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Typical performance measures of emotion regulation and emotion perception and frontal EEG asymmetry in an emotional contagion paradigm

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ABSTRACT

In order to replicate and extend previous observations of validity of the self-reported habitual regulation of one's affect and the perception of other people's emotions, prefrontal electroencephalographic (EEG) asymmetry was recorded during and after social-emotional stimulation. After stimulation with other people's vocal expression of anxiety, individuals with lower scores on emotion regulation did not show recovery of asymmetry changes but even increased changes in the direction that had been adopted during the stimulation. Whether this was to the right or to the left depended on their scores on emotion perception. Participants high on perception showed the expected changes to the right during the anxiety stimulation (indicating increased withdrawal motivation) and to the left during the cheerfulness stimulation (indicating increased approach motivation), whereas individuals low on perception showed the opposite pattern. During the anxiety stimulation, participants low on perception only showed the unexpected change to the left if they were also low on regulation. Individual differences in regulation did not play a role when participants were confronted with other people's laughter. The findings demonstrate the validity of the self-report measures by using EEG measures, and moreover support the usefulness of differentiated and process-oriented approaches in the field of trait emotional intelligence.

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1. Introduction

Previous research showed that individual differences in the self-reported habitual handling of one's own affect and of the affective expression of others could predict subjective and cardiovascular responses to social-emotional stimulation (Papousek, Freudenthaler, & Schulter, 2008). Specifically, the interaction of two scales of the "Self-report Emotional Ability Scale" (SEAS; Freudenthaler & Neubauer, 2005), that is, the perception of other people's emotions and the regulation of one's own emotions explained part of the interindividual variance of susceptibility to an emotional contagion provocation. The habitual tendencies of an individual to perceive the emotions of others and to regulate his or her own emotions can be regarded as facets of the construct of trait emotional intelligence (EI).

Within the field of EI research, Petrides and Furnham (2001) have emphasised a clear distinction between ability EI ("cognitive-emotional ability") and trait EI (or "trait emotional self-efficacy"). While the former concerns actual emotion-related cognitive abilities (referring to maximum-performance) and, therefore, ought to be measured by maximum-performance tests, trait EI encompasses affect-related behavioural tendencies and self-perceived abilities (referring to typical-performance) supposed to be best measured through self-report. According to several authors (e.g., Freudenthaler, Neubauer, & Haller, 2008; Mikolajczak, Nelis, Hansenne, & Quoidbach, 2008), ability EI might capture what individuals are capable of doing (what they could do), whereas trait EI aims to capture how much of this emotional management potential (or declarative knowledge about emotions) translates into practise. Previous research on the intercorrelations between measures of ability and trait EI as well as on their validity in predicting indicators of personal adaptation (e.g., life satisfaction, depression) indicate that individuals' declarative knowledge about emotions is rather irrelevant in relation to regulating emotions in oneself (Freudenthaler et al., 2008). Considering that much expertise is procedural in nature, emotion-related skills may be implicit rather than explicit, suggesting that emotion regulation processes and related behaviours are often executed automatically, without much conscious awareness or deliberation (cf. Fiori, 2009; Gross & John, 2003; Papousek et al., 2008). On this background, the present study – along with other studies – focuses on trait EI which aims to capture the key affect-related aspects of personality (Petrides & Furnham, 2001; Petrides, Furnham, & Mavroveli, 2007).

Whereas most other studies in the field had related individual differences in the responsivity to emotional provocation to

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composite (global) measures of trait EI (e.g., Mikolajczak, Roy, Luminet, Fillee, & de Timary, 2007; Petrides & Furnham, 2003; Schutte, Malouff, Simunek, McKenley, & Hollander, 2002), the study by Papousek et al. (2008) suggested that specific and independent facets chosen for their theoretical relevance to the experimental setting may be more informative. The aim of the present study was to replicate and extend these observations of the validity of the self-reported traits of emotion regulation and emotion perception, and also the interaction between the two. To this end, electroencephalographic (EEG) asymmetry in the prefrontal cortex was recorded, which represents a psychophysiological measure that is not only sensitive to changes of emotional arousal (as cardiovascular measures are), but is also sensitive to changes of the valence or motivational direction of an individual's current affective state. Changes of dorsolateral prefrontal asymmetry to the right are regarded as indicating increased motivation to withdraw (as is typical for most negative affects), whereas changes of asymmetry to the left indicate increased motivation to approach (typical for positive affect; for review see Harmon-Jones, Gable, & Peterson, 2010). In addition, a study design was used that allowed one to study not only the responsiveness to the emotional provocation but also the subsequent recovery. Studying both responsiveness and recovery in the same experimental design may contribute to disentangling the processes related to emotion perception and the observer's initial affective response on the one hand and its down-regulation on the other hand. It has been proposed that the affective state experienced at a given moment is the sum of two antagonistic processes: the initial reaction to an emotion-eliciting stimulus and a lagging compensatory reaction that tends to return the system to equilibrium (Kline, Blackhart, & Williams, 2007; Solomon & Corbit, 1974). Thus, the responsiveness to the stimulation should be determined by both processes, thereby producing the previously observed interactions between traits related to perception and regulation, whereas during the recovery period, down-regulation processes should dominate. Finally, whereas in the previous study by Papousek et al. (2008) female-only samples were tested, a mixed-sex sample was tested in the present one. Consequently, the visual stimulation material that had shown a female poser was replaced by sound clips comprised of the affective expressions of mixed groups of men and women.

The experimental approach of the present study is novel. Previous studies in the field that also measured EEG asymmetry focused on EEG in resting conditions (i.e., the trait aspect of prefrontal cortical asymmetry) and on composite measures of trait EI measures, assessing emotion-related individual differences at the global and the factor (but not the facet) levels (Craig et al., 2009; Kemp et al., 2005; Mikolajczak, Bodarwe, Laloyaux, Hansenne, & Nelis, 2010). The recording of EEG in resting conditions relates to the question whether an individual's general disposition to adequately handle emotions may be correlated with his or her dispositional mood (“affective style”; Davidson, 1992), i.e., the outcome as a trait, or to the identification of potential neurophysiological prerequisites of trait emotional self-efficacy. By contrast, the present study was concerned with state-dependent changes of EEG asymmetry in response to the perception of affective expressions of other people and when the stimulation ceased. Thus, the present study design provided psychophysiological indicators of how social-emotional information is processed when individuals are confronted with affective expressions of others (process-oriented approach).

The emotional contagion paradigm simulates a situation that is common in everyday life and, therefore, represents an ecologically valid procedure in the context of affective processing. Emotional contagion represents a largely automatic and unconscious process, which has been demonstrated using both facial expressions and nonverbal vocal affect expressions (Dimberg, Thunberg, & Elmehed, 2000; Hietanen, Surakka, & Linnankoski, 1998; Neumann & Strack, 2000; Warren et al., 2006). Thus, it is suited to study rather automatic than deliberate processes of affect modulation. Regarding research on emotional intelligence, Fiori (2009) has recently illustrated the importance of considering the way individuals automatically process emotional stimuli in order to get a better understanding of emotion-related individual differences. In contrast to the predominance of negative affect conditions in the relevant literature, the present research also includes a positive condition. Previous research suggested that the habitual tendency to regulate one's emotions, that is, to modify one's emotional state, may play a lesser role in the context of positive than of negative affect (Gross & John, 2003; Papousek et al., 2008; Russell et al., 2011; Volokhov & Demaree, 2010). Anxiety and cheerfulness were chosen as the communicated affective states, because both represent high-arousal affects. Different arousal levels would be unfavourable, because both withdrawal motivation and high emotional arousal are associated with a relative shift of cortical activation asymmetry to the right (Papousek, Schulter, & Lang, 2009). Thus, when motivational direction or valence is in the focus of interest, it is important that the intensities of positive and negative arousal are equated, in order to avoid a confoundation of motivational direction/valence with the intensity of emotional arousal (Alfano & Cimino, 2008; Wager, Phan, Liberzon, & Taylor, 2003).

According to the above cited literature it was expected that individuals would show an increase of relative right to left dorsolateral frontal asymmetry during the confrontation with expressions of anxiety (due to the transfer of withdrawal-related affect). After the end of the stimulation, EEG asymmetry should return to baseline levels. We expected that the effect during the stimulation should be larger in individuals scoring high on emotion perception as compared to lower scoring participants. Individuals higher on emotion regulation should show a more efficient recovery, that is, a more complete return to baseline after the stimulation. A change of dorsolateral frontal asymmetry to the left was expected during the confrontation with laughter (due to the elicitation of approach-related affect), which should also return to baseline levels after the stimulation. An effect of individual differences in self-reported emotion regulation was only expected in the recovery period after the stimulation with anxiety.

2. Method

2.1. Participants

Eighty-six right-handed participants (44 men, 42 women) aged 18–41 years ($M = 23.5$, $SD = 4.8$) completed the experiment. Handedness was assessed by a standardised handedness test (performance test; Papousek & Schulter, 1999; Steingrüber & Lienert, 1971). Participants were requested to refrain from alcohol for 12 h and from coffee and other stimulating beverages for 4 h prior to their lab appointment, and to come to the session well rested. No participant reported using drugs or medication. The study was performed in accordance with the 1964 Declaration of Helsinki and was approved by the local ethics committee. Participants gave their written consent to participate in the study.

2.2. Self-report emotional ability scale (SEAS)

The SEAS (Freudenthaler & Neubauer, 2005) encompasses six subscales for the measurement of trait EI facets, i.e., the assessment of the typical handling of emotion in everyday life. Overall, it includes 49 items, which are rated on a six-point Likert scale. In the present study, only the two subscales ‘perception of the emotions of others’ (11 items, e.g., “It is not hard for me to identify

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