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Angry-happy interpretations of ambiguous faces in social anxiety disorder



Keren Maoz ^{a,*}, Sharon Eldar ^a, Joel Stoddard ^b, Daniel S. Pine ^c, Ellen Leibenluft ^b, Yair Bar-Haim ^{a,d}

^a School of Psychological Sciences, Tel Aviv University, Ramat Aviv, Tel Aviv 69987, Israel

^b Section on Bipolar Spectrum Disorders, Emotion and Development Branch, National Institute of Mental Health, National Institutes of Health, Department of Health and Human Services, Bethesda, MD, USA

^c Section on Development and Affective Neuroscience, Emotion and Development Branch, National Institute of Mental Health, National Institutes of Health, Department of Health and Human Services, Bethesda, MD, USA

^d The Sagol School of Neuroscience, Tel Aviv University, Tel Aviv, Israel

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ABSTRACT

Social Anxiety Disorder (SAD) is characterized by a tendency to interpret ambiguous social cues as negative. Here we tested whether interpretation of ambiguous faces differs between participants with SAD and non-anxious controls. Twenty-seven individuals with SAD and 21 non-anxious control participants completed an emotion recognition task in which they judged ambiguous morphed faces as happy or angry. Participants with SAD judged a higher proportion of the faces as angry compared to non-anxious participants, and were slower to judge faces as angry compared to happy, while no such reaction time bias manifested in the control group. Finally, happy judgments were slower in the SAD group compared to the control group, while angry judgments were faster in the SAD group compared to the control group. These findings provide evidence for a negative bias in resolving emotional ambiguity in facial expressions among individuals with SAD.

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1. Introduction

Cognitive models suggest that social anxiety disorder (SAD) is associated with cognitive biases that promote and maintain this condition, including a tendency to interpret ambiguous social cues as negative (Clark, 2001; Clark and Wells, 1995; Rapee and Heimberg, 1997). Experimental studies have also demonstrated a causal association between negative interpretation bias and anxiety reactivity (Mathews and Mackintosh, 2000; Wilson et al., 2006). Research in interpretation biases in social anxiety can be broadly divided into two lines of studies. The first includes studies on interpretation of socially relevant verbal stimuli, such as descriptions of ambiguous social scenarios (e.g., Amir et al., 1998b; Huppert et al., 2003; Muris et al., 2000; Stopa and Clark, 2000; Voncken et al., 2003), or ambiguous sentences with social content (Beard and Amir, 2009; Huppert et al., 2007). In socially anxious vs. non-anxious participants, these studies generally find a bias towards negative interpretation of ambiguous, socially relevant information. The second line of studies focuses on biased interpretation of facial expressions of emotion. Processing facial

expressions of emotion is central to understanding and evaluating social situations, and is thought to be biased in individuals with SAD who are typically preoccupied with others' evaluation or scrutiny. Negative interpretations of ambiguous facial expressions may result in a tendency to see others as more criticizing, threatening, or hostile, which may contribute to elevated anxiety in social situations.

Recently, studies have begun to use computerized morphing procedures to generate systematic ambiguity in facial expressions and examine biases in emotion identification and classification among socially anxious individuals. Some studies have used sequences ranging from a neutral expression to an emotional expression, examining individual differences in the level of intensity needed to identify an emotion. This work has generated mixed results, with some studies finding a negativity bias in socially anxious vs. non-anxious participants (Gilboa-Schechtman et al., 2008; Heuer et al., 2010; Joormann and Gotlib, 2006; Yoon et al., 2014), while others fail to find this pattern (Philippot and Douilliez, 2005). Since these studies use face stimuli that vary in their emotional intensity (e.g., 50% anger vs. 20% anger), the results may reflect a general sensitivity to emotional cues, rather than interpretative biases (Jusyte and Schönberg, 2014). It has been

* Corresponding author.

suggested that ambiguous faces that contain conflicting information (e.g., morphing an angry and a happy expression), may be more effective in eliciting an interpretation bias because they create a conflict in the classification of ambiguous expressions. This method has been utilized by a smaller number of studies (e.g., Garner et al., 2009; Jusyte and Schönenberg, 2014; Reeb-Sutherland et al., 2015; Richards et al., 2002) and again, the results are mixed. In socially anxious vs. non-anxious participants, two studies found enhanced interpretation of fear (Reeb-Sutherland et al., 2015; Richards et al., 2002); one study found lower sensitivity for fear (Garner et al., 2009); and one study found no between-group difference (Jusyte and Schönenberg, 2014).

Surprisingly, none of these studies found interpretation biases related to anger among socially anxious participants compared to non-anxious participants. Of note anger is the emotion most directly associated with social threat and in SAD samples, angry faces induce attention biases (Gilboa-Schechtman et al., 1999; Mogg et al., 2004), identification sensitivity differences (Joormann and Gotlib, 2006), and enhanced amygdala activation (Stein et al., 2002). Accordingly, it is expected that anger expressions would play an important role in cognitive processes related to SAD. Two previous studies that compared non-clinical samples of individuals with high and low social anxiety found less positive interpretation in the high-anxiety group of schematic or composite expressions that combined happy-angry conflicting information (i.e., a smiling mouth with angry eyes) (Coles et al., 2008; Gutiérrez-García and Calvo, 2014). The current study tests for the presence of negative interpretation bias in clinical SAD patients compared to non-anxious participants. We specifically focused on the interpretation of anger in ambiguous faces containing conflicting information in the form of happy-angry morphed faces.

Two previous studies have examined interpretation of angry-happy morphed faces in clinical SAD samples (Garner et al., 2009; Jusyte and Schönenberg, 2014) and found no difference in interpretation patterns of angry-happy morphed faces between SAD and non-anxious control participants. The failure of these two studies to find SAD-related differences in the interpretation of angry-happy morphed faces may be related to their applied methodology. Specifically, in both studies participants were requested to rate the intensity of the emotion perceived following each morphed face presentation. Evaluating facial emotion on an intensity scale may have required participants to engage in a more thoughtful process of evaluation compared with the more basic and simple process of distinguishing between angry and happy faces. Thus, in the current study we used a simple two forced choice task with brief presentations in order to encourage basic interpretation processes rather than higher level intensity evaluation processes. Moreover, Jusyte and Schönenberg (2014) used happy endpoints that consisted of open mouth smiles but angry endpoints that consisted of closed mouth expressions. According to these authors, this difference may have resulted in biased judgment due to the different pattern of teeth exposure. They suggest that one way to avoid artifacts in happy/angry morphs would be to choose models that display both happy and angry expressions with visible teeth. In the current study we followed this rationale selecting both the happy and angry endpoints of the morphed sequences to have open mouths.

Notably, most of the existing clinical studies quantified interpretation biases based on participants' response types, such as the number of negative responses (Jusyte and Schönenberg, 2014), emotional intensity ratings (Jusyte and Schönenberg, 2014; Philippot and Douilliez, 2005), emotional intensity for correct identification (Joormann and Gotlib, 2006), accuracy rates (Philippot and Douilliez, 2005), or signal-detection based indices (Garner et al., 2009). Another aspect of biased interpretation processing may be reflected in the speed of interpretation. Specifically, if

negative interpretations are more accessible to the anxious individual's mind (Amir et al., 1998a, 1998b; Stopa and Clark, 2000), then negative interpretations will be carried out faster than positive or neutral interpretations. This pattern has been demonstrated with non-clinical high vs. low socially anxious individuals (Gutiérrez-García and Calvo, 2014). Here, in addition to measuring the percent of negative interpretations in participants with SAD and non-anxious controls, we also tested the speed of negative vs. positive interpretations.

The identification of biased interpretation of negative stimuli in SAD has inspired clinical translational attempts targeting bias modification. So far these translational attempts have relied on verbal descriptions of social scenarios or sentences, with several studies demonstrating that promoting benign or positive interpretations (e.g., with feedback or repeated exposure to positive or benign resolutions of ambiguity) is associated with reduced anxiety levels (e.g., Amir and Taylor, 2012; Beard and Amir, 2008; Murphy et al., 2007). To our knowledge no SAD intervention study targeted biased interpretation of facial expressions. The first step toward such translation is to demonstrate a measurable interpretation bias in SAD using a task that can later be used for modification of this specific bias. The aim of the current study was to document an interpretation bias in socially anxious individuals (compared to control participants) using a paradigm appropriate for future CBM intervention. We thus used a variant of a task that has been applied to modify biased interpretation of angry faces in the context of aggressive behavior and mood disturbances (Penton-Voak et al., 2013; Stoddard et al., 2016). In these studies, participants first completed a measurement task in which they judged whether morphed faces were happy or angry. The second phase included cognitive training in which participants received systematic feedback after each response, designed to shift their judgements toward more positive interpretation of the ambiguous morphed faces. Here we used a similar measurement task to examine whether individuals with SAD show biased interpretation of morphed faces compared to controls. We reasoned that, if SAD-related individual differences emerged on this measurement task, future translation toward an interpretation bias modification protocol would be facilitated, given the success of previous studies in modifying this specific bias using systematic feedback.

In sum, we tested whether participants with SAD demonstrate interpretation biases when identifying the emotional content of ambiguous facial stimuli. We used a task similar to that in cognitive bias modification (CBM) studies (Penton-Voak et al., 2013; Stoddard et al., 2016). Specifically, we used a two forced-choice emotion recognition task, with brief presentations of morphed pictures created by blending angry and happy expressions of the same individuals. Two hypotheses were examined. First, we expected participants with SAD to interpret a higher proportion of the faces as angry, relative to non-anxious control participants. Second, we expected participants with SAD to make angry interpretations faster than happy interpretations. This reaction time (RT) bias was not expected in the non-anxious control group.

2. Method

2.1. Participants

The SAD group consisted of 27 participants (mean age=28.4 years, SD=6.8; 14 females). These participants were recruited from the community as part of an ongoing anxiety treatment program run at the University. Free treatment as part of efficacy research is offered and participants agreed to complete our task at baseline before treatment. This procedure was approved by the Institutional Review Board and data are protected through a

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