

An externally oriented style of thinking as a moderator of responses to affective films in women

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Abstract

This study was conducted to test the hypothesis that differences in alexithymia would moderate coupling in physiological and subjective-experiential responses to two affective films, which were shown to induce a common negative (sad) feeling, but to provoke different hyper- or hypo-arousal physiological responses (e.g., heart rate acceleration or deceleration) associated with antipathic or empathic context, respectively (Davydov, Zech, & Luminet, 2011). Only women were studied as persons showing more reactivity to sad films than men. Reactivity was evaluated for facial behaviour, physiological arousal, and subjective experience. Some other affective and cognitive disposition factors (e.g., depression and defensiveness) were considered for evaluating their probable mediation of the alexithymia's effects. While subjective experience was not affected by alexithymia, high scorers on the externally-oriented thinking factor showed reduced physiological reactivity in both film conditions. These effects were mediated through different disposition factors: either low affectivity (low depressed mood), which mediated alexithymia's effect on hyper-arousal responses (e.g., decrease of heart rate acceleration), or impression management (other-deception), which mediated alexithymia's effect on hypo-arousal responses (e.g., decrease of heart rate deceleration).

Keywords: Autonomic arousal; Affective induction; Alexithymia; 'Decoupling' hypothesis; Heart rate; Skin conductance; Appraisal; Externally-oriented thinking style

1. Introduction²

Homeostatic theory of arousal and affect relationship (Davydov, Shapiro, Goldstein, & Chicz-DeMet, 2005, 2007) proposes that physiological reactions associated with the same emotional feeling can go in different hyper- or hypo-arousal directions corresponding to the directional component of the emotion (avoidance or approach motivation). This was confirmed in one recent study (Davydov et al., 2011), which used two films inducing a common sad feeling, but with different secondary contexts, one of avoidance (disgust or antipathy) and the other of approach (tenderness or empathy). In that study, participants reported feeling less happy and showed increased facial activity related to the sad content of both ‘avoidance’ and ‘approach’ films, which presented either less confused, but more unpleasant (negative ‘avoidance’) information or more confused, but less unpleasant (negative ‘approach’) information. Compared to the resting (baseline) period, the ‘avoidance’ film viewing induced an increase in sympathetic arousal as indexed by an increase in skin conductance level and response rate, and by increase in systolic blood pressure (SBP; detected by lower pulse transit time). The condition of an augmented sympathetic arousal was extended to the recovery period after this film presentation as indicated by higher heart rate and SBP. In contrast, compared to the resting (baseline) period, the ‘approach’ film induced a decrease in sympathetic arousal as indicated during the film viewing by a decrease in amplitude of skin conductance responses and during viewing and recovery periods by lower heart rate.

² *Abbreviations:* EMG - electromyographic activity; IBI - interbeat interval; PTT - pulse transit time; SBP – systolic blood pressure; SCR, SRR - skin conductance response and response rate, respectively; HA and LA - groups of high and low alexithymia scorers, respectively; TAS-20 - the 20-item Toronto Alexithymia Scale; DIF, DDF, EOT – ‘difficulties identifying feelings’, ‘difficulty describing feelings to others’, and ‘externally oriented thinking’ dimensions of alexithymia; PANAS, PA, NA, NA_D, and NA_A - the Positive and Negative Affect Schedule in its trait version with positive, negative, negative ‘depression’, and negative ‘anxiety’ affect subscales, respectively; ZDS, ZDS_D, ZDS_C, and ZDS_S, - the Zung Self-Rating Depression Scale with affective (depressive), cognitive, and somatic symptom subscales, respectively; SN and SP films - Sad film with Negative context and the Sad film with Positive context, respectively

In that study (Davydov et al., 2011), we had also measured alexithymia as a potential moderating factor on coupling of physiological and subjective-experiential responses to two affective films, but those moderation analyses were not considered. These predicted moderation effects are the main subject of study in the present paper. Alexithymia's moderation effect may be indicated by its decoupling of correspondence between subjective-experiential reactions on the one hand and physiological reactions on the other hand in response to affective stimuli (Grynberg, Davydov, Vermeulen, & Luminet, 2012; Luminet, Rimé, Bagby, & Taylor, 2004; Newton & Contrada, 1994; Papciak, Feuerstein, & Spiegel, 1985; Stone & Nielson, 2001).

Alexithymia is a multifaceted construct comprising (i) a difficulty identifying and distinguishing between feelings and the bodily sensations of emotional arousal; (ii) a difficulty describing feelings to others; (iii) a restricted imagination, as evidenced by a paucity of fantasies; and (iv) a cognitive style that is literal, utilitarian, and externally oriented (Taylor & Bagby, 2000). We consider that the central mechanisms related to the alexithymia construct belong to inhibition mechanisms developed during evolution, which partially or totally decouple the central processes from peripheral arousal to prevent flexible adjustment (adaptation) of peripheral arousal for the maintaining these central processes. In the general population, these mechanisms should protect people from distress or intensive cognitive and extensive affective responses to adversities, challenges or threats as a kind of anti-stress fortification (resilience) coping mechanisms promoting mainly subject's positive experience (Davydov, Stewart, Ritchie, & Chaudieu, 2010). However, in pathological situations, these mechanisms may over-protect a person from stress reactivity to any challenge, which should disturb balance between anti-stress fortification (resilience) and anti-stress training (adaptation) processes resulting in the detriment of adaptation as a mechanism promoting subject's successful coping with negative experience (Davydov,

Stewart, et al., 2010; Davydov, 2011). Thus, we consider that, although mechanisms of alexithymia in response to stressful situations or stress stimuli should look similar in normal and clinical populations, their particular outcomes should be different – protection against disorders in normal subjects with optimally balanced anti-stress fortification (resilience) and anti-stress training (adaptation) mechanisms, but development of disorder in clinical population due to the disbalance of these mechanisms favouring the development of anti-stress fortification to the detriment of anti-stress training. Moreover, the distribution of low- and high-scorers on the different factors of alexithymia should be different across genders demonstrating generally different attention of men and women to affective challenges (Lysenko & Davydov, 2011a, 2011b, 2012a, 2012b; Mattila, Salminen, Nummi, & Joukamaa, 2006), and may be different across specific clinical groups due to different central mechanisms of disorder development in these clinical groups (Mattila, Salminen, Nummi, & Joukamaa, 2006). For example, the alexithymia factor of externally-oriented thinking (EOT) should not be much present in depressed patients with perseverative rumination as a main central mechanism of the disorder development (Davydov, Stewart, Ritchie, & Chaudieu, 2012; Papageorgiou & Wells, 2004; Robinson & Alloy, 2003). However, it should be more frequently found in persons with the ‘psychopathic personality’, who may utilize this mechanism to detach their mind/behavior from external events and to demonstrate shallow (limited) emotions in high arousal surroundings (Lander, Lutz-Zois, Rye, & Goodnight, 2012). We consider that this conceptualization may give a possibility for researchers to utilize wider cross-references between results obtained in clinical groups and results obtained in "healthy/high functioning" populations like students if objectives of studies are mainly related to the alexithymia's mechanisms.

The relevant literature presents conflicting results related to alexithymia effect on physiological component of emotional response. Some studies have suggested that

alexithymia is related to blunted sympathetic activation (Bermond, Bierman, Cladder, Moormann, & Vorst, 2010; Neumann, Sollers, Thayer, & Waldstein, 2004), while others have suggested the augmented sympathetic activation in high alexithymia scorers (Infrasca, 1997; Waldstein, Kauhanen, Neumann, & Katzel, 2002) or had found no effect (Connelly & Denney, 2007). Other researchers have proposed that alexithymia can affect physiological arousal change differently depending on variation in specific factors: e.g., stimulation vs. recovery period of affect regulation (Neumann et al., 2004), mental vs. emotional load of situation (Franz, Schaefer, & Schneider, 2003), or alexithymia's cognitive vs. emotional component (Bermond et al., 2010).

Our conceptualization of the moderation effect of alexithymia in general and of its particular dimensions on arousal and associated physiological responses may be formulated as follows. If alexithymia in general is related to a lack in emotion processing, each particular dimension of the alexithymia construct is associated with the lack in a particular central mechanism or level of the emotion processing. According to this conceptualization, the association of a particular dimension of alexithymia with both central and peripheral arousal processes in specific situations or in response to specific stimuli should mean that this particular alexithymia's dimension and a central activation or inhibition mechanism, associated with it, is actually involved in these particular situations or in response to particular kinds of stimuli. If not a particular alexithymia's dimension, but the overall alexithymia construct or more than one dimension are related to arousal variations, it should mean that specificities of a situation or a stimulus actualize more mechanisms for emotion processing. Specifically, in the present study, we considered that the experimental negative films should trigger a central rumination (negative thinking) mechanism, which directs attention to internal thoughts and distracts (withdrawal) from the external environment (Luminet, Bouts, Delie, Manstead, & Rimé, 2000). These films should also trigger

correspondent physiological or peripheral arousal changes to support this rumination process metabolically (Davydov et al., 2011; Ottaviani, Shapiro, Davydov, & Goldstein, 2008; Ottaviani, Shapiro, Davydov, Goldstein, & Mills, 2009). If perseverative ruminations (repetitive negative thinking) in response to a stressful event are assumed to form one of the pathways for perpetuating and exacerbating sad or depressed mood (Davydov et al., 2012; Papageorgiou & Wells, 2004; Robinson & Alloy, 2003), this mechanism contributing to the development of depression symptoms may be particularly sensitive to people scoring higher on the EOT dimension. Indeed, EOT was found to distract attention from internal thoughts to external environment (Luminet et al., 2004; Lumley & Bazydlo, 2000), and thus to inhibit central and peripheral arousal changes associated with rumination. Other stimuli (e.g. films with other content) would trigger other central mechanisms of emotion processing and associated peripheral (physiological) arousal changes for supporting the central processes metabolically, and thus should be sensitive to interfering and inhibiting effects from other alexithymia's dimensions separately or from alexithymia as a whole.

The EOT dimension of the alexithymia construct is also positively (Lander et al., 2012) related to primary psychopathy or conditions characterized by impression management (other-deception or manipulation of responses in order to appear as socially desirable; (Kroner & Forth, 1995)), emotional detachment, low tenderness, and lack of empathy. Since our previous study (Davydov et al., 2011) showed significant correlations between subjective (self-rating) and objective (physiological) responses to the present films with moral (empathic or antipathic) content, we expected that the predicted alexithymia's moderation effects on arousal changes in the present study ('decoupling' of the subjective and objective responses to two different, arousal-boosting ['avoidance'] and arousal-damping ['approach'], film clips) would be mainly related to higher scores on the EOT component of the alexithymia construct.

In the present study, to increase conclusion or to provide further evidence for conceptual validity of effects (i.e., to decrease a risk of making Type I and Type II errors), the main ‘decoupling’ hypothesis was tested by three different statistical models or approaches (see Figure 1) evaluating (i) whether high (HA) and low (LA) alexithymia scorers with hypothetically the same initial (baseline or pre-film) physiological or experiential activity would have different on-film or recovery physiological activity, but similar experiential activity related to affective stimuli (the ‘covariance’ moderation model); (ii) whether there was a difference in the means of physiological activity changes for HA and LA, while no difference in the means of experiential changes related to the affective stimuli would be found (the ‘difference’ moderation model); (iii) whether the magnitude of discordance between experiential and physiological reactivity in a subject would be a function of the subject’s alexithymia score (the ‘correlation’ moderation model). An additional set of analyses was considered to conduct for the evaluation of two alternative (direct and indirect) paths of the detected alexithymia’s moderation effects. The latter alternative hypothesis (i.e., ‘mediation’ or ‘indirect path’ model) was related to potential mediation mechanisms (cognitive and affective dispositional deficits) of possible alexithymia’s effects in respect to bias or deficit in subject’s cognitive appraisal of an emotional situation (e.g., rating a situation as unusual), level of subject’s affective disposition (depressive mood), or social desirability predisposition, selected according to previous findings (Franz et al., 2003; Helmes, McNeill, Holden, & Jackson, 2008; Luminet et al., 2004; Prkachin, Casey, & Prkachin, 2009).

2. Method

2.1. Participants

Twenty-six healthy female students at the Université catholique de Louvain, Belgium took part in the experiment³. In Fredrickson and Levenson's study (Fredrickson & Levenson, 1998), women were more reactive to the sad film than men. For this reason, in the present study, only female participants were studied. Their mean age was 20 years ($SD = 1.3$). All participants were French-speaking Belgian citizens. Written informed consent was obtained after the procedures were fully explained. They received course credit for their participation. The participants were treated according to ethical standards and fully debriefed.

2.2. Materials, Procedure, Apparatus and Measures

More details of the procedure were published elsewhere (Davydov et al., 2011).

2.2.1. Visual Materials

Two short clips known to elicit sadness plus an additional emotion (either negative – disgust in the sad ‘avoidance’ film [SN film] or positive – tenderness in the sad ‘approach’ film [SP film]) along with high global emotional intensity and interest were used in this study. These films addressed themes of unjust suffering, loss, and grief. The sad ‘avoidance’ film clip was drawn from the feature film “Dead Man Walking” and the sad ‘approach’ film clip was drawn from the feature film “Philadelphia”. Previous findings (Davydov et al., 2011; Schaefer, Nils, Sanchez, & Philippot, 2009) showed that these films elicited the targeted experiential, physiological and behavioural responses. The film clips were between 5 to 7 minutes long and presented with sound. The small difference in the length of the film clips was accepted to make sure that the thematic content was understandable and involving.

³ The sample size for the present study was computed with respect to the power = .70 and alpha = 0.05, which were considered adequate for finding the alexithymia's moderation effect on physiological reactivity (irrespective to direction, the moderation effect is sufficiently robust according to many previous findings, which is discussed in the introduction), and with respect to the effect size ($R^2 = .22$) of the regression model demonstrated in a previous study, which evaluated the alexithymia's moderating impact on heart rate change throughout a sad movie presentation in a non-clinical sample (Luminet et al., 2004).

2.2.2 Procedure

On arrival at the lab, participants signed a consent form informing them that the study would consist of psychological testing and presentation of unpleasant film material, as well as attachment of devices to record their physiological responses, and that they would be free to withdraw at any time. All procedures were conducted in a 6x3-m electrically and acoustically isolated chamber. Participants were seated in a comfortable armchair, and their forearms rested on armrests at heart level. To get baseline self-evaluation, participants were asked to rate on a paper and pencil form, the 12 emotions and 13 bodily sensations they were currently experiencing. To avoid possible order effects, film presentations were counterbalanced. Physiological channels were continuously sampled during the film presentations, baseline, and recovery periods. Instructions were given from an adjacent room via an intercom. Following an orientation period and attachment of physiological sensors, participants were asked to find a comfortable position, to relax, to empty the mind of all thoughts, feelings, and memories, and reminded to avoid any unnecessary movements and speech. They were asked to stay alert and to look at the white cross on the television monitor.

After a short period (1-2 min) of monitoring to insure proper equipment functioning, the first baseline recording of physiological activity was completed (6 min). Then, the first film presentation (5 min 28 sec or 6 min 40 sec) followed after a short instruction to watch the whole scene attentively. After presentation of the film clip, physiological activity was recorded during the first recovery period (5 min). Then, the film familiarity, emotional upset, 12 emotions, 13 bodily sensations, 8 film content appraisals scales were completed. The same procedure was repeated for the second film. During the baseline and post-film recovery periods, the television monitor was black. Following detachment of electrodes, the

personality questionnaires were administered and participants were fully debriefed. Total time for the experiment was about 60-80 minutes.

2.2.3. *Self- and Film-evaluation Rating Scales*

Baseline feelings of the targeted emotional states at the start of experiment and their changes elicited by the film viewing were assessed using a comprehensive questionnaire with various scales (Schaefer et al., 2003). These seven-point scales ranging from *not at all* (0) to *very much* (6) were used to evaluate subjective responses for the following 12 emotions: interest, joy, sadness, anger, fear, anxiety, disgust, contempt, surprise, shame, guilt, and happiness. Two specifically moral or social emotions (shame and guilt) were added for evaluation since both films contained context related to violation of social and/or internal values. Similar 7-point scales ranging from *not at all* (0) to *very much* (6) were used to evaluate baseline state at the start of experiment and the extent to which participants were experiencing the following bodily sensations while watching the clips: lump in the throat, pounding heart, change of breath, heavy chest, stomach sensations, perspiration, hot head, cold shivers, tension in muscles, shivering, relaxation, impression of ‘blood boiling’, blushing (Wallbott & Scherer, 1986). Composite scores for subjective data were computed for each participant for baseline and two post-film periods by averaging the respective ratings related to positive and negative feelings, heat and organ sensations (Davydov et al., 2011). Other uncorrelated experiential ratings were presented separately for vigilance (interest) and orienting (surprise) arousals, the two socially-orienting feelings (shame and guilt), cold sensation, body tension (reverse of relaxation), shivering, and impression of ‘blood boiling’. General ‘negative feeling’ score was calculated by difference of composite scores (‘negative’-‘positive’). Score of general arousal sensation was calculated as average of all sensations.

Participants rated the extent to which they assessed the situation of the film on eight 7-point bipolar scales (Luminet, Bouts, Delie, Manstead, & Rimé, 2000) ranging from –3 to +3 for typicality (familiar/strange, banal/exceptional, usual/unusual), clarity (clear/confused, comprehensible/incomprehensible), valence (enjoyable/unpleasant, insignificant/serious, no consequence/full of consequences). Composite scores for film content appraisals were computed for each participant by averaging respective ratings of content. Participants also were asked whether they had ever seen the film before (*Yes-No*). More details of the rating procedures were published elsewhere (Davydov et al., 2011).

2.2.4. Personality Questionnaires

In addition to alexithymia, individual differences in social desirability, depression, and dispositional affect were assessed to examine their probable mediation role in the pathway or uniqueness of the impact (i.e., the direct pathway) of alexithymia on the physiological responses. The four questionnaires were adapted for a French-speaking population. The 20-item Toronto Alexithymia Scale (TAS-20, Bagby, Parker, & Taylor, 1994; Bagby, Taylor, & Parker, 1994) is now the most widely used measure of alexithymia (Parker, Taylor, & Bagby, 2003). The TAS-20 has 3 factors: difficulty identifying feelings and distinguishing them from bodily sensations (DIF), difficulty describing feelings to others (DDF), and externally-oriented thinking (EOT). Respective means (SDs) were 15.9 (5.6), 12.6 (4.0), and 14.8 (3.4) in the present sample. Evidence of reliability and factorial validity of the TAS-20 has been established (Bagby, Parker, et al., 1994; Bagby, Taylor, et al., 1994; Parker et al., 2003).

The 36-item Social Desirability Questionnaire (7-point Likert-type format) measures two dimensions of social desirability: impression management (other-deception) and self-deception (Paulhus & Reid, 1991; Tournois, Mesnil, & Kop, 2000). Respective means (SDs) were 72.7 (16.1) and 59.5 (13.7) in the present sample. The Zung Self-Rating Depression

Scale (Zung, 1965) is a 20-item self-report questionnaire that is widely used as a screening tool indicating depression severity and the three factors of affective (ZDS_D, 6 items), cognitive (ZDS_C, 2 items), and somatic (ZDS_S, 6 items) symptoms of depression (Kitamura, Hirano, Chen, & Hirata, 2004). Respective means (SDs) were 38.3 (6.5)⁴, 12.0 (2.7), 4.9 (1.5), and 11.8 (3.1) in the present sample. The Positive (PA) and Negative (NA) Affect Schedule in its trait version (PANAS-Trait; Watson, Clark, & Tellegen, 1988) measures the level of dispositional affect as a general personality trait. Participants were asked to rate the 10 positive and the 10 negative items according to the intensity of affect they felt in general. Previous studies have shown that the PANAS was a reliable and valid measure (Watson et al., 1988). The more depression-orienting or negative affect term mainly related to identified cause (7 items: distressed, upset, guilty, scared, hostile, ashamed, afraid; NA_D) and the more anxiety-orienting or negative affect term mainly related to an unknown source (3 items: irritable, nervous, jittery; NA_A) of the general negative affect of the PANAS were clustered in the present sample with no correlation between the subscales ($r = -.04$, $p = .84$). The trait NA of the PANAS, as well as its more specific (newly introduced), ‘depression’ and ‘anxiety’, subscales (NA_D and NA_A), were considered for analyses. Respective means (SDs) were 19.9 (4.5), 12.5 (3.8), and 7.4 (2.6) in the present sample. Specific subscales of PANAS and ZDS were considered in the present study to specify more precisely probable mediation mechanisms of alexithymia’s effects.

2.2.5. Physiological recording equipment, data reduction and processing

Equipment of Biopac System, Inc and Contact Precision Instruments, London, UK under control of AcqKnowledge software (Biopac System, Santa Barbara, CA) was used to record and sample physiological signals: surface electromyographic (EMG) activity of the Orbicularis Oculi (pars lateralis) and Corrugator Supercilii, interbeat intervals (IBI) from the

⁴ The present ZDS and NA means were close to the scores displayed by respondents having an affective disorder (Joiner, Catanzaro, & Laurent, 1996; Zung, 1973) and thus part of the participants in the present study might have a sub-clinical depression or affective condition.

electrocardiogram, IBI variability (by means of successive differences between IBIs), pulse transit time to the finger (PTT, the interval between the peak of each R wave and the beginning of the upstroke of the pulse wave at the finger) and finger pulse amplitude (the trough-to-peak amplitude of finger pulse), skin conductance level (in the range from 0 to 20 microSiemens [μ S]), rate of skin conductance responses (SRR, in number per minute of short-term skin conductance increases exceeding 0.04 μ S from preceding zero-slope baselines) and amplitudes of skin conductance responses. Data processing of physiological signals for detection of level, interval, rate, amplitude and variability with artefact search and replacement was performed off-line with customized interactive computer programs written in the Spike2 programming environment (Cambridge Electronic Design, Cambridge, England; programs written by DMD, see Davydov, Shapiro, & Goldstein, 2010; Davydov et al., 2011).

This set of measures was selected to allow for continuous measurement, to be as unobtrusive as possible, and to sample broadly from the autonomic system. Whereas IBI is under both sympathetic (β 1-adrenergic receptors) and parasympathetic control, finger pulse amplitude (an index of peripheral vasoconstriction), PTT (an inverse index of SBP changes, see, e.g., Pollak & Obrist, 1983), and skin conductance measures track processes under differential sympathetic control via, respectively, α 1-adrenergic receptors of peripheral blood vessels, mainly β 1-adrenergic receptors of the heart, and muscarinic acetylcholine receptors of sweat glands, and IBI variability traces mainly changes in cardiac vagal control (Friedman, Allen, Christie, & Santucci, 2002).⁵

⁵ Each of these autonomic measures including different indicators of sympathetic activity was expected to index a particular autonomic arousal, which change may not correspond with others in response to different affective stimuli. For example, it was previously found (Fredrickson & Levenson, 1998) that films with complex emotional contents could elicit a peripheral vasoconstriction (finger pulse amplitude decrease) coupled with an IBI increase and a blood pressure increase (PTT decrease) as a response pattern to the presence of a fear content with a risk avoidance context in a film, but a peripheral vasoconstriction (finger pulse amplitude decrease) coupled with a blood pressure decrease (PTT increase) as a response pattern to the presence of a sad content with attachment context in a film.

Raw scores were defined as the arithmetic mean of the physiological data within each experimental condition (two rest baselines, two film presentations, and two recovery periods). This approach likely leads to a conservative estimate of emotional response specificity, as subjects are unlikely to manifest a strong emotional response at a consistent magnitude at the very beginning and throughout the film period. Reactivity for each variable was defined as difference scores calculated by subtracting the prior baseline mean score (i.e., the average of the quiet sitting period immediately preceding each film clip) from the film and recovery raw mean scores. Finally, variables were assessed for normality of distribution. More details of the physiological recording equipment, data reduction and processing procedures were published elsewhere (Davydov et al., 2011).

2.3. Calculation and tested hypotheses

Data analysis was performed with SPSS, Release 17.0 (SPSS Science, Chicago, IL) using General Linear Models. Respective model assumptions (e.g., normality, linearity, multicollinearity, etc.) for each regression model were tested and met. Autonomic and mimic muscle measures and their differences between baseline and film viewing, baseline and recovery periods were analysed as continuous variables. In a previous study (Luminet et al., 2004), the alexithymia factors, in the absence of a clear theoretically defined cutoff point between normal and pathological entities, have been considered as continuous variables and not as discrete entities. Therefore, alexithymia's total score and scores of its three dimensions were also analyzed as continuous variables in the present study. All these variables fitted normal distributions. Since some subjective measures (shame and guilt, cold sensation, shivering, impression of 'blood boiling') and their changes from baseline did not fit a normal distribution, they were dichotomised. Film familiarity ('film already seen') and order of the film presentation were used as covariates in all analyses to control for these effects.

To test the main ‘decoupling’ hypothesis on the difference in physiological reactivity to the Sad film with Negative context (SN film) and the Sad film with Positive context (SP film) between persons with different scores in alexithymia dimensions (the hypothesis of alexithymia’s moderation effect), three sets of tests were conducted (see Figure 1). In these tests the moderation effect of alexithymia was conceptualized in two ways: (i) whether or not alexithymia serves as a predictor of film-induced physiological activities (adjusted to individual pre-film [baseline] levels) or of film-induced physiological changes (from individual pre-film levels) without its relation to corresponding film-induced experiential responses or changes, in the respective ‘covariance’ and ‘difference’ models evaluating alexithymia’s effects on physiological and experiential variables separately, and (ii) whether or not the correspondent relationship between film-induced changes of physiological and experiential variables decreases as a function of alexithymia, in the ‘correlation’ model evaluating alexithymia’s effects on physiological and experiential variables simultaneously. The first ‘covariance’ model tested whether HA and LA with hypothetically the same initial (baseline or pre-film) physiological activity, which was allowed by the covariance technique, would have different on-film and/or recovery physiological activity. Each physiological or subjective measure in this linear model was treated as two independent covariates with its scores during baseline and film, or baseline and recovery periods (e.g., $EOT = \text{constant} + PTT \text{ during baseline} + PTT \text{ during film [or recovery]} + [\text{film familiarity} + \text{film order}]$). Such formula with alexithymia as the dependent variable allowed analysing continuous physiological and dichotomised subjective variables treated as independent factors by the same general linear model preserving the same effect sizes of alexithymia’s effects on arousal changes if alexithymia was treated as an independent factor. A problem with multicollinearity between measures at baseline, film, and recovery periods as independent variables was not expected in the present analyses since for most subjective and

physiological measures tolerance values were high (> 0.10) and for those (PTT and IBI) with low tolerance values (< 0.10), they were not accompanied by large standard errors of the regression coefficients (Freund, Wilson, & Sa, 2006). Results obtained with this method are not affected by the bias related to the ‘regression towards the mean’ phenomenon, while the method is sensitive to non-randomness of a sample (Dimitrov & Rumrill, 2003).

The second ‘difference’ model evaluated whether HA and LA differed in the scores of physiological activity changes. Each physiological or subjective measure in this additional linear model was treated as a difference score of reactivity at film or recovery periods in relation to the baseline period to test for significant relation to alexithymia (e.g., $EOT = \text{constant} + [\text{PTT during film [or recovery]} - \text{PTT during baseline}] + [\text{film familiarity} + \text{film order}]$). Non-randomness of a sample is not a vital concern for this method, while results obtained through this method may be affected by the bias related to the ‘regression towards the mean’ phenomenon (Dimitrov & Rumrill, 2003).

The third ‘correlation’ model directly evaluated the magnitude of concordance/discordance between experiential and autonomic reactivity (film-induced changes) in a subject as a function of the subject’s alexithymia score. Cross-products of physiological reactivity (changes from baseline to film and from baseline to recovery periods of 4 variables [PTT and IBI for the SN film and SRR and IBI for the SP film] that showed significant relation to alexithymia in the first and second steps) and subjective responses (changes from baseline to post-recovery period of 11 composite and simple scores of subjective feelings and sensations that showed significant relation to SN [9 scores] or SP [5 scores] film viewing in our previous study, Davydov et al., 2011: interest, general, positive, negative, and shame feelings, heat, cold, and organ sensations, impression of ‘blood boiling’, body tension, and general somatic arousal) were calculated for each subject. These cross-products show the level of association between changes in a given physiological index and in

a given subjective index for a particular individual equivalent to the Pearson product–moment correlation coefficient. General vectors of individual cross-products for each (film and recovery) period were further evaluated for correlations with alexithymia scores for the predicted 19 pairs. This procedure enabled analysis of the extent of discordance between the subjective reports of emotion detected in the previous study (see Davydov et al., 2011) and physiological activity as a function of alexithymia (e.g., correlation of EOT with [PTT during film - PTT during baseline] * [negative feelings after film - negative feelings during baseline]). Directions of general vectors of individual cross-products would indicate positive (+V), zero (0) or negative (-V) association between particular physiological and experiential changes. Negative (-*r*) or positive (+*r*) correlation coefficients would indicate magnitude and direction of association of vectors of individual cross-products with scores of alexithymia. A significant correlation coefficient would indicate the moderation effect of alexithymia on a cross-product of negatively or positively associated physiological and experiential changes. The final decision of alexithymia's moderation effect depended on the product of (i) the sign of association (direction of a general vector, V) of particular physiological and experiential changes and (ii) the sign of the correlation coefficient (*r*), when a negative product in the cases of -V with +*r* or +V with -*r* meant a decrease of association between physiological and experiential changes with increase in alexithymia score, but a positive product in the cases of -V with -*r* or +V with +*r* meant increase of association between physiological and experiential changes with increase in alexithymia score. A non-significant correlation coefficient indicated absence of the moderation effect of alexithymia. Thus interpretation of the alexithymia's moderation effects requires presentation of both the general vector of cross-products, and the correlation coefficient. Application of these three different analytic approaches of evaluation of the same hypothesis was considered to increase conclusion or conceptual validity of effects.

In a fourth step, affective disposition, impression management and self-deception, and film content appraisal variables were added in the linear models with significant alexithymia's effects confirmed by the 'covariance' and 'difference' models one by one as potential relevant mediators of alexithymia's effects on reactivity and/or recovery evoked by film viewing (additional 'covariance' and 'difference' mediation models: e.g., $EOT = \text{constant} + [\text{PTT during film [or recovery]} - \text{PTT during baseline}] + \text{PANAS_D} + [\text{film familiarity} + \text{film order}]$). We considered a variable as the mediator if it carried influence of a given independent variable to a given dependent variable and decreased their effect to non-significant by applying the Baron and Kenny's approach (Baron & Kenny, 1986). Our small sample size did not allow use of statistically based methods like the Sobel test or bootstrapping mediation procedure by which the mediation may be well assessed only in larger samples (Fritz & Mackinnon, 2007). In this test a variable with mediation effect was conceptualized as a mediator of the moderation effect of alexithymia on the coupling of physiological and experiential changes in response to films.

For the first, second and fourth models, unstandardized parameter estimates were presented along with corresponding standard errors (SE). Partial η^2 was reported as a measure of strength of associations, which is comparable to R^2 expressing the percentage of explained variance. Two-tailed p-values equal to or less than 0.05 were considered statistically significant and $\eta^2 > .13$ was defined as the appropriate (medium or large) effect size, considering the balance between Type I and Type II errors due to the small sample size (Bakeman, 2005). For the third model, signs of general vectors of cross-products and correlation coefficients were reported with two-tailed p-values equal to or less than 0.05 considered statistically significant.

Since all the abovementioned analyses were conducted for to increase the robustness of the findings associated with a single inference related to the same main 'decoupling'

hypothesis predicting the alexithymia's effect on relationships of physiological and experiential changes, no compensations for the number of inferences (i.e., multiple testing correction like the Bonferroni test) were made in either model. Significance of a particular direction of an alexithymia's effect (augmenting or damping of arousal changes in the 'covariance' and 'difference' models, decrease or increase of association of physiological and experiential changes in the 'correlation' model) was approved by the conventional non-directional two-tailed statistic. Since the mediation effects were evaluated by the Baron and Kenny's method, which only detected presence of effects, but not their statistical significance, these analyses did neither demand multiple testing corrections.

3. Results

The general descriptive statistics of the physiological and subjective variables and the results of analyses of the film effects on them irrespective to an alexithymia's impact were published elsewhere (Davydov et al., 2011).

3.1. Alexithymia's effects on experiential responses ('covariance' and 'difference' models)

The 'covariance' and 'difference' models testing alexithymia's total and its dimensions' effects on changes of subjective-experiential measures of affective state (feelings and sensations) as response to film viewing were not significant (all p 's > .05).

3.2. Alexithymia's effects on behavioural and physiological responses ('covariance' and 'difference' models)

Among physiological and behavioural variables and among DIF, DDF, and EOT dimensions of alexithymia, the EOT scores were related to PTT values and Orbicularis Oculi activity during baseline, the SN film presentation and recovery periods and to IBI values during baseline and recovery period after the SN film presentation in the 'covariance' model

(Table 1). The EOT was also related to SRR and IBI values during baseline, the SP film presentation and recovery periods (Table 1). All these effects were confirmed by the ‘difference’ models (Table 1). Inspection of the regression slopes and means showed that, for participants with lower EOT scores, the presentation of the SN film led to a stronger decrease of PTT (i.e., stronger increase of SBP at film and recovery periods; Figure 2a) and a stronger decrease of IBI (i.e., stronger heart rate acceleration at recovery period; Figure 2b) from baseline, whereas participants with higher EOT scores did not show significant changes in these physiological variables with change in the context (i.e., from baseline, through film to recovery period). The presentation of the SP film led to a stronger increase of IBI from the baseline period (i.e., stronger heart rate deceleration at film and recovery periods; Figure 3b) compared to weaker IBI responses in subjects with higher EOT scores. For participants with lower EOT scores, the presentation of the SP film led also to an increase of SRR from the baseline, while it induced a decrease in SRR in subjects with high scores on EOT (Figure 3a). For participants with lower EOT scores, the presentation of the SN film led also to an increase of Orbicularis Oculi activity from the baseline, while it induced only a weaker increase during or its decrease after the SN film in subjects with high scores on the EOT scale (Figure 2c). Thus the alexithymia factor EOT affected physiological and behavioural changes in response to both films, which decoupled them from intact subjective-experiential responses. The concordance of findings in the ‘covariance’ and ‘difference’ models confirmed a reactivity origin of the effect irrespective to probable confounding effects related to differences at baseline or a probable regression toward the mean phenomenon during repeated measures of some physiological variables.

3.3. Alexithymia's effects on concordance between experiential and physiological responses ('correlation' model)

The 'correlation' models were constructed for more direct test of the detected EOT's moderation effects on within-person concordance between previously indicated changes of subjective and physiological indexes of emotional state (9 subjective ratings with 2 physiological variables for the SN film and 5 subjective ratings with 2 physiological variables for the SP film). Thus, this model was not used to test possible moderation effects of the other alexithymia's (DIF and DDF) factors, since they were detected neither in the 'covariance', nor in the 'difference' model.

3.3.1. Alexithymia's effects on predicted concordance of responses to SN film

In general, 9 out of the 18 predicted correlations were detected for reactivity and/or recovery periods related to the SN film. In particular, significant correlations of EOT with 7 predicted vectors of the cross-products of change of PTT from baseline to the SN film period and changes of scores of composite positive, composite negative, general negative feelings, and bodily sensations (body tension, composite heat, composite organ and general arousal sensations) were detected (see details of all correlations in Table 2 and their meaning in terms of the decoupling hypothesis below). EOT was also significantly correlated with 4 predicted vectors of the cross-products of change of PTT from baseline to the recovery period after the SN film and changes of scores of the same body sensations. EOT was additionally correlated with 2 predicted vectors of the cross-products of change of IBI from baseline to the recovery period after the SN film and changes of scores of cold and general arousal sensations.

3.3.2. Alexithymia's effects on predicted concordance of responses to SP film

In general, 4 out of the 10 predicted correlations were detected for reactivity and/or recovery periods related to the SP film. In particular, significant correlations of EOT with 2 predicted vectors of cross-products of change of IBI from baseline to the SP film period and changes of scores for one subjective feeling (shame), and for one bodily sensation indicator (composite heat) were detected (see details of the correlations in Table 2 and their examination below). EOT was also correlated with 2 predicted vectors of the cross-products of change of IBI from baseline to the recovery period after the SP film and changes of scores for the same subjective feeling (shame) and the same bodily sensation (composite heat sensation), and with 2 predicted vectors of the cross-products of change of SRR from baseline to the recovery period after the SP film and changes of scores of vigilance arousal and shame feeling.

3.3.3. Alexithymia's effects on non-predicted concordance of responses to SN and SP films

Other analyses testing EOT effects on concordance of changes between these physiological variables and experiential measures of emotional state detected a non-predicted significant correlation of EOT with respect to the cross-products of PTT and impression of 'blood boiling' changes in response to the SN film, and two non-predicted significant correlations of EOT with respect to the cross-products of IBI changes with changes of composite organ and general arousal sensations in response to the SP film (see details of the correlations in Table 2 and their examination below). Since 13 of the 16 detected EOT moderation effects in the 'correlation' model were found for the predicted vectors of physiological (for either reactivity or recovery period) and experiential variables

according to our previous findings, no corrections for multiple analyses (against occasional or non-predicted inferences) were conducted.

3.3.4. Examination of products of vectors and correlations of responses to SN and SP films

An examination of products of vectors and correlation coefficients (i.e., directions of effects) showed that 13 of the 16 correlations supported the findings of the ‘covariance’ and ‘difference’ models indicating the decoupling of some physiological and experiential changes in responses to the SN and SP films in HA. In particular, the increase of EOT scores was associated with decrease (to zero) of positive coupling of the PTT changes with composite positive feeling changes in responses to the SN film (Table 2). The increase of EOT scores was also associated with decrease (to zero) of negative coupling of the PTT changes with changes of negative feelings, body tension, organ and general arousal sensation, and with decrease (to zero) of negative association of the IBI changes with changes of cold and general arousal sensation in responses to the SN film. In addition, the increase of EOT was associated with decrease (i.e., closer to zero) of negative coupling of IBI changes with changes of shame feeling, composite heat, composite organ and general arousal sensation, and with decrease (i.e., closer to zero) of negative coupling of SRR changes with change of shame feeling in responses to the SP film (Table 2).

At the same time, 3 of the 16 correlations did not support the ‘decoupling’ hypothesis of alexithymia’s effect on associations of physiological and subjective-experiential changes. In particular, the increase of EOT scores was found to be associated with increase of a positive association of the PTT changes with changes of composite heat sensation and impression of ‘blood boiling’, thus indicating their coupling in responses to the SN film in HA, but not in LA (Table 2). In addition, the increase of EOT was found to be associated with increase of a

negative association of the SRR changes with vigilance arousal (interest) changes, thus indicating their coupling in responses to the SP film in HA, but not in LA (Table 2).

3.4. Mediation mechanisms of the alexithymia effects (mediation model)

To disclose cognitive and/or affective mediation mechanisms of the detected significant associations of the EOT dimension, the individual scores on dispositional affect, social desirability and film content appraisals were each added separately in the respective ‘covariance’ and ‘difference’ models.

3.4.1. Mediation mechanisms in responses to SN film

Among the potential mediators, depressed mood (indexed separately by NA_D and ZDS_D) was found to be the only one to decrease to non-significant ($p > .05$) the EOT associations with the subjects’ PTT and Orbicularis Oculi responses (the effect size decreased in up to twice for both SN film viewing and recovery periods), and the EOT associations with the subjects’ IBI response (the effect size decreased in up to 1.5 for recovery period after SN film) with opposite correlation signs (compared to the EOT) of association of depressed mood with these physiological and behavioural responses. Additional analysis showed that the EOT was negatively correlated with the NA_D ($r = -.39$, $p = .07$). Thus low affectivity level (i.e., emotional inhibition or affective detachment) indicated by low depressed mood scores of the two different mood scales demonstrated an emotional mediation pathway (*emotional mediation mechanism*) of the effect of high EOT facet on physiological reactivity and recovery processes associated with SN film viewing.

3.4.2. Mediation mechanisms in responses to SP film

Among the potential mediators, the ‘other-deception’ construct of the Social Desirability Questionnaire was found to affect and to decrease to non-significant ($p > .05$) the EOT associations with the subjects’ SRR (the effect size decreased in up to twice for both SP film viewing, and recovery periods), and the EOT associations with the subjects’ IBI level (the effect size decreased in up to 1.5 for recovery period after SP film). A cognitive appraisal of the SP film content as ‘atypical’ or ‘unusual’ (i.e., inadequate) was also found to decrease to non-significant ($p > .05$) the EOT associations with the subjects’ IBI level (the effect size decreased in up to 1.5 for both SP film viewing and recovery periods). Additional analyses showed that the EOT was positively correlated with the ‘other-deception’ and with appraisal of SP film content as ‘atypical’ (‘unusual’) ($r_s = .50$ and $.56$, $p = .01$ and $.005$, respectively). Thus, high level of the ‘other-deception’ predisposition along with unacceptance of empathic moral collisions (presented in the film) as typical, demonstrated a cognitive mediation pathway (*cognitive mediation mechanism*) of the effect of high EOT facet on physiological reactivity and recovery processes, but now associated with SP film viewing.

4. Discussion

4.1. Alexithymia’s moderation effect on reactivity

While the respective affective (sad attachment or sad avoidance) content of the films evoked a similar sad feeling associated with either dampened or augmented physiological arousal (i.e., decelerated heart rate for the sad attachment content processing or accelerated heart rate for the sad avoidance content processing; Davydov et al., 2011), the present study showed that a higher alexithymia score (specifically, high ‘externally oriented thinking’) was related to weaker physiological changes evident mainly in heart rate (weaker heart rate deceleration or acceleration; Figures 2b and 3b). The effect of ‘externally oriented thinking’

diminished both arousal-boosting and arousal-damping effects of, respectively, ‘avoidance’ and ‘approach’ film clips. Thus, the ‘externally oriented thinking’ factor moderated emotional reactivity by decoupling the physiological domain of the emotional response from its subjective-experience domain staying unaffected. Other alexithymia’s factors (‘difficulties identifying feelings’ and ‘difficulty describing feelings to others’) did not show a moderation effect on the coupling of the physiological and subjective domains of the emotional response. The films were selected specifically due to their main sad component, which is highly relevant to depression and the main cognitive mechanism of depression development - perseverative ruminations or recyclic negative thinking. The selected sample of young women is also relevant to this mechanism, because women are considered especially sensitive to sad content of film due to their proneness to depression and to ruminate, and whose cardiovascular arousal is more affected by sad film viewing compared to men (Fredrickson & Levenson, 1998). The results of the study confirmed the prediction that this mechanism of the depression development could be particularly sensitive to the externally-oriented thinking as a mechanism of the alexithymia, which distracts attention from internal thoughts by inhibition of arousal changes associated with rumination.

The present findings of low responsivity in high scorers on the externally-oriented thinking factor during processing of information related to empathy, a social- or moral-related emotion, corresponds nicely to the concept of primary psychopathy (Lander et al., 2012). A primary psychopathy is a mental disorder characterized by a low tenderness, a lack of empathy, emotional depth, and remorse, shallow emotions, egocentricity, deceptiveness, and feigning emotions. Although psychopaths do not feel deep emotions, they often claim to experience them. Thus this mechanism can decouple the physiological changes (weak heart rate deceleration) to the ‘sad attachment’ film from ratings of strong negative feelings evoked by this film in the present study. Therefore the subjective reports of strong feelings in

the present study may be fabricated or feigned by persons with this disposition, similar to behaviour with malingering or feigning symptoms of disorder. This conclusion corresponds to the mediation analysis of the study, which showed that this decoupling mechanism was indeed mediated by the subject's impression management style (other-deception or faking behaviour) along with unacceptance of empathy-related content of the 'sad attachment' film. This mechanism could minimize cognitive and behavioural involvement in affective content processing, thus 'protecting' the person with the predisposition to externally-orienting thinking against traumatic stress symptoms (Pham, Ducro, & Luminet, 2010). Other results of the mediation analysis suggest that the effects of predisposition to higher externally-orienting thinking on responses to the 'sad avoidance' film could be related to another mechanism - low affectivity (low depressive mood level) of a person. This could minimize emotional involvement in affective content processing, thus also 'protecting' the person with the predisposition to externally-orienting thinking against traumatic stress symptoms. Thus this alexithymia facet might represent two different 'protective' mechanisms against traumatic content, which minimize either emotional or cognitive involvement in processing of affective contents, detected by a weaker physiological reactivity. It also suggests that this facet of the alexithymia construct might include different sub-dimensions related to either emotional or cognitive mechanisms. The last conclusion corresponds to many previous studies showing that the 'externally oriented thinking' dimension of alexithymia is not homogeneous in mechanisms (see, e.g., Bach, Bach, de Zwaan, & Serim, 1996; Gignac, Palmer, & Stough, 2007; Kooiman, Spinhoven, & Trijsburg, 2002; Meganck, Vanheule, & Desmet, 2008; Müller, Bühner, & Ellgring, 2003; Säkinen, Kaltiala-Heino, Ranta, Haataja, & Joukamaa, 2007; Taylor, Bagby, & Parker, 2003; Thorberg et al., 2010), but includes different sub-processes (e.g. "low importance of emotion" and "pragmatic thinking"; Müller et al., 2003).

The association of high ‘externally oriented thinking’ with lower heart rate changes following changes in environmental context (e.g., in the present study from baseline to film viewing and recovery) suggests lower sensitivity of high ‘externally oriented thinking’ scorers to environmental changes associated with both avoidance (i.e., environment rejection), and attachment (i.e., environment intake) behaviours (Papillo & Shapiro, 1990). Another variable of cardiovascular arousal, systolic blood pressure, was similarly moderated by the same facet of alexithymia in response to sad avoidance content of stimuli (see Figures 2a, and 2b). Systolic blood pressure was measured in the present study by inversely directed pulse transit time. It is known to be regulated mainly through sympathetic nervous system under control from parasympathetic (Davydov, Shapiro, Cook, & Goldstein, 2007; Davydov, Shapiro, et al., 2010). These cardiovascular measures, heart rate and blood pressure, are both associated with physiological arousal related to control of energy metabolism (Davydov, Shapiro, Cook, et al., 2007; Davydov, Shapiro, et al., 2010). It suggests that this facet of alexithymia protects the organism against (by minimizing) extra utilization of inner energy for supporting affective involvement (*emotional mechanism of arousal regulation*) during the ‘sad avoidance’ film content processing. Low Orbicularis Oculi muscle response (Figure 2c), as a marker of low disgust feeling to the ‘sad avoidance’ film’s context (Davydov et al., 2011; Ekman, 2003; Rohrmann & Hopp, 2008) also indicated lower emotional involvement in this film’s content processing in high scorers on the externally-oriented thinking factor. Thus ‘externally oriented thinking’ facet can be viewed as ‘protective’ for psychosomatic health against aversive events or in highly aversive environments, which boost physiological arousal for extra utilization of inner energy, such as when expecting a cardiac surgery (Bokeriia, Golukhova, Polunina, Davydov, & Kruglova, 2008).

The effects of the same facet on changes of heart rate coupled with changes of rate of skin conductance in response to the ‘sad attachment’ film seem to be associated with

another, behavioural or cognitive, mechanism affecting arousal-damping processes. In high scorers on the externally-oriented thinking factor, physiological reactivity associated with rate of skin conductance responses was negatively coupled with vigilance arousal. These persons had also the relatively higher baseline rate and habituation-like dynamics of skin conductance responses through all periods and low ‘deceleration reactivity’ of heart rate. This pattern seems to indicate a decoupling of the person’s behavioural activity from perception of arousing context of the affective environment. This mechanism minimizes cognitive involvement in processing of the content of the ‘sad attachment’ film as was detected by a mediation analysis. In contrast, the arousal level of these physiological measures (heart and skin conductance rates) followed the arousing changes of the environmental context in low scorers on the externally-oriented thinking factor. Some authors have suggested that the rate or the frequency of skin conductance responses is related to the intensity of thoughts or cognitions such as the subjects’ current concerns, negative emotion, subjective arousal, and inner speech related to preceding activity (Laine, Spitler, Mosher, & Gothard, 2009; Nikula, Klinger, & Larson-Gutman, 1993; Nikula, 1991). A pattern of higher baseline rate of nonspecific skin conductance responses, low baseline heart rate and their low follow-up reactivity suggests that high scorers on the externally-oriented thinking factor were engaged in a higher cognitive activity with another external focus, distracting them from the processing of content of the ‘sad attachment’ film (Papillo & Shapiro, 1990). This cognitive mechanism of arousal regulation might be a ‘protective’ factor against depressive rumination by detaching attention from a traumatic content (Papillo & Shapiro, 1990) or by an inhibition of concrete-experiential rumination related to a traumatic content (Di Schiena, Luminet, & Philippot, 2011). It suggests that the high ‘externally oriented thinking’ facet of alexithymia may also be viewed as being a ‘protective’

factor (at least on the short term) against psychosomatic illness in the face of aversive events which evoke depressive rumination with damping effect on baseline physiological arousal.

These mechanisms of emotional and cognitive detachments for reducing affective information processing can protect high scorers on the externally-oriented thinking factor not only against experience of negative feelings, but also expand this ‘shield’ against experience of positive feelings, thus making alexithymia positively associated with anhedonia and negatively associated with life satisfaction. Whereas protecting against negative stress or distress, these mechanisms of the facet can be harmful with dysfunctional psychosomatic outcomes in long term by depriving high scorers on the externally-oriented thinking factor from a positive stress or eustress experience (Davydov et al., 2012). This two-faced aspect of alexithymia should be examined in future studies.

4.2. Discordance between experiential and physiological responses in alexithymics

The other findings of the present study with direct analyses of the moderation effect of alexithymia on the concordance between experiential and physiological responses seemed to further support the decoupling hypothesis of alexithymia (Papciak et al., 1985). For example, in confrontation to a sad condition with an avoidance context the ‘externally oriented thinking’ facet of alexithymia decoupled concordant relationships of physiological responses with the experiential variables which indexed an increase of negative feeling, cold, organ, and body arousal sensations (Davydov et al., 2011). However, in high scorers on the externally-oriented thinking factor, physiological reactivity appeared to be concordantly associated with the experiential measures, which indexed a decrease in heat sensation (Davydov et al., 2011). In confrontation to the sad condition with an attachment context, an ‘externally oriented thinking’ facet of alexithymia decoupled concordant relationships of physiological responses with the experiential variables, which indexed a decrease of social

(shame) feeling and heat sensation (Davydov et al., 2011). However, in high scorers on the externally-oriented thinking factor, the physiological reactivity appeared to be concordantly associated with another experiential measure change, a feeling of interest, which indexed variance of attention or vigilance (Davydov et al., 2011). It suggests that one concordant association between physiological and subjective-experiential processes presented in low scorers on the externally-oriented thinking factor is replaced by a new ‘alexithymia-related’ association between physiological and other subjective-experiential processes in high scorers on the factor. These findings specify the ‘decoupling’ effect of alexithymia in healthy people by the fact that it should go in conjunction with the creation of a new association (‘recoupling’) of physiological processes with comparable, but less intensive sensations or other feelings.

Thus, in low scorers on the externally-oriented thinking factor, the pattern of intensive blood pressure and heart rate increase in response to the sad film with the avoidance context was associated with an increase in a general somatic arousal indexed by cold, organ and body sensations. In high scorers on the externally-oriented thinking factor, a less intensive blood pressure increase was only associated with a decrease in heat and ‘blood boiling’ sensations in response to the same film. Both associations of physiological and experiential responses in these different groups of low or high alexithymia were in the same direction of arousal change. This thus suggests that the responses trace similar arousal boosting changes in response to the film. The responses were different only in intensity of sensation of assumed core temperature changes associated with respectively stronger (coupled with increase of cold sensation) or weaker (coupled with decrease of heat sensation) cardiovascular changes, and also in additional coupling of the former association of more intensive physiological and sensation changes with negative feelings.

In persons with a low ‘externally oriented thinking’, the intensive heart rate decrease in response to and after the sad film with attachment context was also associated with a decrease in a general somatic arousal indexed by heat and organ sensations. However, a decrease of skin conductance rate after this film was associated with an increase in vigilance or attention (feeling of interest) in persons with a high ‘externally oriented thinking’. This period after the film is assumed to be related to extended processing of the preceding affective stimulus’ content (Davydov et al., 2011; Lysenko & Davydov, 2012a, 2012b) and the decrease of skin conductance rate during this period could be a marker of decrease of concerns, subjective arousal, and inner speech related to the film (Laine et al., 2009; Nikula et al., 1993; Nikula, 1991). Therefore the association of decrease of skin conductance rate during this period with an increase in vigilance may detect an increase of interest (attention bias) in persons with a high ‘externally oriented thinking’ for events irrelevant to the present experimental situation (i.e., from internal post-processing of the negative film’s content). All three models (covariance, difference, and correlation) detected effects of the same cognitive detachment mechanism in these persons providing attention bias for experimentally irrelevant external object or objects (environment intake), which distracts them from serial (external and internal) processing of the experimental stimulus’s content (i.e., negative film). The concordance in findings between the models increased conclusion and provided evidence for conceptual validity of the detected effects.

4.3. Limitations and Expectations

Concerning some possible shortcomings of the present study (not a large sample size, one gender and a healthy status of the sample), the results should be replicated with a larger sample of both genders to extend the conclusions to male subjects, and include patients with depression and persons with psychopathy to confirm the mediation mechanisms related to

these factors. This would also provide a possibility to conduct more sophisticated mediation procedures to test the detected mediation models for their statistical significance.

The present findings of the effects of the alexithymia's dimension on reactivity and their different mediation pathways in situations, which either boost or damp arousal, may help in selecting and applying different emotion regulation procedures after distress, which either emotionally or cognitively detached the person from a stressful information. For example, a *decrease* of physiological arousal *boosting effect* associated with the respective traumatic event by a mechanism of *emotional detachment* from the event can decrease autonomic accompaniment of the negative sensations and feelings in a sad environment with *an avoidance context* (e.g., from a distress accompanying antipathy or negative feeling to the subject bringing harm). However, in a sad environment with *an attachment context*, a mechanism of *cognitive detachment* or attentional distraction from the affective event can also protect a person from autonomic accompaniment of the negative sensations and feelings by a *decrease* of physiological arousal *damping effect* associated with the respective traumatic event (e.g., from a distress accompanying empathy or positive feeling to the object getting hurt). However, while these detachment mechanisms may help individual to effectively cope with distress, the application of these mechanisms in long-term may have a negative impact on social relationships of the individual, because the mechanism of emotional or cognitive attachment to stressful events may have a positive social or moral attribution (e.g. the regulation of shame feeling in the latter case).

Two main inferences from the findings could be clinically useful. First, a low score in the alexithymia's factor externally-oriented thinking should not always be considered as a positive individual trait, but as a possible risk factor for depressive mood in the face of occasional (random) adverse events (Davydov et al., 2012; Davydov, Stewart, et al., 2010) since it may lead to a maladaptive or highly intensive affect-related cognitive activity due to

a high empathic involvement (attachment) in the processing of negative information (Lysenko & Davydov, 2011a, 2011b, 2011c). Second, a high score in this particular alexithymia dimension should similarly not always be considered as a negative characteristic, but as a possible resilience factor protecting mood during situations constantly involving hostile or life-threatening surroundings (Davydov et al., 2012; Davydov, Stewart, et al., 2010) by a psychopathic or detachment way of coping with depression (Evren, Cinar, & Evren, 2012; Lysenko & Davydov, 2011a, 2011b, 2011c). It could be suggested that in the first case of someone with a low score on externally-oriented thinking after an adverse event, the therapeutic approach should be directed to the development of mechanisms protecting against depressive mood by methods distracting attention aside from the declarative cognitive processes associated with maladaptive thinking towards more engagement in the operational (sensory-motor) processes. In the case of someone with a high score on externally-oriented thinking, it should be considered as a protective mechanism if a person has long lived in adverse environment like asylum seeking. In this case, a therapeutic intervention aiming at decreasing the ‘externally-oriented thinking’ or emotionally detached behavior may be harmful if it is not considered together with changes of the environment toward a friendly one.

4.4. Summary and Conclusion

The ‘externally oriented thinking’ dimension of alexithymia was found to be an important factor, which affected physiological and behavioural reactivity and decoupled it from subjective-experiential reactivity to complex sad stimuli with different, avoidance or attachment, contexts. The effects of the ‘externally oriented thinking’ factor were related to different mediation mechanisms in the different avoidance and attachment contexts evoking the same sad emotion, namely an emotional or cognitive detachment from the negative content processing.

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Table 1. Significant¹ effects of ‘externally oriented thinking’ dimension of the alexithymia construct (EOT) on physiological activity and reactivity during viewing and recovery after the Sad film with Negative context (SN film) and the Sad film with Positive context (SP film).

Physiological variables		Covariance models ²			Difference models ²	
		Baseline	Film period	Recovery period	Film - baseline (Δ)	Recovery - baseline (Δ)
SN film						
PTT (msec)	B (SE)	-0.25 (0.11)	0.28 (0.11)	0.33 (0.15)	0.25 (0.11)	0.27 (0.14)
	F(η^2)	5.02* (.20)	5.98* (.23)	4.91* (.20)	5.31* (.20)	3.74 [√] (.15)
IBI (ms)	B (SE)	-0.07 (0.03)		0.08 (0.03)		0.08 (0.04)
	F(η^2)	4.61* (.19)		6.29* (.24)		4.86* (.19)
EMG (mV)	B (SE)	1.76 (0.89)	-1.54 (0.70)	-1.65 (0.74)	-1.52 (0.69)	-1.64 (0.71)
	F(η^2)	3.90 [√] (.16)	4.82* (.19)	5.00* (.20)	4.88* (.19)	5.32* (.20)
SP film						
SRR (response per min)	B (SE)	0.92 (0.34)	-1.03 (0.57)	-1.21 (0.52)	-1.22 (0.53)	-0.96 (0.33)
	F(η^2)	7.48* (.27)	3.27 [√] (.14)	5.50* (.22)	5.24* (.20)	8.46** (.29)
IBI (ms)	B (SE)	0.06 (0.03)	-0.06 (0.03)	-0.06 (0.03)	-0.07 (0.03)	-0.06 (0.03)
	F(η^2)	6.18* (.24)	3.83 [√] (.16)	4.52* (.18)	4.89* (.19)	5.65* (.21)

[√]p < .1, *p < .05, **p < .01

Note: SRR – Skin Conductance Response Rate; PTT – Pulse Transit Time; IBI– Inter-Beat Interval Mean; EMG – here, Electromyographic activity of Orbicularis Oculi muscle

¹ Only the tests yielding significant results are reported; df of error for the covariance model was 20; for the difference model was 21.

² The ‘film order’ and ‘film already seen’ variables were always presented in the models as covariates to adjust for their effects.

Table 2. Results of alexithymia's moderation effect (*r*) on within-person concordance (V) between changes of physiological¹ and experiential² indexes in response to the Sad film with Negative context (SN film) and the Sad film with Positive context (SP film).³

Experiential variables	Physiological variables					
	SN film		SN film		SP film	
	viewing period	recovery period	viewing period	recovery period	viewing period	recovery period
	PTT (msec)	PTT (msec)	IBI (ms)	IBI (ms)	SRR (1/min)	IBI (ms)
Interest (vigilance)	-V, 0	-V, 0	-V, 0	+V, 0	-V, -.42*	+V, 0
Positive feelings	+V, -.43*	+V, 0	+V, 0	-V, 0	0, 0	-V, 0
Negative feelings	-V, .45*	-V, 0	-V, 0	+V, 0	-V, 0	+V, 0
General 'negative feeling'	-V, .45*	-V, 0	-V, 0	+V, 0	-V, 0	+V, 0
Social affect (shame)	-V, 0	0, 0	0, 0	-V, .45*	-V, .49**	-V, .50**
Heat Sensation	+V, .46*	+V, .47*	+V, 0	-V, .59***	0, 0	-V, .51**
Cold sensation	-V, 0	-V, 0	-V, .47*	+V, 0	-V, 0	+V, 0
Impression of 'blood boiling'	+V, .41*	+V, .59***	-V, 0	-V, 0	0, 0	-V, 0
Organ sensation	-V, .50**	-V, .48**	0, 0	-V, .41*	0, 0	+V, 0
Body Tension	-V, .60***	-V, .55**	-V, 0	0, 0	-V, 0	+V, 0
General somatic arousal	-V, .45*	-V, .46*	-V, .46*	-V, .42*	-V, 0	+V, 0

*- $p < .05$; **- $p < .01$; ***- $p < .001$

¹ Physiological measures sensitive to alexithymia's effects according to the results of the 'covariance' and 'difference' models (see the table 1) were selected for the 'correlation' model.

² Experiential measures sensitive to film effects according to the results of our previous analyses (see Davydov et al., 2011) were selected. Predicted alexithymia's effects are marked in bold. Effects, where alexithymia increased coupling of physiological and experiential changes are presented in italic, whereas other effects of alexithymia are decoupling.

³ The characters in the cells indicate general positive (+V), zero (0) or negative (-V) associations (a general direction of vectors of individual cross-products) along with correlations (*r*) of magnitudes of these individual cross-products (vectors) with scores of 'externally oriented thinking' dimension of the alexithymia construct (EOT). A higher correlation coefficient indicates a higher moderation effect of EOT on a cross-product of negatively or positively associated physiological and experiential changes. The 'zero' correlation coefficients indicate nonsignificant correlations ($p > .05$).

Figure captions

Figure 1. Schema of the different models tested in the present study.

Figure 2a. Mean pulse transit time levels at baseline, during and after the Sad film with Negative context (SN film) viewing for persons with low or high scores of a median-split 'Externally-Oriented Thinking' (dichotomized for illustration).

Figure 2b. Mean of inter-beat-intervals levels at baseline, during and after the Sad film with Negative context (SN film) viewing for persons with low or high scores of a median-split 'Externally-Oriented Thinking' (dichotomized for illustration).

Figure 2c. Mean magnitude of Orbicularis Oculi muscle activity (EMG) at baseline, during and after the Sad film with Negative context (SN film) viewing for persons with low or high scores of a median-split 'Externally-Oriented Thinking' (dichotomized for illustration).

Figure 3a. Mean SRR (rate of nonspecific Skin Conductance Responses, SCR) at baseline, during and after the Sad film with Positive context (SP film) viewing for persons with low or high scores of a median-split 'Externally-Oriented Thinking' (dichotomized for illustration).

Figure 3b. Mean of inter-beat-intervals levels at baseline, during and after the Sad film with Positive context (SP film) viewing for persons with low or high scores of a median-split 'Externally-Oriented Thinking' (dichotomized for illustration).

Figure 1.

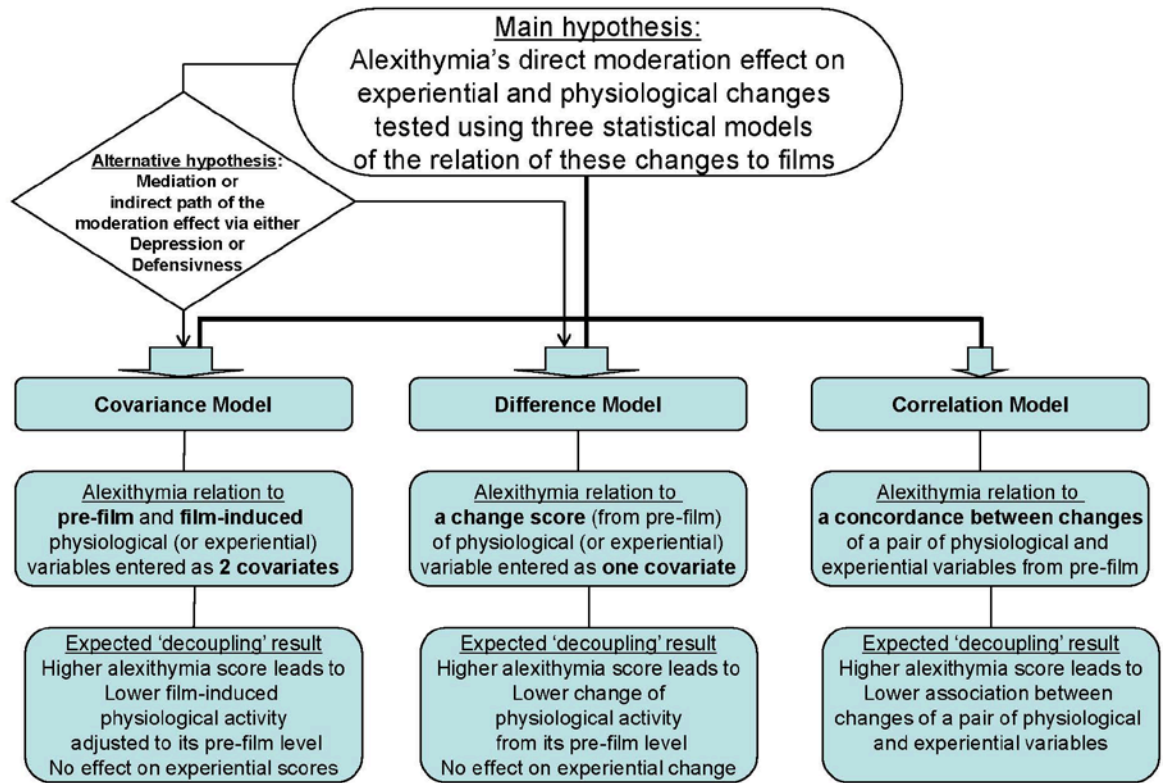


Figure 2a.

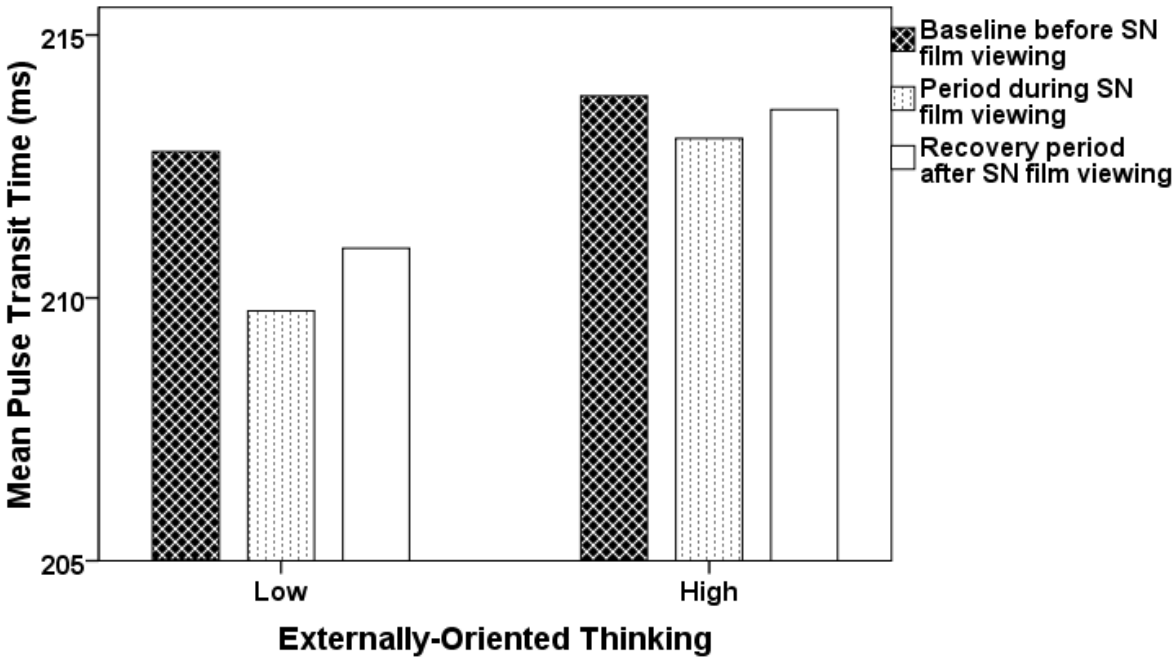


Figure 2b.

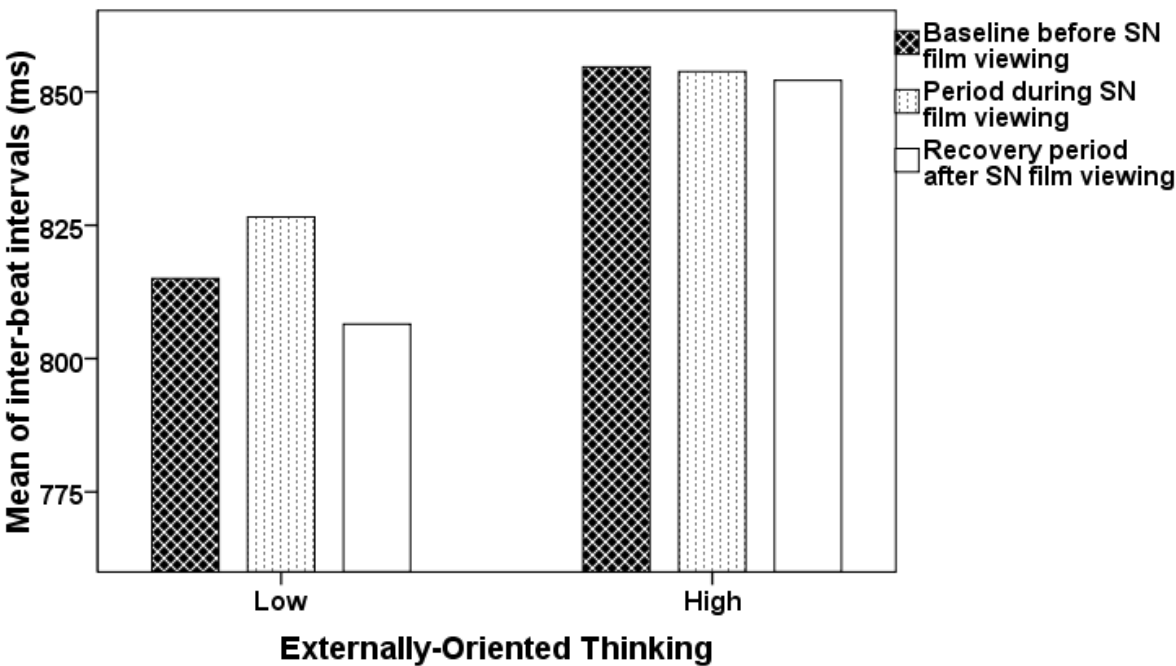


Figure 2c.

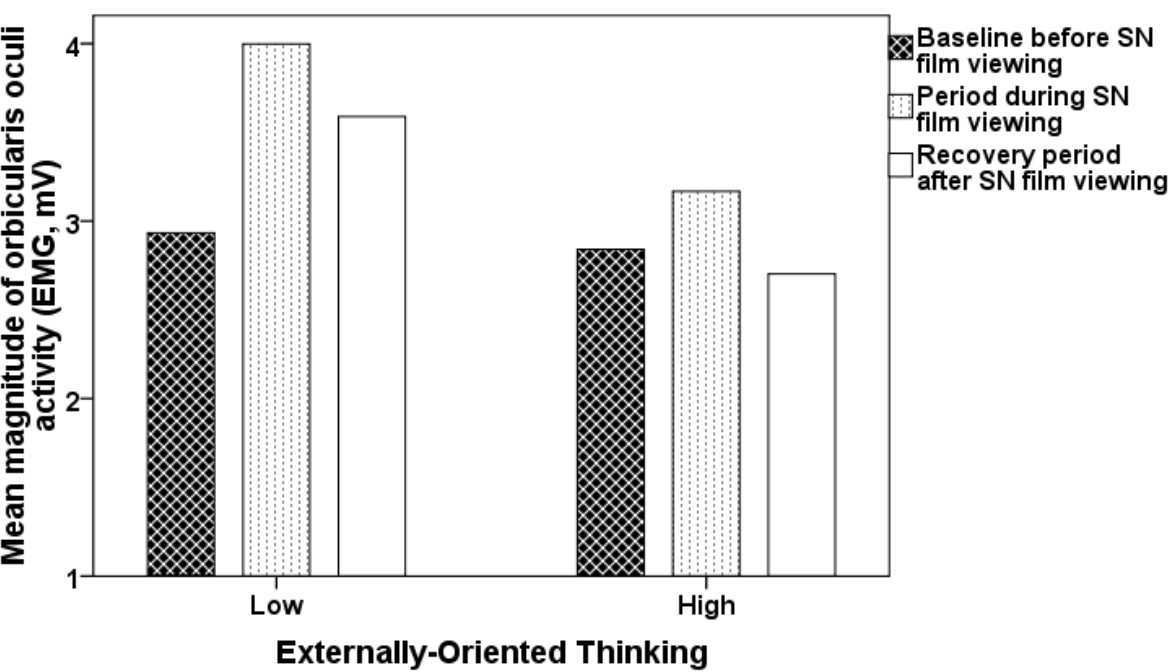


Figure 3a.

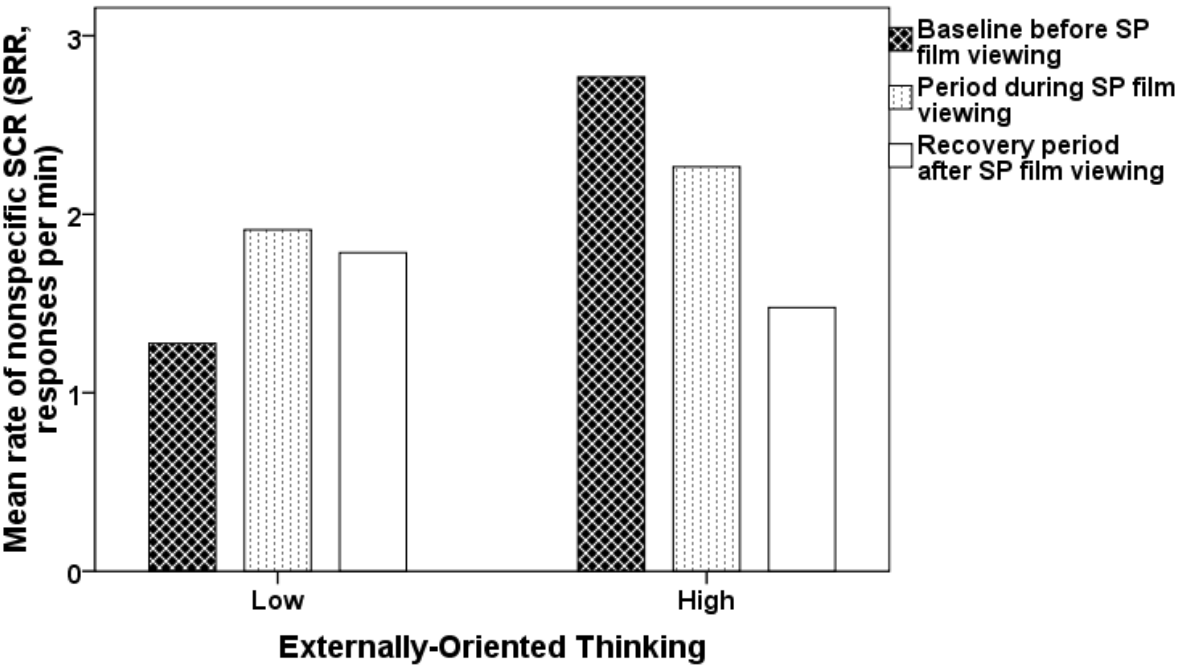


Figure 3b.

