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Morphed emotional faces: Emotion detection and misinterpretation in social anxiety

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ABSTRACT

The current study investigated detection and interpretation of emotional facial expressions in high socially anxious (HSA) individuals compared to non-anxious controls (NAC). A version of the morphed faces task was implemented to assess emotion onset perception, decoding accuracy and interpretation, either with time pressure (Restricted Viewing Task, RVT) or with unlimited viewing (Free Viewing Task, FVT). Twenty-seven HSA and 30 NAC viewed sequences of neutral faces slowly changing to full-intensity angry, happy, or disgust expressions. Participants were instructed to assign the expression as soon as possible to one of four given emotion categories (angry, contempt, disgust, or happy). While no group differences were found for emotion onset perception or decoding performance, the results suggest an interpretation bias in HSA. Under the RVT condition, HSA demonstrated a threat bias (disgust interpreted as contempt), contrasting the NAC's positive bias (disgust interpreted as happy). No group differences were found in the FVT. We suggest that socially anxious individuals tend to misinterpret facial expressions as threatening when they must do so quickly and efficiently, as in real life.

1. Introduction

Social Phobia (Social Anxiety Disorder, SAD) is a common and debilitating disorder characterized by marked and persistent fear of one or more social and performance situations in which the person is exposed to unfamiliar people or to possible scrutiny by others (American Psychiatric Association, 2000). The anxiety of being judged and evaluated negatively causes considerable distress and impairment in everyday life.

There is growing evidence linking social anxiety to biases in cognitive processes. From a cognitive perspective, Clark and Wells (1995) suggest that social phobia is characterized by negatively biased processing of social situations. In particular, socially anxious individuals tend to interpret ambiguous responses as signs of disapproval. To date, studies exploring these threat-related interpretation biases have relied heavily on questionnaires or experimental tasks containing verbal stimuli (for a review, see Heinrichs & Hofmann, 2001). Such stimuli can be rather weak and have an indirect relationship with real-life situations. For instance, a threatening face, staring directly at you, is a direct sign of hostility, whereas a threat-related word is an arbitrary symbol. Therefore, these potential limitations of verbal stimuli point to the need to corroborate earlier results by using other types of stimuli such as emotional facial expressions. Such stimuli are naturalistic, ecologically valid and directly salient.

Recognizing emotions from facial expressions is of special importance in processing socially relevant information. Facial expressions typically contain cues of different emotion categories and are therefore intrinsically ambiguous (Matsumoto, Keltner, Shiota, Frank, & O'Sullivan, 2008). This ambiguity is prone to be misinterpreted as it leaves room for the socially anxious' tendency to interpret social responses as signs of disapproval (Clark, 2001). As a consequence, emotional facial expressions have been the focus of recent research on interpretation biases in social anxiety (Mullins & Duke, 2004; Philippot & Douilliez, 2005; Schofield, Coles, & Gibb, 2007). Interestingly, studies so far have failed to consistently demonstrate interpretation biases for facial images, although they are strongly supported by theory.

To gain a better understanding of why there is such a discrepancy between theory and research, it is worthwhile to look at methodological aspects in greater detail. Specifically, stimuli and task characteristics deserve further investigation. Studies originally used static images of prototypical facial expressions of certain emotions, some of them with different degrees of intensity

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(Philippot & Douilliez, 2005; Schofield et al., 2007). In contrast, everyday social life is characterized by high informational complexity. Dynamic facial signals require immediate behavioral responses. The ability to decode emotions in a very short time while interacting and responding in an appropriate way is essential for adequate social behavior. Moreover, during social interaction, expressions are constantly changing. Static facial expressions, even if they are of low intensity, may not suffice to measure on-line processing. In sum, paradigms that mimic real-life contexts need to be improved. One suggestion is therefore to implement a task that presents sequences of emotions in change (dynamic facial expressions) under limited viewing capacity.

To this end, Niedenthal, Halberstadt, Margolis, and Innes-Kerr (2000) developed the "morphed faces task." Morphing typically means generating continuous, physically linear changes between two faces and is inspired by the seminal work of Young et al. (1997) who first differentiated between categorical and dimensional perception of facial expressions. For their initial study, Niedenthal et al. (2000) produced computerized 100-image movies of emotional expressions (happy or sad), each changing into a neutral face. Participants in an induced happy, sad, or neutral mood played the movies and indicated the image from which the emotion disappeared. The results showed that over the course of the movie, emotion–congruent expressions were subjectively perceived to disappear later than emotion–incongruent expressions. In a subsequent study, the authors successfully replicated emotion congruency effects (Niedenthal, Brauer, Halberstadt, & Innes-Ker, 2001).

Joormann and Gotlib (2006) were the first to adopt the "morphed faces task" to assess identification biases in depression and social phobia. In contrast to Niedenthal et al. (2000), the authors were interested in emotion onset perception. Therefore, pictures showing neutral faces were morphed into fully emotive expressions of anger, sadness, fear, or happiness. Participants viewed the morph movies and were instructed to stop them as soon as they could recognize the developing emotion. Interestingly, socially phobic participants required less emotional intensity to identify angry faces than control participants did, while their identifications were just as correct. An equivalent result was found for depressed participants who identified sad expressions particularly quickly. Given Joormann and Gotlib's (2006) success in using a morphing paradigm to show differences in the identification of anger expressions, it seems promising to use the task with other socially threatening expressions.

Despite Joormann and Gotlib's evidence for differences in emotion decoding *speed*, the available studies suggest that there are no differences in decoding *accuracy* between socially anxious and non-anxious controls. This has been demonstrated with adult participants for static faces without (Mullins & Duke, 2004) and with graded intensity (Philippot & Douilliez, 2005; Schofield et al., 2007), as well as for morphed facial expressions (Joormann & Gotlib, 2006). Therefore, most authors assert that there are no interpretation biases of facial expressions evident in social anxiety (Philippot & Douilliez, 2005). In these studies, interpretation biases were equated with group differences in decoding accuracy. The specific nature of the misinterpretations that participants made were not addressed, although these might be especially informative. If emotions are mistakenly perceived, which ones are they? Which real emotions are likely to be misinterpreted as which other emotions? Do socially anxious individuals tend towards threatening misinterpretations, while the misinterpretations of non-anxious individuals tend to be positive?

The current study was designed to address these questions and extend the existing findings. A group of high socially anxious (HSA) individuals was compared to a non-anxious control (NAC) group. In order to improve ecological validity, we employed a modified "morphed faces task" (Joormann & Gotlib, 2006; Niedenthal et al., 2000). The morphing technique provides an effective way to present faces that change gradually and regularly from one emotion to another (Young et al., 1997). For the present study, we created interpolated (morphed) movies depicting a neutral face which gradually changed into an angry, happy, or disgusted expression. The participants' task was to identify the evolving emotion at its onset by stopping the movie and subsequently categorizing the emotion. Disgust expressions were included because they are related to interpersonal/socio-moral processes (Rozin, Haidt, & McCauley, 2000) and HSA evaluate them even more negatively than angry faces (Amir et al., 2005). Moreover, there is evidence that in social phobics, the visual processing of disgust expressions causes an increased activation of the anterior cingulate cortex, an area that is involved in emotional evaluations (Amir et al., 2005).

The present study took advantage of the ambiguity inherent in emotional facial expressions (Matsumoto et al., 2008), especially in expressions with low emotional intensity as generated by the morphing technique. Contempt was chosen as an additional response category – although there were no contempt expressions shown-because it is strongly associated with social rejection (Philippot & Douilliez, 2005), thereby addressing the main fear of socially anxious individuals. This resulted in three different types of emotional faces (anger, happy, disgust), but four different interpretation categories (anger, happy, disgust, contempt). This way, the probability of misinterpretations was increased, which allowed us to study the nature of these misinterpretations more easily. Given the results of previous studies, we did not expect a substantial difference between HSA and NAC with respect to decoding accuracy, that is, in the overall number of misinterpretations. However, we expected a difference in the type of misinterpretations being made: The HSA's misinterpretations should be threatening more frequently, while the NAC's misinterpretations should be positive more frequently.

Our second objective concerned the conditions under which interpretation biases appear. Since emotion decoding is assumed to take place at different stages of processing (Williams, Watts, MacLeod, & Mathews, 1997), we implemented the morphing task under two experimental conditions: a time-pressured Restricted Viewing Task (RVT) and a Free Viewing Task (FVT) with unlimited viewing time. These two conditions were meant to address fast and more spontaneous processes (RVT) versus slower and more strategic processes (FVT) involved in emotion detection. For both theoretical (see Williams et al., 1997) and empirical (see Joormann & Gotlib, 2006) reasons, we expected the differences between HSA and NAC to be more pronounced in the RVT than the FVT. This should be the case because the RVT – unlike the FVT – does not allow for an extensive decision process and a correctness check of the first impression.

In addition to decoding accuracy and interpretation biases, the present study addressed emotion onset perception, which refers to the moment at which participants subjectively decide that an emotion is perceivable. In case of the RVT, the emotion onset perception measure is identical to the participant's reaction time because the trial ends as soon as the participant indicates the perceived onset of the emotion. This measure allows us to identify possible speed-accuracy tradeoff patterns, which is important because emotion onsets perceived earlier might be associated with higher error rates. To relate our results to Joormann and Gotlib's (2006) "required emotional intensity", we also analyzed emotion onset perception separately for correctly identified emotions. Following their results, we expected that HAS should perceive anger earlier than NAC, without making more mistakes.