ALEXITHYMIA AND SYMPATHETIC RESPONSES IN REACTION TO EMOTION INDUCING STIMULI

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Abstract

Previous research has demonstrated that second order factor analyses on BVAQ subscale scores produced in various populations two factors: an affective dimension of alexithymia (emotionalizing and fantasizing) and an emotion-cognitive dimension (verbalizing-, identifying-emotions) with analyzing-emotions loading on both factors. These two factors make four extreme groups thinkable (cognitive high, affective high; cognitive high, affective low; cognitive low, affective high; cognitive low, affective low). The four such extreme groups of female subjects were exposed to randomized neutral and emotional pictures while their skin conductance was measured continuously. Baseline level preceding the stimuli, latency time response, peak amplitude, and peak areas, were taken as dependent variables. Results show no differences between the groups in baseline levels but significant interactions between type of emotional deficit (cognitive or affective) and GSR latency times. The results further indicated that, the affective alexithymia dimension (emotionalizing & fantasizing) is a more important factor in the regulation of the intensity of sympathetic responses (GSR peak amplitudes & GSR peak areas), then the cognitive alexithymia dimension. The results, thus, support the idea, that classification of alexithymics on the basis of two dimensions might provide a more consistent understanding of physiological responses to emotional stimuli than the usual classification on the basis of a single dimension.

Introduction

Sifneos (1973a) coined the term 'alexithymia' to label a complex of features, referring to severe reductions in as well the cognitive as the affective components of the emotional experience, as it was assumed that alexithymia-like features are common in psychosomatic patients. Many publications claim experimental or clinical support for this idea (Ruesch, 1948; Mc Lean, 1949; Groen, van der Horst, & Bastiaans, 1951; Sifneos, 1973b, 1975; Krystal, 1979, Heiberg, 1980; Shipko, 1982; Smith, 1983; Gage & Egan, 1984; Cooper and Holstome 1984; Fernandez, Sriram, Rajkumar, & Chandrasekar, 1989; Nemiah, 1996; Lumley, Stettner, & Wehmer, 1996; De Gucht, & Heiser, 2003; Porcelli, Bagby, Taylor, De Carne, Leandro, Todarello, 2003; Neyal, Demirci Herken &, Neyal, 2004; Modestin, Furrer, Malti, 2004). The belief in the relationship between alexithymia, and psychosomatic complaints was and still is wide spread (Noël and Rimé, 1988; Lumely et al., 1996; Gündel, Ceballos-Bauman & von Rad, 2000). Some authors even used the labels alexithymia and psychosomatic complaints interchangeably (Lesser and Lesser, 1983; Dewarja, & Sasaki, 1990; Montreuil, Jouvet, Bungener, and Wildlöcher 1991). Yet, despite the many publications suggesting such a relationship, and despite the fact that it has been demonstrated that alexithymics have a lower life expectancy (Kauhanen, Kaplan, Cohen, Julkunen, & Salonen, 1996), this issue remains under debate. Other authors failing to demonstrate such a relationship, state that the assumed relationship between alexithymia, and physical illness still has to be proven or state that even if a correlation will be clearly demonstrated the causal relationship between the two concepts still remains unclear (Lumely, et al., 1996; Gündel, et al., 2000;

Friedman, Vila, Even, Timsit, Boitard, Dardennes, Guelfi, Mouren-Simeoni, 2003; Kooiman, Bolk, Rooijmans, Trijsburg, 2004).

The proposed relationship between alexithymia and psychosomatic complaints has stimulated research into the emotional physiological responses in alexithymics compared to non-alexithymics, because long term or frequent enhanced emotional physiological responses in alexithymics could explain the relationship between alexithymia and (psycho-) somatic complaints. There have appeared as well publications claiming that alexithymia is associated with, higher base-line-levels, larger response amplitudes or longer-lasting physiological responses (for instance; Papciak, et al., 1985 Martin, & Pihl, 1986; Rabavilas 1987; Stone & Nielson, 2001; Gündel, Greiner, Ceballos-Baumann, Ladwig, Von Rad, Forstl, Jahn, 2004), as well as many publications failing to demonstrate such relationships (for instance; Papciak, et al., 1987; Wise, Mann, Hryviak, Mitchell and Hill, 1990; Modestin, et al., 2004).

Although the relevant literature is far form unequivocal (Bermond, 1997), the consensus seems to be, that alexithymia, higher physiological responses and somatic complaints are correlated, albeit possibly weakly (Taylor, Bagby & Parker, 1997; Gündel, et al., 2000; De Gucht & Heiser, 2003).

One of the possible explanations for the inconsistencies in these results is that classification of the subjects into alexithymic and control groups in most studies are done with aid of one the Toronto alexithymia questionnaires: TAS-26, TAS-R or TAS-20 (Taylor, Ryan and Bagby, 1985; Taylor, Bagby, and Parker, 1992; Bagby, Parker, and Taylor, 1994). These scales fail to measure two important components of alexithymia: emotionalizing and fantasizing, thus the TAS scales only measure the emotion-cognitive

aspects of alexithymia. However, in accordance with early descriptions of patients with psychosomatic complaints (Horney, 1952, Kelman, 1952; Nemiah & Sifneos, 1970), the founding fathers of the alexithymia concept (Nemiah & Sifneos, 1970, have always stressed the importance of the affective components (reduced emotionalizing and reduced fantasizing) as important aspects of alexithymia (Nemiah, 1996; Sifneos, 1991, 2000). Since due to the introduction of the TAS scales alexithymia is nowadays of defined as just a reduction in the cognitive components often the emotional experience, we like to cite Nemiah (1996): "Far from manifesting a complex psychological structure and a richly endowed inner life of affects and fantasies, it became apparent that alexithymic individuals had major deficits in both their capacity to experience, differentiate, and describe feelings, and their ability to create fantasy."

Although the hypothesis of an association between reduced emotional cognitions and enhanced emotion physiological responses could provide an explanation for the proposed relationship, the hypothesis of an association between enhanced affective mental responses and enhanced physiological responses seem more reasonable, especially if these enhance affective responses are accompanied by severely reduced emotional cognitions. Since it is feasible that such persons would not only experience emotion induced mental arousal, but also stress due to the fact that they lack the information to explain the experienced emotional feelings.

The current study was explores the relationship between the affective component, as well as the cognitive component of alexithymia and emotion induced sympathetic activation.

Methods

Alexithymia measurement

Alexithymia was measured by aid of the Bermond-Vorst alexithymia questionnaire (BVAQ) (Vorst and Bermond, 2001). This questionnaire has five separate subscales, (8 items per sub-scale, four indicative and four contra indicative) for all alexithymia features as mentioned by Nemiah and Sifneos (1970) and Sifneos (1973a), who defined the concept of alexithymia by the following traits: reduced capacities for emotionalizing, fantasizing, identifying emotions, verbalizing emotions and pensé opératoire (Marty & M'Uzan, 1963) or analyzing emotion. Examples of respective items are: " When friends around me argue violently, I become emotional." (Emotionalizing; pos); NB the items are formulated in such a way that the emotional feeling can remain unspecified). "Before I fall asleep, I make up all kinds of events, encounters and conversations" (Fantasizing: pos). "When I am distressed, I know whether I am afraid or sad or angry" (Identifying: pos). "I find it difficult to verbally express my feelings" (Verbalizing: neg). "I hardly ever go into my emotions" (Analyzing: neg).

In previous research confirmative second order factor analyses, as well as principal component analyses, on BVAQ subscale scores produced in various populations two factors, indicating an emotion-affective dimension of alexithymia (emotionalizing and fantasizing) and an emotion-cognitive dimension (verbalizing-, identifying-emotions) with analyzing-emotions loading on both factors. Thus the BVAQ allows an analysis on the basis of the two alexithymia dimensions, hence called COG and AFF. Finally, the BVAQ has, in various languages, acceptable to very-good psychometric properties (Zech, Luminet, Rimé, & Wagner, 1999; Bertholz, Ouhayoun, Perez-Dias, Consil, & Jouvent,

2000: Vorst & Bremond 2001; Müller, Brüner & Ellgring, 2004; Bermond, Clayton, Liberova, Luminet, Maruszewski, Ricci-Bitti, Rimé, Vorst, Wagner, and Wicherts, 2005). Since the subscale 'analyzing-emotions' loads, in the Dutch population, clearly on the cognitive factor (.77) and only minor on the affective factor (.22) (Vorst and Bermond, 2001, Bermond et al. 2005), we included 'analyzing-emotions' in the cognitive factor.

Subjects

Sixty-six female psychology students (mean age = 21.2, sd= 6.21) participated in this study. Subjects were selected out of the population of first- and second-year psychology students on base of their BVAQ scores. The selection-criteria were scores in the top or bottom 30% of the population on the two alexithymia-dimensions. In this way four extreme groups were created: (1) Low on both dimensions (affective dimension [emotionalizing & fantasizing] & cognitive dimension [verbalizing-, identifying- & analyzing-emotions] [N=15]); (2) low on the cognitive dimension & high on the affective dimension [N=20]; (3) high cognitive & low on the affective [N=16]; and (4) high on both dimensions [N=15] (low means here that the capacities are low). This selection was done double blind by a coworker not involved in the study. The experimenters knew subjects only by name; their alexithymia scores were kept secret till after the end of the study. The subjects themselves were told that they were selected on basis of scores on various tests, and only after the experiment were informed that the selection was based on their alexithymia scores. All subjects had signed an informed consent and received 7 euros for their cooperation.

Measurement of sympathetic response

The GSR was chosen as the estimate of the sympathetic response, since this response is innervated by the sympathetic nervous system only, is easy to measure, sensitive, and relatively independent of respiration and muscle tension or other somatic influences (Dawson, Schell & Filton, 1990). Skin conductance was registered by applying of 1 volt pk-pk alternating voltage (50 Hz) and measure the current. These values were converted to an analog voltage of -0.2 volt / microSiemens and were converted to digital values using a BioSemi 24 bit analog to digital converter. The following skin-conductance parameters were analyzed: (1) Latency (time between the appearance of a picture and the moment the conductance starts to increase, defined by the peak between 1500 and 3000 msec after stimulus onset in the second derivative of the conductance (see Boucsein, 1992) who uses this method calling the second derivative the gradient in incline). (2) Amplitude (the mean value in the conductance curve between 3 and 4 seconds after stimulus onset). (3) Peak area (the area under the conductance curve from 2 till 12 seconds after stimulus onset). Finally, (4) conductance base line values, taken during 1 second before the presentation of the pictures, were calculated.

Procedure

Subjects were asked to sit in front of a computer screen, on which emotion inducing pictures were going to be presented. Subject were told that their galvanic skin responses would be measured and Ag-AgCl electrodes with isotonic electrode paste were connected to the medial phalanges of the index and middle finger, according to the method as

described by Dawson, et al. (1990). Subject were told to sit as relaxed as possible, to move as little as possible and to watch the to be presented pictures passively.

Materials

The pictures presented were selected out of the International Affective Picture System (IAPS) and contained either, fear/aggressive, erotic or emotional neutral information[1]. Previous research with this picture set invoked reliable electrodermic responses (Tranel & Damasio, 1994; Lane, Chua & Dolan, 1999). To the IAPS pictures 20 pictures with high erotic content, which are often used in sex-studies in our laboratory, were added (Laan, Everaerd, and Evers, 1995). Stimuli were presented on a 75 Hz color (16 bit) display with a 1024*786 resolution started with a fixation point for 6.5 seconds, followed by picture presentation time for 0.5 seconds, followed by a blank screen for 11 seconds, after which a new trial started. The presentation of fear/aggressive, erotic and neutral pictures was randomized with replacement for each subject separately.

Results

Responders and non-responders

The skin conductance of some subjects does not noticeably vary with the stimuli. There might be a slow drift of the baseline but no recognizable peaks. We call these subjects 'no responders'. An objective criterium to separate responders from no-responders is the mean RMS (root mean squared value) in their skin conductance records after removing the drift..

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

When using a criterion that the mean RMS should be larger than 0.002 microSiemens we found that 19% of the subjects were classified as no responders. Table I gives the distribution of these 'flat-liners' over the 4 groups of subjects.

Table 1. Counts of Responders and Non-responders

Group	responders	No-responders
COG- AFF-	13	2
COG- AFF+	14	6
COG+ AFF-	14	4
COG+ AFF+	14	1

The non-responders are equally distributed over the 4 categories of subjects (chi2=3.47, df=3, p=0.32). A part form the non responders there are also subjects that show reasonable variability in the data but hardly a relation of the GSR with stimuli.

GSR measurement

The mean skin conductance for each stimulus condition as a function of time since stimulus onset for all subjects is given in figure 1. In figure 2 the data are split for the 4 different groups of subjects. The baselines in these figures are corrected with the mean value of the skin conductance from -1 seconds to stimulus onset.

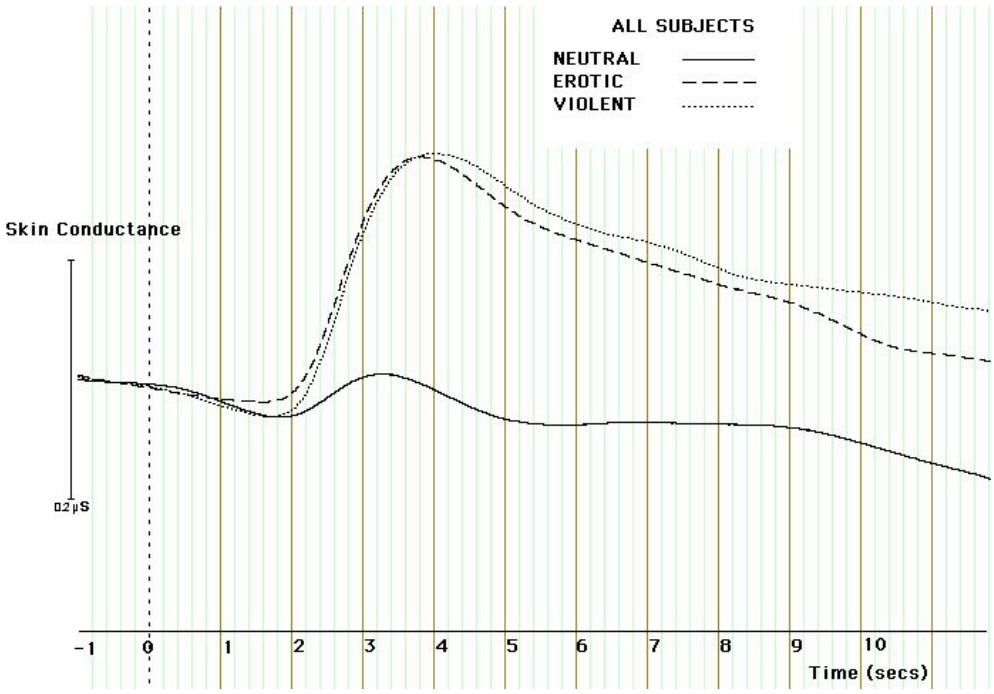

Figure 1. The average skin conductance response for all subjects split for three types of stimuli. Baseline correction is from –1 to 0 seconds.

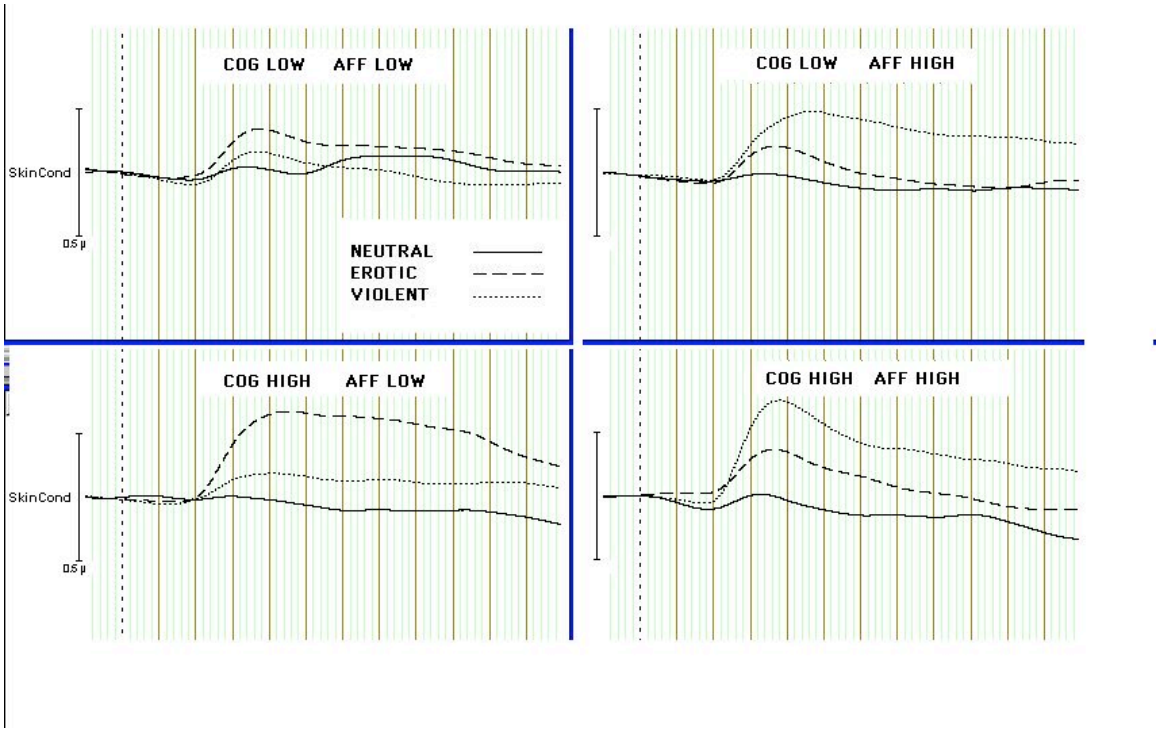

Figure 2: The average skin conductance response split for the 4 categories of subjects.
High indicates high capacities.

Base-line scores

Mean values and standard deviations of the base-line values are presented in table 2.

Table 2: Base line values before base line correction in microSiemens

Group	Count	Mean (micros)	SD
COG- AFF-	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

* + means that the capacities are high, thus non-alexithymic

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 = .069; F_{aff} = .22 df = 1, p = .64 ; $F_{cog \times aff} = .95$ df = 1, p = .33.).

Note that all subjects, including 'flatliners', entered this analysis because even in case of no activity a baseline can be assessed. Excluding the 'flatliners' from the analysis yields comparable results ($F_{cog} = 3.17$, df =1, p = .081).

Latencies

In this analysis only subjects were included that showed a definite response on the mean of all trials irrespective of valence of the stimulus picture, thus responders for which a latency between 1.5 and 3 seconds from stimulus onset could be determined using the maximum in the second derivative of the skin conductance. Of course this excludes the 'flatliners'. But also subjects that show variability without a relation to stimuli do not enter this analysis. Even more subjects did not show a clear latency using the criterion of the second derivative in response to neutral stimuli. This is understandable since these neutral pictures hardly induce any change in skin conductance. For this reason neutral pictures were left out of the statistical analyses for skin conductance latency times. The removed subjects are equally distributed over the 4 experimental groups (chi2 = 4.33, df= 3, p = 0.23)

Table 3: overall (erotic & fear/aggressive pictures) latencies

		Mean Latency in milliseconds (sd)	
Group	N	Erotic	Fear/Aggresive
COG- AFF-	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)

Repeated measurement Analysis of Variance (type = erotic or fear/aggression) shows a three-way interaction between the two factors COG and AFF and the type of emotion inducing picture. ($F_{type*COG*AFF} = 7.954$, df =1, p = 0.0097). Analyses of variance over the two emotional stimulus types separately provided non-significant results for the erotic stimuli, but clear significant results for fear/aggressive stimuli (Erotic stimuli: $F_{cog} = .00003$, df = 1, p = .995; $F_{aff} = .446$, df = 1, p = .508; $F_{cog\ x\ aff} = 2.132$, df = 1, p = .152), (Fear/aggressive stimuli: $F_{cog} = .833$, df =1, p = .367; $F_{aff} = .339$, df= 1, p = .564; $F_{cog\ x\ aff} = 17.062$, df= 1, p = .0002).
This result is due to the long latency of the mixed groups on Fear inducing stimuli. Especially the group with high cognitive emotional capacities, but low affective emotional capacities (COG+ AFF-) has a ~ 20 % higher latency.

Peak amplitude

Results for peak amplitudes are given in table 3.

Table 3; mean values and standard deviations of peak-values in microSiemens

Group	N	Neutral	Erotic	Fear/Aggressive
COG- AFF-	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)
ALL	66	0.003 (0.140)	0.174 (0.468)	0.171 (0.395)

Standard deviations between parentheses

As is clear from figure 1 there is a non-surprising 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). More interestingly this effect shows an interaction with the type of alexithymia and most notably

with the AFF factor ($F_{valence*aff}$ = 3.462, df = 2, p = 0.034) but not with the COG factor ($F_{valence*cog}$ = 0.662, df = 2, n.s.).

Removing the neutral condition from the analysis shows the interaction effect of the AFF factor on peak values more clearly ($F_{valence*aff}$ = 5.996, df = 1, p = 0.017) while there is absolutely no effect of the COG factor (F_{cog} = 0.88, df = 1, p = 0.35). The conclusion is that subjects with low affective capacities respond stronger on erotic pictures while the subjects with a high affective capacities respond more strongly on violent pictures, the latter being the normal finding for female subjects. The COG factor doesn't differentiate between responses on the two types of emotional stimuli at all (see also Figure 2).

Post hoc four contrast were calculated: a) 'Cog+, Aff+' vs 'Cog+, Aff-,' and b) 'Cog-, Aff+' vs 'Cog-, Aff-' for as well fear/aggressive as erotic stimuli. Only for fear/aggression stimuli there was a suggestive difference between 'Cog+, Aff+' vs 'Cog+, Aff-'($p < .05$, one tailed). This indicates that the combination of high cognitive and high affective abilities might result in higher GSR responses, compared to the combination of high cognitive and low affective. All other three comparisons were insignificant.

It should be noted that all subjects entered these analysis because the definition of peak value we have been using allows to include 'flatliners'. Removing the 'flatliners' from the analysis does not change the picture. Most notably the interaction between the valence of the stimulus and the AFF factor remains the same (($F_{peak*aff}$ = 3.467, df = 2, p = 0.035) while there are nor COG effects.

Peak areas

Peak area values are of course dependent on peak values. However different results might be indicative for an effect that occurs later during the evaluation of the different type of stimuli. Indeed this analysis shows basically the same results as the analysis of peak values (see table 4)

Table 4; mean peak area values and standard deviations in microSiemens

Group	N	Neutral	Erotic	Fear/Aggressive
COG- AFF-	15	0.021 (0.186)	0.085 (0.233)	-0.005 (.215)
COG- AFF+	20	-0.044 (0.097)	0.001 (0.136)	0.161 (0.446)
COG+ AFF-	16	-0..041 (0.123)	0.251 (0.615)	0.065 (0.234)
COG+ AFF+	15	-0.073 (0.202)	0.043 (0.124)	0.190 (0.308)
ALL	66	-0.035 (0.154)	0.090 (0.342)	0.106 (0.327)

Standard deviations between parentheses

Similar to the peak values, also the peak areas show a main effect of valence ($F_{valence}$ = 5.29, df = 2, p=0.0062) and an interaction effect with the affective component of alexithymia ($F_{valence*aff}$ = 4.93, df=2, p = 0.0087) and no interaction effect with the cognitive alexithymia ($F_{valence*cog}$ = 1.28, df=2, p = 0.26). However, using peak values as covariance measure reduces all effects to non significant values suggesting that all area affects are indeed due to the peak effects.

Discussion

Results demonstrate that the emotion induced GSR latencies were significant longer in the mixed groups (aff. high, cog. low & aff. low, cog high) compared to the non-mixed groups (aff. low, cog low & aff. high, cog. high). This suggests, that such subjects, in whom the two components of the emotional experience (affective component & cognitive component), are not in line with one another need more time to appraise emotional stimuli as emotional. However, it is also possible that this delay in reaction is not limited to emotional information. Recently, we have found a comparable delay in reaction times, for these mixed groups in comparison the high/high and low/low groups, in response to color-words in a Stroop test (Bermond et al., in preparation).

The results, regarding, peak values demonstrated that, the affective alexithymia dimension (emotionalizing & fantasizing) is an important factor in the regulation of the intensity of sympathetic responses, whereas the influence of the cognitive alexithymia dimension in negligible. The significant interaction factor [alexithymia affective dimension x type of emotion] found suggest that subjects with low affective capacities (emotionalizing & fantasizing) respond stronger on erotic pictures while the subjects with a high affective capacities respond more strongly on violent pictures, the latter being the normal finding for

female subjects. However, the fact that only one contrast (fear/aggression Cog+, Aff+ vs Cog+, Aff-) resulted an p-value of any interest, indicates that the significance of this interaction factor mentioned is mainly due to the increased galvanic skin-response in subjects with high affective capabilities in their response to fear/aggression stimuli.
Although the analyses regarding peak areas, provided, in essence, the same results as those for peak values, the analyses with peak values as covariance, indicated that these peak area results had to be attribute to the peak effects.

Three theories have been published regarding emotional physiological responses in alexithymics. The decoupling hypothesis (Papciack, Feuerstein & Speigel, 1985; Papciak, Feuerstein, Belar, & Pistone, 1987; Stone & Nielson 2001), proposing that although alexithymics have higher physiological base-line levels they reach equal levels during emotional stimulation as non-alexithymics, clearly does not fit with our results. Firstly, there are no indications that alexithymic subjects have higher baseline levels. On the contrary there was a slight indication for the reverse, higher cognitive emotional capacities resulting in higher GSR baseline levels. Secondly the results clearly indicate that only the alexithymia affective dimension is an important factor in the regulation of emotional physiological responses.
The discharge theory (MacLean, 1949; Cacioppo, Uchino, Crites, Snydersmith, Smith, Berntson, Lang, 1992; Roedema & Simons, 1999), proposing that the 'emotional energy' can be discharged in two ways; 1) by emotional mental responses or 2) by motional physiological responses, receives some support. The significant interaction factor [affective dimension x type of emotion] suggests that lower affective capacities result in lower skin responses in reaction to fear/aggressive stimuli whereas such lower affective capacities result in higher galvanic skin responses in reaction to erotic stimuli. However, calculation of contrasts, demonstrated that his enhanced response to erotic stimuli is clearly insignificant.
The alexithymia stress hypothesis (Martin, Pihl, Young, Ervin, & Tourjam, 1986; Taylor, Bagby, & Parker, 1997), proposes that since alexithymics show a sever reduction in emotional-cognitions; they often come to the wrong conclusions, resulting in more emotional problems instead of reducing such problems, and thus in repeated periods of enhanced levels of physiological stress. This idea is consistent with publications stating that the emotional

experience forces people to reflect upon their emotions (Laird & Bressler, 1992; Damasio, 1999). Although this theory cannot be tested directly by our results, these results still provide some indications. There are two groups in our study with low emotional cognitive capacities (COG low & AFF low, and COG low & AFF high). The extremely low GRS responses in the subgroup COG low & AFF low, suggest, that if true, the stress hypothesis counts only for the group COG low & AFF high.

Most research in the field of alexithymia has been done with the Toronto Alexithymia Scale (TAS) or later versions of TAS, the TAS-R and TAS-20 (Taylor, et al. 1985; Taylor, et al., 1992; Bagby, et al., 1994), since these were for a long period the only reliable alexithymia scales. None of these scales, however, measures emotionalizing and the TAS-R and TAS-20 also do not measure fantasizing. The fact that the various versions of the TAS don't measure the affective component of alexithymia, could explain why the alexithymia literature concerning physiological emotional responses is not unequivocal (Bermond, 1997).

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