literature regarding alexithymia and autonomic responses to stress or negative affect is also clearly equivocal. Some studies suggest that alexithymia is related to attenuated autonomic responses to stress (Newton and Contrada, 1994; Wehmer et al., 1995; Linden et al., 1996; Friedlander et al., 1997; Fukunishi et al., 1999; Roedema and Simons, 1999; Neumann et al., 2004), while others suggest the opposite (Papciak et al., 1985; Martin and Pihl, 1986; Infrasca, 1997; Waldstein et al., 2002; Gündel et al., 2004; Bagby et al., 2009) or found no effect (Rabavilas 1987; Franz et al., 1999; Stone and Nielson, 2001; Connelly and Denny, 2007). In the study conducted by Franz et al. (1999) it should be noted that although the results demonstrated no difference in mean GSR response, they also demonstrated that the fluctuations in GSR responses were significantly greater in *low* alexithymics compared to *high* alexithymic subjects. To make matters even more confusing, various studies used several measures of autonomic response, of which only one or a few were associated with the expected effect, or with just one of the alexithymia subscales (Nyklicek, 2004; Spitzer et al., 2005) for instance.

Three hypotheses have been proposed to explain the enhanced emotional physiological responses in alexithymics: the decoupling hypothesis (Papciak et al., 1985), the discharge theory (Cacioppo et al., 1992), and the stress hypothesis (Martin and Pihl, 1985). One theory has been proposed to explain lower autonomic responses in alexithymics. The hypo-arousal theory of alexithymia predicts that, under conditions of comparable emotional provocation, there is less physiological activation in individuals with alexithymic tendencies (Linden et al., 1996).

For the following reasons we believe that the hypo-arousal theory fits the classical alexithymic subject as described by Nemiah and Sifneos (1970). The severe reduction in affective feeling (see above) is an important element in their description of the alexithymic features. Damasio et al. have underlined the importance of the orbitofrontal cortex (O-FC) in the regulation of the emotional feeling and emotional decision-making (Damasio and Anderson, 1993; Damasio 1994, 1999; Bechara et al., 2000; Tranel et al., 2002; Bechara 2004), and specific O-PFC activations in reaction to emotion-inducing stimuli have been described (Taylor et al., 2002). The O-FC projects to the hypothalamus, where the orbitofrontal neurons connect with neurons projecting to the brainstem- and spinal-autonomic centers. It is by these connections that the O-FC has control over emotional autonomic responses (Simpson et al., 2001; Barbas et al., 2003). Finally, electrical stimulation of the O-FC produces many autonomic responses (Iversen et al., 2000).

Based on these neuropsychological data, it is feasible that subjects that show no or very low affective responses, also show low activation in their O-FC, and thus low activations in the brainstem- and spinal-autonomic centers, which would result in lower autonomic responses in the classical alexithymic subjects (Bermond et al. 2006; Bermond, 2008).

Most studies have used the Toronto alexithymia questionnaires, i.e., the TAS-26, TAS-R, or TAS-20 (Taylor et al., 1985; Taylor et al., 1992; Bagby et al., 1994). None of these scales, however, measures emotionalizing (reduced ability to experience emotional feelings). In addition, the TAS-R and TAS-20 do not measure fantasizing. Thus, although, the originators of the alexithymia concept included the affective components (reduced emotionalizing and fantasizing) of alexithymia explicitly (Nemiah and Sifneos, 1970; Nemiah, 1996; Sifneos, 1991, 2000) the TAS scales focuse on the emotion-cognitive aspects of alexithymia.

For the reasons presented above, a failure to classify subjects with respect to affective alexithymia features may have introduced uncontrolled variance into the data produced in the experiments reviewed above. In the present study, therefore, the distinction between the cognitive and the affective components is retained in the selection of subjects, i.e., we study the relationship between the affective and cognitive components of alexithymia, and emotion-induced sympathetic activation.

Our hypothesis is that adding the affective component, as a separate measure for alexithymia, will explain a significant part of the variance. In addition to measuring the amplitude of the physiological responses which allows for direct comparison with previous studies we also will *explore* baseline levels preceding the stimuli and latency times.

2. Methods

2.1. Alexithymia measurement

Alexithymia was measured by aid of the Bermond Vorst Alexithymia Questionnaire (BVAQ) (Vorst and Bermond, 2001). The BVAQ has five separate subscales, (8 items per subscale, four indicative and four contra-indicative) for all alexithymia features as discussed by others (Nemiah and Sifneos, 1970; Sifneos et al., 1977; Taylor et al., 1985; Nemiah, 1996; Sifneos, 1991, 2000; Hendryx et al., 1991); reduced capacities concerning: (1) 'emotionalizing' [When friends around me argue violently, I become emotional.], (2) 'fantasizing' [I have few daydreams and fantasies.], (3) 'identifying' emotions, [When I am upset, I know whether I am afraid or sad or angry.], (4) 'verbalizing' emotions [I like to tell others about how I feel.], and (5) 'analyzing' emotions, i.e., the opposite of Marty and M'Uzan's (1963)'pensé opératoire' [I hardly ever consider my feelings.]. The original Dutch BVAQ and its translations all have acceptable to very-good psychometric properties, and its usefulness has been demonstrated in several different settings (Nähring and van der Staak, 1995; Houtveen et al., 1991; Zech et al., 1999; Berthoz et al., 2000: Van Dijk et al., 2002; Elzinga et al., 2002; Vorst and Bermond, 2001; Morera et al., 2005; Bermond et al., 2007; Debordea et al., 2008). For reasons of comparisons with the TAS-20, it should be noted that the BVAQ emotion-cognitive subscales (Identifying, Analyzing, and Verbalizing) cover the same domain as the TAS-20, because the sum-totals of these BVAQ subscales correlate highly ($r = 0.80$) with the TAS-20 sum-totals (Vorst and Bermond, 2001).

In a previous research, exploratory and confirmative factor analyses of BVAQ subscale scores in various populations consistently produced two orthogonal factors (one factor comprises the subscales 'Emotionalizing' and 'Fantasizing', the other factor comprises 'Verbalizing-' and 'Identifying-emotions'). These factors reflect the emotion-affective[1] dimension and the emotion-cognitive dimension of alexithymia. Furthermore, this dichotomy has been theoretically underpinned by Bermond, 2008, and fits with neuropsychological data (Bermond et al., 2006). The subscale 'Analyzing-emotions' invariably loads on both dimensions, albeit with differing loadings in the various populations or languages (Vorst and Bermond, 2001; Bermond et al., 2007). Thus the BVAQ allows an analysis on the basis of the two alexithymia dimensions mentioned, henceforth called the cognitive alexithymia dimension (COG) and the affective alexithymia dimension (AFF). Since the subscale 'analyzing-emotions' loads, in the Dutch population, clearly on the cognitive dimension (0.77) and much less on the affective dimension (0.22) (Vorst and Bermond, 2001; Bermond et al., 2007), we included 'analyzing-emotions' in the cognitive dimension. In a study with 492 first-year psychology students the Cronbach's alphas for the AFF and COG dimensions turned out to be 0.768 and 0.874 respectively.

[1] 'Emotion affective' may seem redundant, however this label has been chosen to differentiate this dimension clearly from the 'emotion-cognitive dimension' ('identifying', 'verbalizing' and 'analyzing' emotions).

2.2. Subjects

Sixty-six female psychology students (mean age = 21.2, SD = 6.21), scoring extremely on both alexithymia dimensions (either in the top or bottom 30% of the population) selected out of the population of freshman psychology students ($N = 516$, ± 70% female), were willing to participate in this study. Parker et al. (1993), in Connelly and Denny (2007) published TAS cut-off scores for non-alexithymia (≤52), borderline (52–60), and alexithymia (>60). Since then many authors in alexithymia research work with extreme groups, ignoring subjects scoring in the borderline or middle range (for instance: Roedema and Simons, 1999; Stone and Nielson, 2001; Gündel et al., 2004, and Connelly and Denny, 2007; Bagby et al., 2009). Since the BVAQ provides scores on two dimensions, we complied to this approach by creating four extreme groups: (1) low capacities on both dimensions (AFF−, COG−; $N = 15$); (2) low on the cognitive dimension and high on the affective dimension (AFF+, COG−; $N = 20$); (3) high cognitive and low on the affective (AFF−, COG+; $N = 16$); and (4) high on both dimensions (AFF+, COG+; $N = 15$) (For reasons of convenience we applied a reversed scoring, thus a plus (+) indicates that the capacities are high, whereas a minus (−) corresponds to low capacities (alexithymia is related to low capacities)).

Although the first two groups mentioned (AFF−, COG− and AFF+, COG−) are now clearly recognized as two different types of alexithymia, one could question whether the other two groups are also types of alexithymia. It is, for instance, clear that the last group (AFF+, COG+) is just the opposite of the classical alexithymics as described by Sifneos and Nemiah, and it is for this reason that it has been labeled 'Lexithymic' in the past. Moreover, although the AFF−, COG+ group has been labeled alexithymia type 3, this is still open for debate. However, all this is of no importance for the research presented here. It is a well-established fact that there are two dimensions in alexithymia, and we therefore selected the four groups mentioned, since only then can the effects of these two dimensions on the autonomic responses been studied well (Nemiah and Sifneos, 1970; Vorst and Bermond, 2001; Bermond et al., 2007).

Since gender differences in psychophysiological responses in alexithymic subjects have been described (Spitzer et al., 2005; Bermond et al., 2008), and also since including males in the study would result in low numbers of males in the various cells (±30% males in the population of freshman psychology students), it was decided to limit this study to females only.

A co-worker, who was not otherwise involved in the study, carried out the actual selection. The experimenters knew subjects only by name and had no knowledge of their alexithymia scores. The subjects were informed that they had been selected on the basis of scores on a test. Only after the experiment were they informed of the nature of the selection.

Subjects were asked to abstain from smoking, coffee and alcohol consumption on the day they participated in the experiment. All subjects provided informed consent, and received 7 euros standard fee for their cooperation. The study was approved by the ethical committee of the Department of Psychology of the University of Amsterdam.

2.3. Measurement of sympathetic responses

The GSR was chosen as the estimate of the sympathetic response, because it is easy to measure, sensitive, and (given proper instructions to the subjects) relatively free of artifacts (Dawson et al., 1990). Furthermore, in contradistinction to most autonomic responses, this response is innervated by the sympathetic nervous system only. Therefore this measurement provides the clearest information about the activity in the sympathetic system. However, this advantage comes at a price, because nothing can be concluded about the involvement of the two alexithymia dimensions regarding the parasympathetic system.

Table 1
Counts of responders and non-responders.

Group	Responders	Non-responders
COG− AFF−[a]	13	2
COG− AFF+	14	6
COG+ AFF−	14	2
COG+ AFF+	14	1

[a] Means that the capacities are low, referring to alexithymic features.

Skin conductance was registered by applying a constant one volt peak to peak alternating voltage (50 Hz), and measuring the current. These values were converted to an analog voltage of 0.2 V/μS, and digitalized using a BioSemi 24 bit analog-to-digital converter (BioSemi, Netherlands). Analyses were done using the Brain Vision Analyzer package (Brain Products GmbH, Germany). The following skin-conductance parameters were analyzed: (1) conductance *baseline values*, defined by the mean value during the second preceding the stimulus onset; (2) *latency*, defined by time between the appearance stimulus and the moment the conductance departed from baseline (defined by the peak in the second derivative of the conductance, between 1500 and 3000 ms after stimulus onset) (Boucsein, 1992); and (3) *amplitude* defined by the mean value in the conductance curve between 3 and 4 s after stimulus onset.

2.4. Procedure

Subjects were asked to sit in front of a computer screen, on which the stimuli (emotion-inducing pictures) were to be presented. Subjects were told that their galvanic skin responses would be measured. To this end, Ag–AgCl electrodes with isotonic electrode paste were connected to the medial phalanges of the index and middle fingers, according to the method described by Dawson et al. (1990). Subjects were asked to relax, to move as little as possible, and to passively watch the pictures.

2.5. Materials

The pictures presented were selected out of the International Affective Picture System (IAPS), and contained fear-inducing, erotic or emotionally neutral information.[2] In a previous research, this picture set was found to elicit reliable electrodermic responses (Tranel and Damasio, 1994; Lane et al., 1999). Twenty pictures with erotic content, which are often used in sex-studies in our laboratory (Laan et al., 1995), were added to the IAPS stimuli. Stimuli were presented on a 75 Hz color (16 bit) display with a 1024*786 resolution starting with a fixation point for 6.5 s, followed by picture presentation time for 0.5 s, followed by a blank screen for 11 s, after which a new trial started. The presentation of the various pictures was randomized with replacement for each subject separately, with equal probabilities for fear-inducing, erotic, and neutral pictures. Forty-eight pictures were presented to each subject.

3. Results

The skin conductance in some subjects did not noticeably vary with the stimulus presentation; there could be a slow drift from the baseline, but no recognizable peaks. We call these subjects 'non-

[2] IAPS, numbers: 1201, 1205, 1220, 1301, 1460, 1525, 1750, 2080, 2260, 2278, 2299, 2304, 2383, 2395, 2399, 2490, 2516, 2590, 2650, 2715, 2840, 3000, 3053, 3060, 3063, 3064, 3068, 3069, 3080, 3100, 3102, 3120, 3150, 3170, 3400, 4460, 4470, 4651, 4652, 4653, 4656, 4659, 4666, 4670, 4677, 4681, 4810, 5500, 5530, 5760, 5831, 6260, 6510, 6550, 6560, 7009, 7010, 7090, 7207, 7830, 7950, 9000, 9040, 9050, 9070, 9220, 9330, 9341, 9342, 9570, 9611, 9910, and 9911.

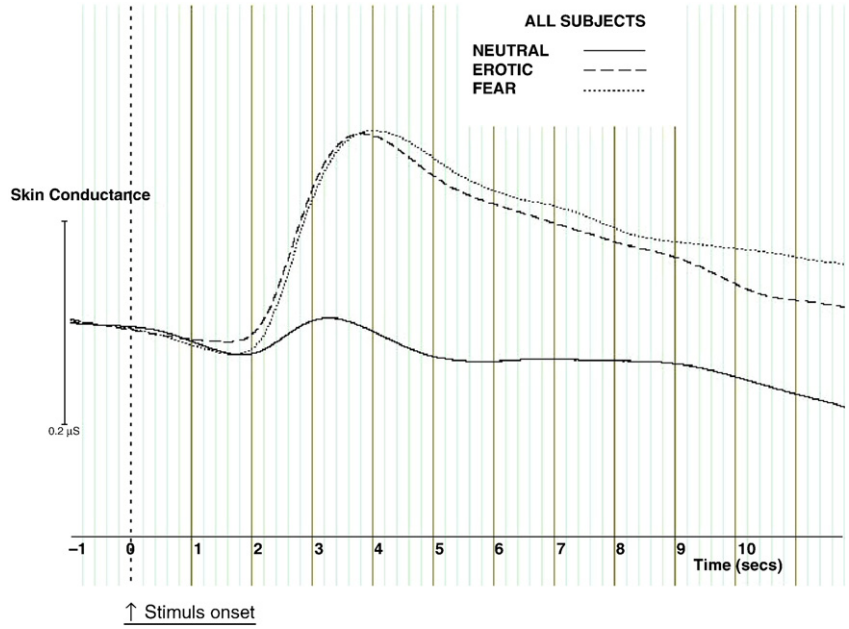

Fig. 1. The average skin-conductance response split for all subjects for three types of stimuli. Baseline correction is from −1 to 0 s.

responders'. An objective criterion to identify non-responders is the mean RMS (root mean squared value) in their skin-conductance records after removing the drift (Dawson et al., 1990). Using the criterion that the mean RMS be larger than 0.002 $\mu S^2/s$, we found that ~17% of the subjects were classified as non-responders. Table 1 gives the distribution of these subjects over the 4 groups.

Non-responders are randomly distributed over the 4 categories of subjects ($Chi^2 = 3.960$, df = 3, $p = 0.27$).

4. GSR measurement

The mean skin conductance is shown in Fig. 1 for each stimulus condition as a function of time with respect to stimulus onset for all subjects (responders and non-responders). In Fig. 2 the data are shown for the 4 groups of subjects separately. The baselines in these figures are corrected with the mean value of the skin conductance from −1 s to stimulus onset.

4.1. Peak amplitude

Results for peak amplitudes are given in Table 2.

As is clear from Fig. 1 there is an expected main effect of stimulus valence giving a larger peak value for emotional than for neutral pictures [$F_{Valence} = 7.18$, df = 2, $p = 0.001$, $N = 66$]. More interestingly this effect showed an interaction with the type of alexithymia dimension, and most notably with the AFF dimension [$F_{Valence * AFF} = 3.462$, df = 2,

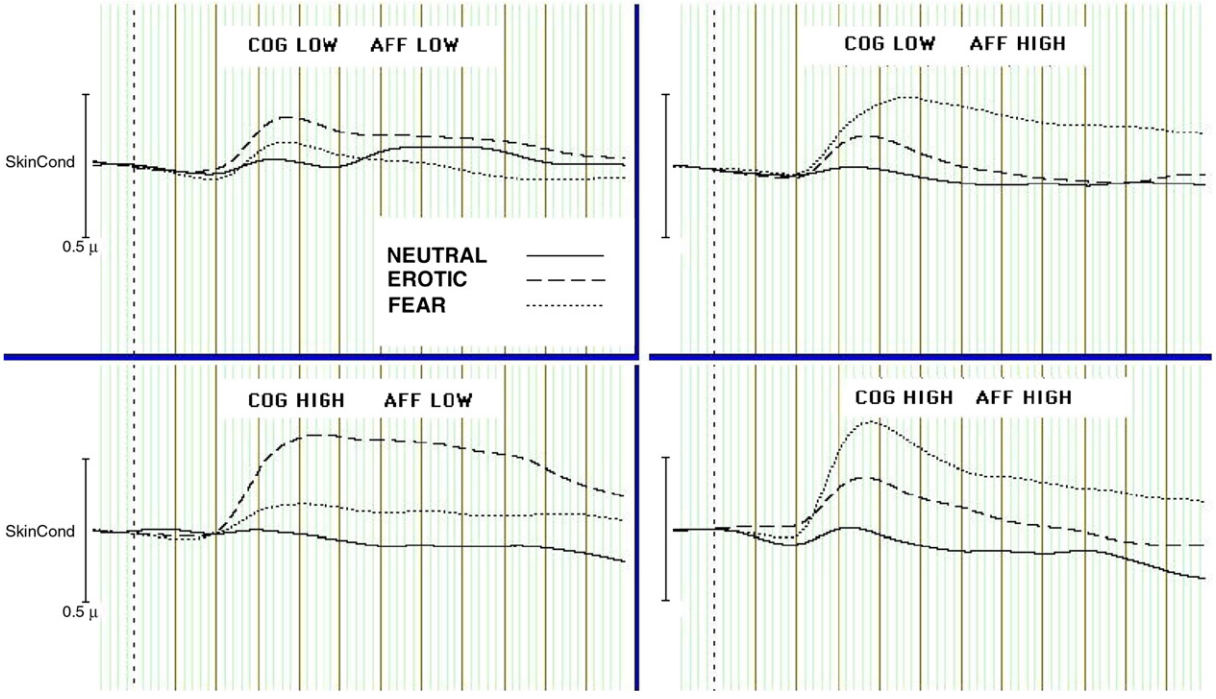

Fig. 2. The average skin-conductance response split for the 4 categories of subjects.

Table 2
Mean values and standard deviations of peak values in microSiemens.

Group	N	Neutral	Erotic	Fear
COG− AFF−[a]	15	0.014 (0.086)	0.154 (0.354)	0.069 (0.242)
COG− AFF+	20	−0.001 (0.123)	0.069 (0.242)	0.179 (0.452)
COG+ AFF−	16	0.00001 (0.089)	0.284 (0.813)	0.088 (0.182)
COG+ AFF+	15	−0.0001 (0.233)	0.174 (0.230)	0.348 (0.549)

Standard deviations between parentheses.
[a] Means that the capacities are low, referring to alexithymic features.

$p = 0.034$, $N = 66$], while there is no effect of the COG dimension [$F_{Valence * COG} = 0.662$, df = 2, $p = 0.52$, $N = 66$].

Removing the neutral condition from the analysis revealed the interaction effect of the AFF dimension on peak values more clearly [$F_{Valence * AFF} = 5.996$, df = 1, $p = 0.017$, $N = 66$], while the effect of the COG dimension remained negligible [$F_{Valence * COG} = 0.88$, df = 1, $p = 0.35$, $N = 66$].

It should be noted that all subjects were entered in these analyses, because the definition of peak value allows us to include 'non-responders'. Removing the non-responders from the analysis did not change the overall result. Most notably the interaction between the valence of the stimulus and the AFF dimension remains the same [$F_{Valence * AFF} = 3.467$, df = 2, $p = 0.035$, $N = 55$], while there are no COG effects [$F_{Valence * COG} = 0.39$, df = 2, $p = 0.68$, $N = 55$].

Post hoc two contrasts were calculated: ('Cog high, Aff high' + 'Cog low, Aff high' versus 'Cog high, Aff low' + 'Cog low, Aff low') for both (1) the fear stimuli, and (2) the erotic stimuli. Only for fear stimuli was there a suggestive difference [mean difference 0.173, df = 64, t = 1.80, $p = 0.076$ two-tailed, $N = 66$], whereas the same analysis for erotic stimuli provided a clear insignificant result [mean difference 0.088, df = 64, t = −0.764, $p = 0.764$ two-tailed, $N = 66$]. Removing the 'non-responders' from the analyses provided the same results more clearly: fear stimuli [mean difference 0.228, df = 53, t = 2.054, $p = 0.045$ two-tailed, $N = 55$] and erotic stimuli [mean difference 0.087, df = 53, t = −0.633, $p = 0.529$ two-tailed, $N = 55$]. This indicates that the significance of the interaction factor (stimulus valence × affective alexithymia dimensions) is mainly due to the higher GSR peak values in subjects with high affective capabilities, in response to fear stimuli, compared to subjects with low affective capabilities in their response to fear stimuli.

4.2. Baseline scores

Mean values and standard deviations of the baseline values preceding the stimuli are presented in Table 3.

Analysis of variance provided suggestive evidence for higher GSR baseline levels in subjects with higher cognitive emotional capacities [$F_{COG} = 3.43$, df = 1, $p = 0.069$, $N = 66$], [$F_{AFF} = 0.22$, df = 1, $p = 0.64$, $N = 66$], [$F_{COG \times AFF} = 0.95$, df = 1, $p = 0.33$, $N = 66$].

Note that all subjects, including 'non-responders', were entered in this analysis, because baseline can be assessed in the absence of clear peaks. Excluding the non-responders from the analysis yields comparable results [$F_{COG} = 3.17$, df = 1, $p = 0.081$, $N = 55$] [$F_{AFF} = 0.353$, df = 1, $p = 0.552$, $N = 55$] [$F_{COG \times AFF} = 0.378$, df = 1, $p = 0.542$, $N = 55$].

Table 3
Baseline values before baseline correction in microSiemens.

Group	Count	Mean	SD
COG− AFF−[a]	15	15.056	5.438
COG− AFF+	20	14.248	4.572
COG+ AFF−	16	16.451	8.231
COG+ AFF+	15	18.751	7.242

[a] Means that the capacities are low, referring to alexithymic features.

Table 4
Overall (erotic and fear pictures) latencies in milliseconds.

Group	N	Mean (SD)	
		Erotic	Fear
COG− AFF−[a]	11	1947 (236.2)	1911 (170.0)
COG− AFF+	10	2142 (361.2)	2270 (447.3)
COG+ AFF−	9	2082 (221.9)	2422 (379.9)
COG+ AFF+	12	2009 (327.2)	1944 (271.7)

[a] Means that the capacities are low, referring to alexithymic features.

4.3. Latencies

In this analysis only subjects who showed a definite response on the mean of all trials, regardless of the nature of the stimulus picture were included. This excludes the 'non-responders', and also subjects who did not show one single clear peak in the second derivative of the conductance. Many subjects did not show a clear latency in response to neutral stimuli. This is understandable, since these neutral pictures hardly induce any change in skin conductance. For this reason, the responses to the neutral pictures were excluded from the statistical analyses of the skin-conductance latency times. The excluded subjects were randomly distributed over the 4 experimental groups ($Chi^2 = 4.33$, df = 3, $p = 0.23$) (Table 4).

Repeated Measurement Analysis of Variance shows a three-way interaction between the two alexithymia dimensions (cognitive and affective), and valence (the type of emotion-inducing picture; erotic or fear) ($F_{Valence * COG * AFF} = 7.954$, df = 1, $p = 0.0097$, $N = 42$). Analyses of variance of the responses to two emotional stimulus types separately produced non-significant results for the erotic stimuli, but a clear significant interaction result for fear stimuli: *fear stimuli* [$F_{COG} = 0.833$, df = 1, $p = 0.367$, $N = 42$]; [$F_{AFF} = 0.339$, df = 1, $p = 0.564$, $N = 42$]; [$F_{COG \times AFF} = 17.062$, df = 1, $p = 0.0002$, $N = 42$]; *erotic stimuli* [$F_{COG} = 0.00003$, df = 1, $p = 0.995$, $N = 42$]; [$F_{AFF} = 0.446$, df = 1, $p = 0.508$, $N = 42$]; [$F_{COG \times AFF} = 2.132$, df = 1, $p = 0.152$, $N = 42$]. The significant interaction factor for fear stimuli is due to the long latency of the mixed groups on fear stimuli. Especially the group with high cognitive emotional capacities, but low affective emotional capacities (COG+ AFF−) has a ~20% higher mean latency, whereas the COG− AFF+ has a ~10% higher latency, compared to the COG+ AFF+ and COG− AFF− groups.

5. Discussion

Results provided suggestive evidence that the cognitive alexithymia dimension (verbalizing-, identifying- and analyzing-emotions) could be a factor in GSR baseline levels. Specifically, higher emotional cognitive capacities result in higher baseline GSR levels. These suggestive results seem to contradict the results of a very recent study (Bagby et al., 2009) indicating that high alexithymics (subjects scoring in the top 20% on the TAS-20) have higher GSR baseline levels. However, it should be noted that our baseline levels refer to the second preceding the stimulus onset. Thus, it is feasible that subjects with high emotional cognitive capacities ruminate longer than those with strongly reduced emotional cognitive capacities. This prolonged emotional engagement could spill over to the next trial, and thus explain the higher baseline levels. If this conjecture is correct, then our results are consistent with Brosschot et al. (2006). These authors, in a review of the relevant literature, concluded that rumination results in enhanced activation of numerous physiological responses.

The present results demonstrated that the emotion-induced GSR latencies to fear stimuli were significantly longer in the mixed groups (AFF high, COG low and AFF low, COG high) than those in the non-mixed groups (AFF low, COG low and AFF high COG high). This suggests that subjects, with discordant scores on the two components

in the mental emotional responses (affective component and cognitive component), need more time to appraise emotional stimuli as fearful.

The results concerning the main aim of this study, peak values, demonstrated that the affective alexithymia dimension (emotionalizing and fantasizing) is an important factor in the regulation of the intensity of sympathetic responses in response to fear stimuli. Specifically, higher emotional affective capacities result in higher GSR peak values in response to fear-inducing stimuli. The influence of the cognitive alexithymia dimension (verbalizing-, identifying- and analyzing-emotions) turned out to be negligible. This is in line with the hypo-arousal model of alexithymia (Linden et al., 1996), and neuropsychological data concerning the emotional experience and emotional physiological responses (see Introduction). This result could also explain why the literature regarding the relationship between alexithymia and autonomic responses has produced equivocal results, since alexithymia has been assessed in these studies by aid of a version of the TAS, which does not explicitly measure the affective dimension of alexithymia. The results of the recent study of Bailey and Henry (2007), indicating that alexithymia type 2 (high affective capacities together with low cognitive capacities) is related to the report of more somatic symptoms than either type 1 alexithymia (low affective as well low cognitive capacities) or lexithymia (high affective as well high cognitive capacities), also point at the importance that both alexithymia dimensions should be measured separately. However, as stated in the Methods section, the choice for a clear sympathetic measurement comes at a price, because nothing can be concluded about the involvement of the two alexithymia dimensions regarding the parasympathetic system. Thus it is feasible, for instance, that changes in parasympathetic activation are linked to the cognitive dimension. For this reason further studies are needed, especially since it is known that the two autonomic systems inhibit one another at their target organs.

There is, however, room for a slightly different explanation. Most studies used rather complicated negative affect inductions, like 'anger recall tasks' or 'stress quizzes', while in our study subjects were required only to passively watch emotion-inducing pictures. Therefore, the task in the present study was undemanding at processing cognitive information, thus the cognitive dimension was a less important factor in affect-induction, while the affective dimension was relatively more important. Support for this notion is provided by Wehmer et al. (1995). These authors also used slides to induce affect, and their results indicated less reactive heart rate increases and fewer GSR responses in alexithymics compared to non-alexithymic subjects. Wehmer et al. (1995) used two alexithymia measurements; (1) the TAS and (2) the percentage of emotion words in descriptions of a modified Thematic Apperception Test (TAT). The results concerning the aforementioned physiological responses were statistically significant only, when alexithymia was assessed by TAT descriptions. It is possible that this TAT-based assessment (percentage of emotion words used) is more strongly related to the affective alexithymia dimension than the assessment based on the TAS.

In conclusion, we cautiously interpret the current results as being supportive of the contention that the equivocal results, which characterize part of the literature concerning alexithymia and autonomic responses, might be due to the uncontrolled variance arising from the, not measured, affective alexithymia dimension.

However, more research is clearly necessary. First of all, we did not control for height and weight of our subjects, and although subjects were asked to abstain from smoking, coffee and alcohol consumption during the hours before participating in the experiment, we had no way of controlling whether or not they heeded our advice. This may have contributed to the error variance and hence weakened our statistical conclusions. Also, this research should be replicated with male subjects, in order to see whether or not the results may be generalized to males also. Furthermore, possible relations between the two alexithymia dimensions and the activity in the parasympathetic system should be studied. Finally, future research should take into account both the cognitive and the affective alexithymia dimensions, and should utilize various negative emotion inductions, which require varying levels of cognitive reflection.

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