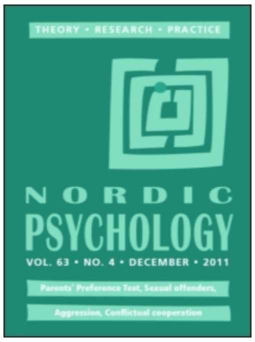

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ARTICLE

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Associations between trait emotional awareness and automatic emotion processing

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Abstract

Emotional awareness refers to the capacity of attending to, identifying, and describing emotions in oneself and in others, and it has been discussed as a factor promoting mental health. It has been shown to be associated with the recognition of others' verbal and facial emotions at a controlled or explicit processing level. So far, little is known about the relation between emotional awareness and automatic or implicit emotion processing. In the present study, priming techniques were used to assess the processes of automatic evaluative shifts due to masked emotional faces and automatic response facilitation based on masked emotional words. A face- and a word-priming task were administered to 49 healthy women, along with the Levels of Emotional Awareness Scale (LEAS). In the total sample, significant affective priming was obtained in the word priming task. Moreover, significant evaluative shifting due to negative faces was observed. As expected, LEAS correlated positively with affective priming by negative faces and tended to be correlated with affective priming, as measured in the word priming task. The present data suggest that individuals with a high level of emotional awareness exhibit heightened automatic sensitivity for negative facial expressions with respect to influencing affective judgments. More emotionally aware individuals also tend to manifest heightened automatic affective processing on a semantic level. In sum, the results of the present study add to the understanding of the reflective awareness of emotions by revealing links to basic processes of emotion perception that are rapid and occur without intention or effort.

Keywords: emotional awareness, automatic processing, emotions, affective priming, levels of emotional awareness scale

1. Introduction

Emotional awareness is the ability to attend to, identify, and label one's own emotions and those of other people (Lane, 2000). Lane and Schwartz (1987) put forward a cognitive-developmental theory on the organization of emotional experience in which five levels of emotional awareness are differentiated. The formation of emotional awareness is assumed to be a process in which awareness changes from being global and undifferentiated into being a new and more sophisticated way of representing emotions. The five levels, in ascending order, are awareness of physical sensations (level 1), action tendencies (level 2), single emotions (level 3), blends of emotions

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(level 4), and blends of blends of emotions (level 5, the capacity to appreciate complexity in the experiences of the self and other persons). A fundamental tenet of this model is that individual differences in emotional awareness reflect variations in the degree of differentiation and integration of schemata used in emotional processing. Input for emotion processing schemata can be derived from the internal world, through introspection, or the external world, through exteroception (Lane & Schwartz, 1987).

It is assumed that the five levels of emotional awareness are hierarchically related and that reaching a new level modifies but does not eliminate the function of previous levels (Lane, 2008). The feelings associated with an emotional reaction can be viewed as a construction consisting of each of the levels of awareness up to and including the highest level attained (Lane & Garfield, 2005). The level at which a person usually organizes his/her emotional experiences is termed the trait level of emotional awareness (Lane, 2008). On average, women manifest higher emotional awareness scores than men (Barrett, Lane, Sechrest, & Schwartz, 2000). Women display more complexity and differentiation in their articulations of emotional experiences than men. The onset of a mental disorder can lead to a regression from one's typical level of emotional awareness. For example, a person who becomes clinically depressed may experience a decline in his/her complexity of emotional awareness and an intensification of the somatic concomitants of emotional arousal (Donges et al., 2005; Lane & Schwartz, 1992). There is evidence that through the successful psychotherapeutic treatment of psychopathology, patients can increase their level of functioning (Montag et al., 2014; Subic-Wrana, Bruder, Thomas, Lane, & Köhle, 2005).

Low emotional awareness has been shown to be associated with impairments in the recognition of verbal and non-verbal (i.e. facial) emotional stimuli (Lane, Sechrest, Riedel, Shapiro, & Kaszniak, 2000; Lane et al., 1996). These findings are in accordance with the idea that the same schemata are used to process internal and external sources of emotional information. Findings from a priming experiment in which prime stimuli were presented only briefly (with a stimulus onset asynchrony of 300 ms) but were clearly visible suggest that persons with high trait emotional awareness may allocate more attention to verbal and non-verbal emotional stimuli than those with low trait emotional awareness (Suslow, Junghanns, Donges, & Arolt, 2001). In that study, the LEAS was administered as a performance-based measure of alexithymic tendencies, and no efforts were made to refer the correlational findings to the levels of emotional awareness theory. There is evidence that trait emotional awareness is positively correlated with an electro-dermal response to emotional stimuli (Lane, Allen, Schwartz, & Sechrest, 2000; McRae, Reiman, Fort, Chen, & Lane, 2008). This means that greater trait emotional awareness is characterized by stronger autonomic sympathetic arousal in response to emotion cues. Results from neuroimaging studies have suggested that the level of emotional awareness may depend on the degree to which the anterior cingulate cortex participates in the processing of emotional stimuli (Lane et al., 1998; McRae et al., 2008). The abovementioned findings indicate that individuals who are more emotionally aware are also more sensitive to external emotion cues at a controlled or explicit processing level.

The fMRI study of Lichev et al. (2015) was the first time that the relationship between trait emotional awareness and automatic emotion processing was explicitly examined within the context of the levels of emotional awareness theory. According to these findings, trait emotional awareness is positively associated with implicit positive affect elicited by a masked happy facial expression. Compared to less emotionally aware individuals, more emotionally aware individuals manifested a greater response to covert positive facial emotions in cortical and subcortical systems such as the amygdala, basal ganglia, and thalamus, which are relevant for the detection of biologically relevant stimuli. In that experiment, subjects had to evaluate the fit between artificial and emotional words, which could be used as an index of implicit affectivity (Quirin, Kazén, & Kuhl, 2009). The behavioral data suggested that high emotional awareness was characterized by an increased resonance to others' positive emotions at an automatic processing level. It was argued that the greater brain response of individuals with high emotional awareness could augment the input signal, enabling the perception of greater complexity in emotional stimuli or making it possible to extract more information from them (Lichev et al., 2015). The findings of Lichev et al. (2015) indicate that reflective awareness of emotions may also depend on the intensity and the extent of automatic affective responses. In everyday life, the identification of subtle emotions may be facilitated by an enhanced responsiveness of limbic brain areas to low intensity emotional stimuli. Individuals who spontaneously develop stronger cerebral and behavioral responses to emotional cues could become more easily aware of these affective reactions and, as a consequence, may reflect more frequently on them, thereby generating more complex representations of knowledge about emotions.

According to Zajonc's (1980) affective primacy hypothesis, emotional reactions can be elicited automatically with minimal stimulus input. Emotional stimuli presented only for a fraction of a second influence decision-making and color subjective impression (Zajonc, 2000). Typically, in affective priming tasks that assess automatic evaluative shifts, facial expressions of emotions varying in valence (e.g. angry, sad, happy, or neutral) are shown briefly and immediately masked by ideographs (Murphy & Zajonc, 1993; Murphy, Zajonc, & Monahan, 1995) or neutral facial expressions (Donges, Kersting, & Suslow, 2012; Suslow et al., 2013). Subjects have to rate the valence of the (ambiguous or neutral) mask stimuli. It is observed that compared to neutral expressions, angry facial expressions lead to more negative evaluations of subsequently presented stimuli, while happy facial expressions elicit more positive evaluations (Murphy & Zajonc, 1993; Murphy et al., 1995). The affect-congruent influence of emotional primes on subsequent judgments is one type of affective priming.

Another type of affective priming refers to automatic processes of response facilitation and response inhibition. Fazio, Sanbonmatsu, Powell, and Kardes (1986) presented a priming paradigm based on affective words, in which subjects had to evaluate target words as positive or negative (dichotomous decision). In this context, affective priming refers to the phenomenon by which the processing of an emotional target word (e.g. *music*) is accelerated when it is preceded by a word of the same valence (e.g. *friend*) rather than a word of the opposite valence (e.g. *cancer*) (Klauer & Musch, 2003). Typically, affective priming effects are determined by subtracting response latencies in the congruent (i.e. positive–positive and negative–negative) prime target conditions from those in the incongruent (i.e. positive–negative and negative–positive) prime target conditions. Affective priming occurs even when prime words are masked and hardly visible or detectable (Draine & Greenwald, 1998; Greenwald, Klinger, & Liu, 1989). This type of affective priming technique assesses the efficiency of automatic evaluative processing.

As stated above, in a neuroimaging study, Lichev et al. (2015) found a positive correlation between trait emotional awareness and implicit positive affect elicited by masked happy faces. These data indicated that high emotional awareness might be characterized by an increased emotional responsivity to positive facial expressions at an automatic processing level. In the present behavioral study, the relationship between trait emotional awareness and automatic emotion processing was investigated with the aim to extend previous findings by applying two further types of affective priming techniques. More specifically, the processes of automatic evaluative shifts due to masked emotional faces and automatic response facilitation based on masked emotional words were examined as a function of trait emotional awareness. It was hypothesized that trait emotional awareness is positively related to automatic evaluative shifts due to angry or happy facial expressions and positively related to automatic response facilitation based on emotional words. It appears plausible that representations of the emotional valence of words could be more accessible for individuals with more integrated and differentiated affective-cognitive schemata. The results of the present research might help further our understanding of the relation between the reflective awareness of emotions and the basic processes of emotion perception that take place at an automatic processing level. It was a goal of the present study on trait emotional awareness to extend the investigation of automatic affective perception to other types of processes administering established affective priming procedures. Revealing positive correlations of levels between emotional awareness and different measures of automatic affective perception could strengthen the idea that high emotional awareness is related to an enhanced processing of emotional information at an automatic processing level.

As mentioned above, previous research has shown that high trait emotional awareness is related to a better recognition of lexical and facial emotional stimuli at a controlled or explicit processing level (Lane et al., 1996, Lane, Sechrest, et al., 2000). It is possible that greater emotional awareness does not only reflect enhanced complexity in one's own experience of feelings or involve a heightened ability to verbalize and identify emotions or blends of emotions at a controlled processing stage; rather, it may be also related to an enhanced automatic affective responsivity to emotional facial expressions and a more efficient processing of covert lexical emotional information. In general, the fast and effortless recognition of emotional valence or quality of environmental stimuli may be a type of "foundation" for reflective processing. It is assumed that automatic search and evaluation processes can serve as initial or bottom-up guides for the detection of emotional information (Moors, 2016). Compared to individuals who are perceptually less sensitive to emotional information, individuals who tend to detect emotional cues more easily and involuntarily integrate subtle emotional context information in the evaluation of stimuli at a controlled processing level can build up over time semantic and associative representations of stimuli that contain more emotional information.

Only women participated in our study because women seem to manifest stronger affective priming than men (Donges et al., 2012), and a recent neuroimaging study observed relations between emotional awareness and brain response to emotion-evoking stimuli only for women (McRae et al., 2008). Emotional awareness has been found to be associated with verbal intelligence and negative affect (e.g. Conway, 2000); therefore, we administered measures of verbal intelligence, depression, and trait anxiety to control for these potentially confounding variables.

2. Material and methods

2.1. Participants

Forty-nine young, healthy women whose first language was German participated in this study. Participants' mean age was 24.12 years (SD = 3.78). The mean duration of their school education was 12.39 years (SD = .53). For all participants, exclusion criteria were a history of psychiatric or neurological disorder, current substance abuse, and use of any psychotropic medication. All subjects had normal or corrected-to-normal vision. Subjects were required to be between

18 and 39 years of age. Participants were recruited via public notices that were posted in several locations, such as canteens and libraries, on the campus of a university. The vast majority of study participants were university students. They were tested individually. Test sessions were conducted in a quiet room free of auditory and visual distractions. Participants received financial compensation for taking part in the study.

All participants gave written informed consent after receiving an explanation of the study and its procedures. The study was approved by the local ethics committee and was conducted in accordance with the Declaration of Helsinki.

2.2. Psychometric measures

2.2.1. Levels of emotional awareness scale

The Levels of Emotional Awareness Scale (LEAS [Lane, Quinlan, Schwartz, Walker, & Zeitlin, 1990]; German adaptation [Subic-Wrana, Thomas, Huber, & Köhle, 2001]) is a paper-pencil performance questionnaire that presents emotion-evoking, interpersonal situations, each described in up to four sentences and involving two persons (e.g. "A neighbor asks you to repair a piece of furniture. As the neighbor looks on, you begin hammering the nail but then miss the nail and hit your finger"). The LEAS asks the subject to describe his or her anticipated feelings and those of the other person in each of the scenes in an open-ended response format. The subject is told to use as much or as little of the page as needed to answer both questions. The LEAS assesses the five levels of emotional awareness identified in Lane and Schwartz's (1987) cognitive-developmental theory: bodily sensations, action tendencies, single emotions, blends of emotions, and combinations of blends. Reliable structural scoring criteria have been provided to assess the degree of differentiation and integration of words denoting emotion attributed to the self and the other (Barchard et al., 2011). Responses are scored separately for each situation. Each reply receives separate scores for the emotion described for self and for the other. A total LEAS score is determined by carrying across the highest of either the self or other subscale scores, or if level 4 is obtained for both the self and the other, a total score of 5 can be awarded. Ratings are exclusively founded on structure; no attempt is made to evaluate the appropriateness of responses. High LEAS scores indicate an awareness of emotional complexity in the self and others as well as emotional differentiation in verbalizing emotions. There is evidence of convergent and divergent validity of the LEAS (Lane et al., 1990; Siegling, Saklofske, & Petrides, 2015).

In the present study, the raters were blind to the questionnaire and priming results of the study participants and were not involved in data collection. A short version of the LEAS with 10 situations was administered (form A). Thus, the theoretical range of the total score was 0 to 50. The scoring of responses was based on a consensus rating of both authors, who are experienced in scoring LEAS protocols (Donges et al., 2005; Suslow, Donges, Kersting & Arolt, 2000; Suslow et al., 2001). In our study, the intratest homogeneity for the LEAS total score, measured using Cronbach's alpha, was .82. The mean LEAS total score was 38.16 (SD = 5.53; range: 26 to 50).

2.2.2. Self-report measures of affectivity

The German version (Hautzinger, Keller, & Kühner, 2006) of the Beck Depression Inventory II (BDI-II; Beck, Steer, & Brown, 1996) was used to assess the depressivity of study participants. Cronbach's alpha for the BDI-II was .71. In our sample, the mean BDI-II score was 7.31 (SD = 4.51).

The German adaptation (Laux, Glanzmann, Schaffner, & Spielberger, 1981) of the State Trait Anxiety Inventory (STAI; Spielberger, Gorsuch, & Lushene, 1970) was applied to measure trait anxiety. Cronbach alpha for the STAI was .89. The mean STAI score was 37.86 (SD = 8.68).

2.2.3. Verbal intelligence test

A multiple-choice vocabulary test, the MWT-B (Lehrl, 2005), was administered to measure the verbal intelligence of the study participants. The MWT-B contains five words per item (four non-sense words; one correct word), and the correct word must be identified. The correct recognition of each word earns a point, which is added to the total score for a maximum of 37. There are no time restrictions. The mean MWT-B IQ score was 113.22 (SD = 11.89).

2.2.4. Word priming task

Stimuli. In this affective priming task, 10 positive and 10 negative adjectives were used as the target stimuli (e.g. *geduldig* [patient], *kreativ* [creative]; *entmutigt* [demoralized], *kriminell* [criminal]). The primes were 20 different adjectives (10 positive, 10 negative; e.g. *treu* [faithful], *schön* [beautiful]; *giftig* [toxic], *feige* [cowardly]). The prime and target stimuli were identical to those administered by Wentura and Degner (2010; study 2). A string of six X's was administered as the no-word prime condition.

Procedure. Participants were told that they should classify words with regard to their valence as positive or negative. In our task instructions, the main emphasis was on speed. Participants were instructed to decide as quickly as possible but told that they should also not make too many errors. Participants were informed that they would see strings of letters before the words. They were instructed not to be distracted by this and to focus their attention on the words. At the beginning of each trial, a randomly generated string of 13 consonant letters (e.g. PYLDQFBYTQKPH) was presented, serving as a forward mask. After 300 ms, it was replaced by the prime. The prime word was always shorter than the forward mask, and the prime was completely embedded in the string of letters. The prime word was shown for 50 ms and replaced by another string of 13 consonants (e.g. KQHYTPDQFPBYL) that remained on the screen for 17 ms and served as a backward mask. Then, a blank screen followed for 17 ms. It was replaced by the target word, which remained on the screen until a response was given (see Figure 1 for a summary of events within a trial). The "negative" response was assigned to the left index finger ("Y" button on the keyboard) and the "positive" response to the right index finger ("M" button). The interval

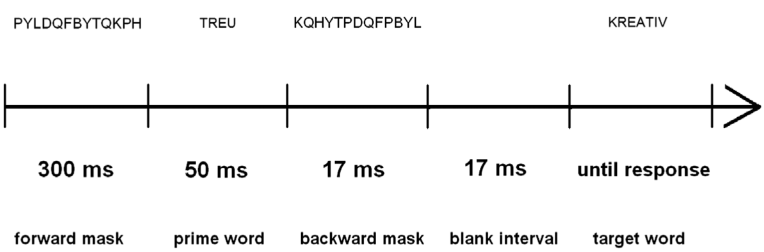

Figure 1. Sequence of events within a trial in the word priming experiment. In our example, a trial with positive adjectives as a prime word ("faithful" in English) and a target word ("creative" in English) is shown.

between trials was 2.3 s. Participants started with 20 practice trials in which each target word was shown once together with X's as a (no-word) prime to familiarize them with the experiment. During the practice trials, feedback was given only in the case of errors. The actual experiment consisted of three blocks of 100 trials. Each block was subdivided into five 20 trial sequences in which each target word was presented once. In each block, each target word was assigned at random two times to a negative prime, two times to a positive prime, and one time to a string of X's. Participants received feedback indicating the percentage of correct responses and the mean RT after each block.

2.2.5. Face priming task

Stimuli. Face stimuli were monochrome happy, angry, and neutral expressions that were selected from the Pictures of Facial Affect database (Ekman & Friesen, 1976). Affective and neutral facial expressions of 10 individuals (5 women, 5 men) were administered as primes. Neutral primes were vertically mirrored (i.e. neutral prime faces were created by a mirror inversion (left to right) of neutral mask faces). In this way, the identity of prime and mask stimuli was avoided in the neutral prime condition. The prime stimuli included 10 faces with a happy expression, 10 faces with an angry expression, and 10 faces with a neutral expression. In 10 trials, primes with no facial features were shown. In the no-facial-expression condition, face stimuli consisted of neutral faces in which the mouth, nose, and eyes had been replaced by a uniform surface without contours (see Figure 2 for examples of the four prime conditions and the neutral mask face).

Procedure. In our experiment, each trial was presented twice. In each trial, facial expressions of the same individual were shown. Trials were presented in a fixed random sequence with the following constraints: (a) no trial was shown twice per half, (b) no two subsequent trials depicted the same person, and (c) the same prime category was presented in no more than two subsequent trials. This experiment was introduced as a task requiring snap judgments of faces. Participants were tasked with watching a series of faces and evaluating the facial expressions as negative or positive on a six-point scale (from −2.5 to +2.5) by pressing a button on the computer keyboard. When deciding, they were instructed to rely on their first impression. Participants were instructed to answer quickly and to give a response approximately seven seconds after the face presentation. Each trial had a duration of 8 s. A prime face was presented for 33 ms, preceded by a fixation cross for 800 ms and followed by a face with a neutral expression for 467 ms. It followed a blank screen for 6,700 ms in which subjects had to evaluate the mask face by pressing buttons on the keyboard.

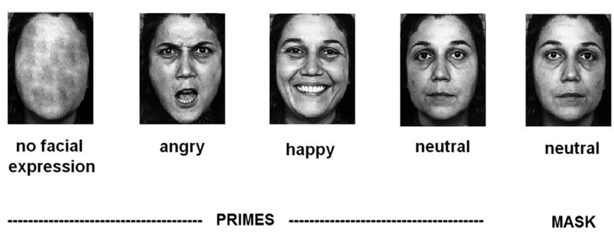

Figure 2. Examples of faces presented in the four prime conditions (happy, angry, neutral, and no facial expression) and of a (neutral) mask face.

2.3. General procedure

After the exclusion criteria were verified (in most cases by telephone), individuals were invited to participate in the study. At the beginning of the test session, participants' sociodemographic data were registered after they gave written informed consent. The test session started with paper-pencil instruments. MWT-B, BDI-II, STAI, and LEAS were presented in a fixed order.

The word priming task was always administered before the face priming task and followed by a break for 10 minutes. During the priming tasks, participants were seated in front of a computer. The computer screen was placed directly in front of them at a distance of approximately 60 cm from their eyes. The stimulus presentation and response registration were realized via Inquisit program 2.0 (Draine, 2004) on a Dell Latitude E6510 with a monitor refresh rate of 60 Hz. At the end of the testing session, participants were fully debriefed about the experimental procedure and given the opportunity to ask questions.

2.4. Statistical analyses

Product moment correlations were used to investigate the correlations of trait emotional awareness (LEAS) with age, education, verbal intelligence (MWT-B), depressivity (BDI-II), trait anxiety (STAI), and affective priming scores.

In the word priming task, the mean reaction times were derived only from correct responses. RTs above 1500 ms or below 150 ms were discarded. Affective priming indices were calculated as the difference in incongruent (negative–positive, positive–negative) and congruent (positive–positive, negative–negative) mean RTs. That is, the mean RT of the valence-congruent conditions was subtracted from the mean RT of the valence-incongruent conditions. One-sample *t*-tests were used to assess the occurrence of affective priming.

In the face priming task, two affective priming scores were calculated (for angry and happy faces) on the basis of the evaluation scores. Neutral faces were used as the baseline condition. In this way, the specific effect of emotionality in facial expressions on evaluative assessment could be determined. A paired-samples *t*-test was applied to examine differences between evaluation scores in the neutral face condition and the no-facial expression condition. For happy faces, we computed a priming score by subtracting the mean evaluative ratings for neutral target faces primed by neutral faces from the mean evaluative ratings for neutral target faces primed by happy faces. A positive priming score for happy faces indicated that participants rated neutral masks more positively if they were primed by happy faces than if they were primed by neutral faces. In this case, a prime valence-congruent shift due to masked happy faces is observed in the evaluative ratings. For angry faces, a priming score was computed by subtracting the mean evaluative ratings for neutral target faces primed by angry faces from the mean evaluative ratings for neutral target faces primed by neutral faces. A positive priming score for angry faces indicated that participants evaluated neutral masks more negatively if they were primed by angry faces than if they were primed by neutral faces. Thus, a positive priming score for angry faces indicated a prime valence-congruent evaluative shift due to masked angry facial expressions. One-sample *t*-tests were also applied to assess the occurrence of affective priming in the face priming task.

All statistical analyses were calculated using the statistical software package SPSS 20.0 (IBM Corporation). All tests are reported as two-tailed, if not otherwise stated.

3. Results

3.1. Correlations of trait emotional awareness with sociodemographic variables, affectivity, and intelligence

In our sample, trait emotional awareness (as assessed by LEAS total scores) was not significantly correlated with age ($r = .13$), education ($r = .06$), verbal intelligence ($r = .11$), depression ($r = -.07$), or trait anxiety ($r = -.01$) (all *p*s > .05).

3.2. Word priming task

In the word priming task, participants gave a total of 14,700 responses (300 × 49). As noted above, the analysis of RTs was based on correct responses. Participants committed 552 evaluative errors; thus, the mean error rate was low (3.76%) in the word priming task. There were only 49 RTs above 1500 ms or below 150 ms that had to be discarded (.33%). None of the participants had an error rate >10%. As mentioned above, affective priming indices were calculated as the difference in incongruent (617 ms [SD = 50 ms]) and congruent (609 ms [SD = 53]) mean RTs. In our sample, the resulting mean affective priming score was 8 ms (SD = 15). This priming score differed significantly from zero (t (48) = 4.03, $p < .001$).

3.3. Face priming task

On average, participants tended to evaluate neutral mask faces as negative across prime conditions. The mean evaluation scores for the four prime conditions were −.043 (SD = .428; happy prime condition), −.175 (SD = .313; angry prime condition), −.095 (SD = .308; neutral prime condition), and −.118 (SD = .313; no-facial expression prime condition). The evaluation scores in the neutral prime condition did not differ from those in the no-facial expression prime condition (t (48) = .95, $p = .34$).

First, we computed a priming score for happy primes by subtracting the mean evaluative ratings for neutral target faces primed by neutral faces from the mean evaluative ratings for neutral target faces primed by happy faces. The affective priming score for masked happy faces was .052 (SD = .278). The results from one-sample *t*-tests indicated that the evaluative priming score based on happy faces did not differ significantly from zero ($t(48) = 1.31$, $p = .19$). Although the evaluation score in the happy prime condition was descriptively more positive than that in the neutral prime condition, the difference between the scores failed to reach statistical significance.

Second, we calculated a priming score for angry primes by subtracting the mean evaluative ratings for neutral target faces primed by angry faces from the mean evaluative ratings for neutral target faces primed by neutral faces. The affective priming score for masked angry faces was .080 (SD = .160). The results from one-sample *t*-tests showed that the evaluative priming scores based on angry faces differed significantly from zero ($t(48) = 3.50$, $p \leq .001$). Thus, masked angry prime faces produced more negative evaluative shifts than masked neutral faces.

3.4. Correlations of trait emotional awareness with affective priming scores

Trait emotional awareness (LEAS) tended to be correlated with affective priming, as measured in the word priming task ($r = .24$, $p = .0508$, one-tailed) (see scatterplot in Figure 3). Thus, some evidence was found that high trait emotional awareness was associated with less affective priming in the word priming experiment.

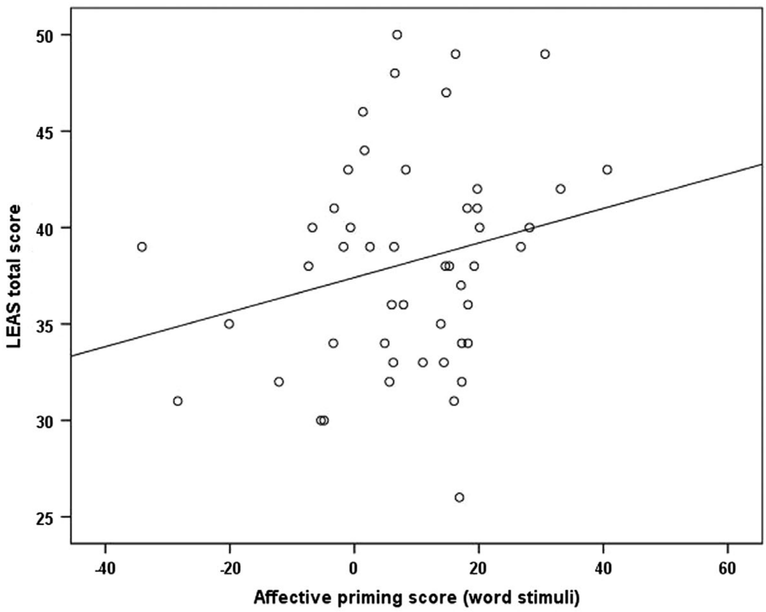

Figure 3. Scatterplot depicting the correlation between trait emotional awareness (LEAS) and affective priming in the word priming task (in ms; RT difference between valence-incongruent and valence-congruent prime target pairs) (r (47) = .24, p = .051, one-tailed).

As hypothesized, trait emotional awareness correlated positively with affective priming by angry faces (r = .26, p < .05, one-tailed) (see scatterplot in Figure 4). This means that subjects with high emotional awareness manifested stronger evaluative shifts due to masked angry primes than individuals with low emotional awareness. No significant correlation was observed between trait emotional awareness and affective priming by happy faces (r = −.03).

3.5. Correlations between affective priming scores

There were no significant correlations of affective priming, as assessed in the word experiment, with affective priming based on facial expressions (r = −.10 (angry primes), r = −.04 [happy primes]). Finally, affective priming due to angry faces did not correlate significantly with affective priming by happy faces (r = −.21).

4. Discussion

Following the fMRI study of Lichev et al. (2015), in which the *Implicit Positive and Negative Affect Test* (Quirin et al., 2009) was administered to assess changes in implicit affectivity due to masked faces, the present investigation is the second study to explicitly focus on the relationship between trait emotional awareness and automatic emotion processing. In our research, two established affective priming techniques, a face and a word priming task, were applied for the first time to investigate automatic evaluative shifts due to emotional faces and automatic response facilitation based on emotional words in a sample of healthy women. The goal of the

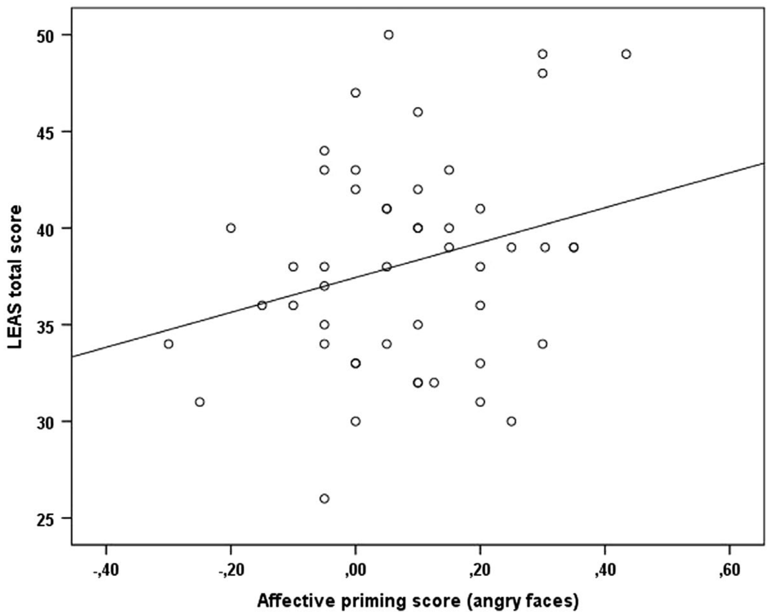

Figure 4. Scatterplot depicting the correlation between trait emotional awareness (LEAS) and affective priming by angry facial expression (r (47) = .26, $p < .05$, one-tailed).

present behavioral study was to extend the investigation of automatic affective perception and levels of emotional awareness to other types of processes. Revealing the positive correlations of trait emotional awareness with different measures of automatic affective perception could help consolidate and specify the idea that high emotional awareness is related to an enhanced processing of emotional information at an automatic processing level.

In the word priming task, a significant affective priming effect was obtained, suggesting response facilitation in the case of valence congruence compared to valence incongruence between the prime and the target. These findings confirm the general idea that the affective valence of lexical stimuli is processed involuntarily and effortlessly (Draine & Greenwald, 1998; Greenwald et al., 1989; Wentura & Degner, 2010). Importantly, affective priming occurred under conditions in which prime words were completely embedded in strings of letters (i.e. forward and backward masked). Moreover, in our face priming task, significant affective priming in the sense of evaluative shifting was observed for masked angry but not masked happy facial expressions. This means that participants judged (neutral) mask faces more negatively when preceded by angry faces than when masked faces were preceded by neutral primes. Therefore, our study provides evidence of valence-congruent evaluative shifts due to angry faces, as shown in previous research (Murphy & Zajonc, 1993; Murphy et al., 1995). The evaluative shift for happy faces (compared to neutral faces) was in the expected direction but did not reach statistical significance. Unsurprisingly, no correlations between the word and face priming scores were observed in our study. These data indicate that automatic processes of evaluative shifting due to facial emotion are independent of automatic processes of response facilitation based on emotional words.

The present results basically confirm our expectations that trait emotional awareness is related to both automatic evaluative shifting and automatic response facilitation due to emotional words. According to our data, trait emotional awareness was significantly positively associated with affective priming by angry faces (but not with priming by happy faces) and tended to be positively correlated with affective priming, as measured in the word priming task. The correlation coefficients obtained indicate a link between emotional awareness and automatic processing parameters, showing a (small to) medium effect size. Thus, more emotionally aware individuals exhibit heightened automatic sensitivity for angry facial expressions with respect to influencing affective judgments. Persons with a high level of emotional awareness seem to recognize negative valence of briefly shown, unattended facial expressions and integrate this information into their explicit conclusions and judgments to a greater extent than persons at low levels of emotional awareness. It appears that high emotional awareness is characterized by the more efficient reading and use of minimal emotional information in the conscious appraisal of social stimuli.

The findings are consistent with results of Lichev et al. (2015), showing a link between trait emotional awareness and implicit affective responsivity to masked happy faces. These data indicate that high emotional awareness might be characterized by an increased emotional responsivity to others' facial expression at an automatic processing level. These results of an enhanced affective resonance are also in line with those of previous studies suggesting heightened responses of physiological arousal to emotion cues in individuals high in emotional awareness (Lane, Allen, et al. 2000; McRae et al., 2008). Lichev et al. (2015) also found that more emotionally aware individuals showed a greater response to masked positive faces in cortical areas such as the primary somatosensory cortex and the inferior parietal lobule, which are known to be involved in emotional mimicry and imitation (Adolphs, Damasio, Tranel, Cooper, & Damasio, 2000; Carr, Iacoboni, Dubeau, Mazziotta, & Lenzi, 2003; van der Gaag, Minderaa, & Keysers, 2007). Somatosensory representations of facial expressions of emotion appear to be an important factor in empathic responses (Preston & de Waal, 2002). This fits with the observation that people who are low in emotional awareness have been found to be less empathetic (Ciarrochi, Caputi, & Mayer, 2003; Igarashi et al., 2011).

Interestingly, in our study and in that of Lichev et al. (2015), emotional awareness was found to correlate with those face priming conditions for which a significant affective priming effect could be observed. Thus, an absence of priming effects might explain the failure to detect associations between emotional awareness and evaluative shifts, respectively.

The present data also revealed a possible relationship between trait emotional awareness and automatic response facilitation due to emotional words. According to our findings in the word priming task, individuals with high emotional awareness tended to process emotional information on a semantic level more efficiently than those with low emotional awareness. More emotionally aware individuals manifested a tendency toward a faster automatic processing of affective valence in lexical stimuli. Trait emotional awareness is assumed to reflect variations in the degree of differentiation and integration of cognitive schemata used in emotional processing (Lane & Schwartz, 1987). Lane (2008) specified that these schemata could represent *implicit programs*. Language processing is highly automated in literate adults and depends upon the ability to efficiently access linguistic information, that is, to match an external stimulus with internal representations (Rayner, Pollatsek, Ashby, & Clifton, 2012). It is possible that representations of the valence of external lexical stimuli could be more accessible in individuals with more integrated and differentiated affective-cognitive schemata. However, based on the present data from the word priming task, no definite conclusions can be drawn concerning the mechanisms underlying the affective priming effects.

Recently, it has been put forward that the reflective construction of emotional experience necessitates the integration of implicit and explicit emotional processes (Quirin & Lane, 2012). It is assumed that functioning at high levels can alter but does not remove the functioning of previous levels. Emotional awareness is the ability to attend to, identify, and verbalize one's own emotions and those of others. It has been shown to be associated with better recognition of verbal and facial emotional stimuli at a controlled processing level (Lane et al., 1996, Lane, Sechrest, et al. 2000). Considering our findings and previous findings (Lichev et al., 2015), it can be concluded that trait emotional awareness is also related to enhanced automatic perception and responses to emotional information. From an ontogenetic perspective, one may argue that high automatic responses to others' emotions and the efficient involuntary processing of emotional information very early in infancy could represent advantageous conditions for the development of high emotional awareness. Automatic emotion responsivity might represent an important factor in promoting emotional development and differentiation of individuals. However, there are other factors that are assumed to improve or increase discrimination and awareness of one's emotions, such as parents' skills in emotion coaching (Gottman, Katz, & Hooven, 1996), the emotional competencies of socialization agents outside the home, e.g. teachers and peers (Katz, Maliken, & Stettler, 2012), and verbal abilities and intelligence (Schultz, Izard, & Abe, 2006).

The effortless production of responses in early emotion processing systems has been assumed to be an important basis of information for higher processing systems (cf. Lichev et al., 2015). Thus, the extent of reflective emotional awareness may also derive from the efficiency and the ease of triggering automatic emotion processing. Responsiveness to weak, unattended emotional signals could make the recognition of subtle emotions easier in everyday life. Perceptual sensitivity to minimal affective signals should contribute to a better understanding of other persons' emotional states. People who automatically develop stronger responses to emotion cues might become more quickly aware of them and have easier access to conscious reflection. Repeated reflections on and analyses of emotional experiences and events could result in more complex cognitive representations of emotional information.

However, it cannot be excluded that more complex and differentiated cognitive representations of emotional information could favor the detection of emotion cues or enhance the speed of involuntary emotion processing and the elicitation of emotional responses. Longitudinal studies examining changes in emotional awareness in patients suffering from mental disorders through psychotherapy may help clarify whether increases in emotional awareness affect automatic emotion processing characteristics.

Our study included only women as participants, limiting the generalizability of the results. Future studies must be carried out to clarify whether relations between trait emotional awareness and automatic emotion processing can also be found among men. Another limitation of our study is that we did not conduct an awareness test to check participants' ability to recognize the valence of prime stimuli. Against this background, we cannot claim to have assessed *subliminal* processing of emotional stimuli in our study. The fact that prime stimuli were *masked* by subsequent target stimuli does not mean that the reported priming effects happened without conscious awareness of the primes. However, the unawareness or invisibility of prime stimuli is not a necessary feature of automaticity with regard to information processing (Moors & De Houwer, 2006). Automatic information processing can be differentiated from controlled information processing by a number of (additional) contrasting features, such as fast vs. slow, unintentional vs. intentional, uncontrollable vs. controllable, and efficient vs. non-efficient (Bargh, 1992, 1997). In our experiments, the processing of emotional prime stimuli should have been automatic in the sense of being unintentional and fast. Subjects were not informed about the prime stimuli, and they had no conscious intent to process them. The perception of prime stimuli occurred under conditions of distraction or inattention as subjects were tasked with evaluating target stimuli. Face primes were shown for a thirtieth of a second (with a stimulus onset asynchrony (SOA) of 33 ms), and word primes were presented for a twentieth of a second (with an SOA of 84 ms). Thus, it can be concluded that the evaluation and response processes operating on the primes were fast in our study.

Overall, the results of the present study add to the understanding of the reflective awareness of emotions by revealing links to basic processes of emotion perception that evolve fast without intention or effort. Against the background of the current findings, greater emotional awareness not only comprises high differentiation in experiencing emotions and a good ability to identify and verbalize emotions at an explicit or controlled processing level; it also appears to be related to enhanced automatic emotional responsivity and more efficient processing of covert emotional information.

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