



Decoding of affective facial expressions in the context of emotional situations

Monika Sommer^{a,*}, Katrin Döhnel^a, Jörg Meinhardt^b, Göran Hajak^a

^a Department of Psychiatry and Psychotherapy, University of Regensburg, Regensburg, Germany

^b Department of Psychology, Ludwig-Maximilians University, Munich, Germany

ARTICLE INFO

Article history:

Received 29 October 2007

Received in revised form 18 March 2008

Accepted 21 April 2008

Available online 3 May 2008

Keywords:

Theory of Mind

Precursor functions

Emotion decoding

Amygdala

ABSTRACT

The ability to recognize other persons' affective states and to link these with aspects of the current situation arises early in development and is precursor functions of a Theory of Mind (ToM). Until now, studies investigated either the processing of affective faces or affective pictures. In the present study, we tried to realize a scenario more similar to every day situations. We employed fMRI and used a picture matching task to explore the neural correlates associated with the integration and decoding of facial affective expressions in the context of affective situations. In the emotion condition, the participants judged an emotional facial expression with respect to the content of an emotional picture. In the two other conditions, participants indicated colour matches on the background of either affective or scrambled pictures. In contrast to colour matching on scrambled pictures, colour matching on emotional pictures resulted in longer reaction times and increased activation of the bilateral fusiform and occipital gyri. These results indicated that, although task irrelevant, participants may attend to the emotional background of the pictures. The emotion task was associated with higher reaction times and with activation of the bilateral fusiform and occipital gyri. Additionally, emotion attribution induced left amygdala activity. Possibly, attention processes and amygdala projections modulated the activation found in the occipital and fusiform areas. Furthermore, the involvement of the amygdala in the ToM precursor ability to link facial expressions with an emotional situation may indicate that the amygdala is involved in the development of stable ToM abilities.

© 2008 Elsevier Ltd. All rights reserved.

1. Introduction

Successful navigation through the human social world demands the ability to attribute mental states to one and others and is called Theory of Mind (ToM; Frith & Frith, 2006; Perner, 1991). The development of ToM abilities proceeds in several steps. Whereas children develop an understanding of knowledge and belief around the age of 3–4 years even 2-year olds possess an understanding of desires and intentions (Wellman, Cross, & Watson, 2001). And the understanding of someone's actions in terms of the actors' underlying intentions is preceded by the understanding that emotional displays are providing information about specific objects and situations (Wellman & Languttag, 2000). Therefore, the abilities to recognize other persons' emotions and to link these emotions to the given situation are important precursor functions for developing a ToM (Sodian & Thoermer, 2008).

Until now, most studies that investigated the neural correlates of emotion recognition examined either the processing of affective faces (Adolphs, 2002; Blair, 2003; Vuilleumier & Pourtois, 2007; Winston, O'Doherty, & Dolan, 2003) or affective pictures (Lane, Chua, & Dolan, 1999; Paradiso et al., 2003; Sabatinelli, Bradley, Fitzsimmons, & Lang, 2005). However, real life situations are more complex because they are defined by a combination of different socially relevant stimuli. It is not sufficient only to decode the facial expression in order to assess a social situation. Fridlund (1994) suggests that faces are not purely surfaces on which private affective meanings are somehow made visible but rather tools for communicating behavioral intentions and social motives to specific addressees. In his view, facial expressions relate to how people are likely to act rather than their current subjective emotional experience. Therefore, in ambiguous or emotional situations a person's facial expression may communicate information about approach or withdraw movements toward an object (Parkinson, 2005). For example, by the age of 12 months infants confronted with an ambiguous situation, where they do not know what to do, consult their mother's face for advice (Sorace, Emde, Campos, & Klinnert, 1985). Frijda (1953) found that spontaneous open-ended judgments about pictures of facial movements often referred to situations that might have provoked the observed responses and that

* Corresponding author at: Department of Psychiatry and Psychotherapy, University of Regensburg, Universitätsstraße 84, D-93053 Regensburg, Germany. Tel.: +49 941 9412050; fax: +49 941 9412053.

E-mail address: monika.sommer@medbo.de (M. Sommer).

emotional interpretations were only offered later. And for detection of deception it is not sufficient to decode nonverbal cues like affective face expressions (Zuckerman, DePaulo, & Rosenthal, 1981) also the situational context of the face movement must be considered.

In sum, face expressions carry important information about the situational context within they occur (Carroll & Russell, 1996) and provide hints for an adequate modulation of our own behavior in this situation. Therefore, the proper way of understanding affective facial expressions is to consider the context in which they appear (Parkinson, 2005). Therefore, attributional processes during interaction with other people demand the integration of different sources of information. In order to represent the mental state of a particular individual in a particular situation, both a person's facial expression and the social context must be simultaneously represented and integrated. This demands not only the decoding of an affective face expression but also the consideration how a certain situation influences other people's mental states (Lieberman, 2007).

Until now, face processing research focused on the neural mechanisms that are specific for emotion expression recognition (Adolphs, 2002; Haxby, Hoffman, & Gobbini, 2002; Vuilleumier & Pourtois, 2007). Therefore, in most studies the affective face stimuli were presented without any social or affective context. In these studies, participants usually had to recognize the presented affective expression with respect to prescribed emotional adjectives (Adolphs, Damasio, Tranel, & Damasio, 1996; Hennenlotter & Schroeder, 2006) or to make judgements about non-affective aspects like similarity (e.g. Vuilleumier & Pourtois, 2007). It is still under debate whether facial emotion perception is organized in a modular fashion with distinct neural circuitry sub serving individual emotions (Adolphs, 2002) or whether there is a common substrate to the perception of multiple basic emotions (Blair, 2003; Winston et al., 2003). Whereas neuroimaging studies consistently show activation of the amygdala during the processing of negative, especially fearful, facial expressions (Gorno-Tempini et al., 2001; Iidaka et al., 2001; Morris et al., 1998; Pessoa, McKenna, Gutierrez, & Ungerleider, 2002; Vuilleumier, Armony, Driver, & Dolan, 2001) or when subjects view faces of people who are perceived in negative ways, like untrustworthy or bizarre (Winston, Strange, O'Doherty, & Dolan, 2002), results on positive facial expressions appear inconsistent (Zald, 2003).

Besides the processing of facial affect, neuroimaging studies that dealt with the neural correlates of emotion recognition have commonly used affective pictures, particularly pictures of the International Affective Picture System (IAPS; Lane et al., 1997, 1999; Paradiso et al., 2003; Sabatinelli et al., 2005). Results revealed that affective pictures and affective faces seem to activate similar brain regions, especially the amygdala and the visual cortex (Phan, Wager, Taylor, & Liberzon, 2002; Zald, 2003). However, until now only some studies have directly compared facial expressions and affective pictures (Britton, Taylor, Sudheimer, & Liberzon, 2006). Britton et al. (2006) presented either facial expressions or IAPS pictures. Independent of the emotional content of the stimuli, facial expressions and IAPS pictures activated similar brain regions, reflected in a common pattern of activation which included the amygdala, posterior hippocampus, ventromedial prefrontal cortex, and visual cortex. A differential pattern of activation was found in superior temporal gyrus, insula, and anterior cingulate. In these regions the emotional faces induced more activation than the IAPS pictures.

In sum, there is conclusive evidence that affective face and affective picture processing are associated with activation of similar brain areas, especially the occipital visual cortex and the amygdala. But until now studies investigated either face or picture processing. However, for navigating through the social world it is important to integrate relevant information of different sources. In humans,

facial expressions do not automatically display the emotions of a person, as well the social context predicts the probability of an emotional facial expression (Fridlund, 1994). Therefore, for a valid attribution of another person's mental state in everyday situations people must be able to take into account both the person's facial expression and the affective content of the specific situation.

In the present study, we focused on the human ability to link affective face expressions with the emotional context of a given situation, which seems to be an important precursor function of ToM (Wellman & Langutta, 2000). In order to realize a scenario somewhat similar to real life situations, we presented simultaneously affective faces and emotional pictures. The participants' task was to link the emotional content of the situation with the appropriate face expression. Therefore, in the emotion condition, participants had to decide which of two faces matched with the affective situation. In the two other conditions, participants should indicate colour matches either on the background of emotional pictures or on the background of scrambled pictures.

2. Methods

2.1. Participants

Eighteen subjects (9 men and 9 women; range 19–33 years, mean 24.8) with no neurological or psychiatric history participated in the imaging study. All gave informed consent according to the guidelines of the local Ethics Committee.

2.2. Material

Three different conditions were realized "emotion", "colour unscrambled (colour.us)", and "colour scrambled (colour.s)". Examples of the stimuli are presented in Fig. 2. The two conditions "emotion" and "colour unscrambled" consist of the same visual stimuli and only differ with respect to the experimental instruction. In the upper part a pleasant, unpleasant, or neutral picture of the International Affective Picture System (IAPS; CSEA-NIMH) was presented. In the lower part two affective faces developed by Ekman and Friesen (1976) were presented. While one of the two faces matches the emotional content of the IAPS picture, the other mismatches the content. The side of the matching face picture was counterbalanced. From the IAPS 10 neutral, 10 pleasant and 10 unpleasant pictures were selected. The unpleasant pictures depicted sadness, disgust and fear. All IAPS pictures were tested with respect to their emotional unambiguity in a prior study (Sommer, Döhnel, Ettenhuber, et al., 2007). The Ekman pictures consist of 7 male and 7 female faces depicting happiness, sadness, fear, disgust and a neutral faces. The allocation of a male or female face to the IAPS picture was counterbalanced. After fMRI scanning, all participants rated the intensity of the specific emotion categories depicted by the IAPS and face pictures. For each picture, subjects rated the intensity of the five emotions happy, neutral, sadness, disgust and fear on rating scales from 1 (not at all) to 9 (extreme). Both IAPS and face pictures were presented in black-and-white. Randomly distributed over the pictures' border were red, pink, green, blue and yellow squares (0.5 cm × 0.5 cm).

In the "colour scrambled" condition, the arrangement of the pictures and the coloured squares were the same as in the two experimental conditions, except that the pictures were scrambled. Therefore, in this condition the pictures had the same brightness, but their affective content was invisible.

2.3. Experimental procedure

We used a block design with three different block types. Each block type was comprised of a series of five pictures of the same condition. Each picture was presented for 2500 ms. At the beginning of each block, an instructional cue was presented in the centre of the screen for 1600 ms. On "emotion" blocks, participants were instructed to judge which affective face matched to the IAPS picture. On "colour" blocks, participants judged whether the colour square of the lower right or left picture matches the colour square of the upper image independent of the content of the pictures. Each block lasted 18.6 s and consisted of 7 volumes. Between the blocks, a fixation cross was presented for 18 s. Every condition consisted of 20 blocks. Altogether 848 volumes were recorded.

Responses were recorded using two buttons of a five-button fMRI compatible response pad. Subjects used the index finger for indicating left side matches and the middle finger for indicating right side matches of the right hand for response.

The software package Presentation (Neurobehavioral Systems Inc., <http://www.neuro-bs.com>) was used to present stimuli and to record responses. The pictures were viewed by projection onto a mirror mounted onto the head coil in the scanner.

متن کامل مقاله

دریافت فوری ←

ISIArticles

مرجع مقالات تخصصی ایران

- ✓ امکان دانلود نسخه تمام متن مقالات انگلیسی
- ✓ امکان دانلود نسخه ترجمه شده مقالات
- ✓ پذیرش سفارش ترجمه تخصصی
- ✓ امکان جستجو در آرشیو جامعی از صدها موضوع و هزاران مقاله
- ✓ امکان دانلود رایگان ۲ صفحه اول هر مقاله
- ✓ امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
- ✓ دانلود فوری مقاله پس از پرداخت آنلاین
- ✓ پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات