Impaired recognition of emotion in facial expressions following bilateral damage to the human amygdala

R. Adolphs*, B. Tranel*, N. Damasio* and A. Damasio*

*Department of Neurology, Division of Cognitive Neurosciences, University of Iowa College of Medicine, Iowa City, Iowa 52242, USA
†The Salk Institute for Biological Studies, La Jolla, California 92037, USA

Sustains in animals have shown that the amygdala receives highly processed visual input," contains neurons that respond selectively to faces, and that it participates in emotion" and social interaction." These results, along with the behavioral effects of lesions in the amygdala, demonstrate that the amygdala's function in humans has been damaged by the study of patients with selective amygdala lesions. Here, with the help of one such case patient, we report findings that suggest the human amygdala may be indispensable for (1) recognition of facial expressions, (2) recognition of multiple emotions in a single facial expression, and (3) the recognition of persons in faces. These results suggest that damage restricted to the amygdala causes very specific recognition impairments, and thus constrains the broad notion that the amygdala is involved in emotion.

We studied subject S.M., a 39-year-old woman with normal IQ (measured), a Wechsler Adult Intelligence Scale-Revised (WAIS-R) full scale IQ of 100, a high school education, and a neuro-psychological profile remarkable for a history of defective personal relationships. The patient's medical history revealed that she had a history of recurrent depression and bipolar disorder. On the Beck Depression Inventory, Mini-Mental State Examination, and the Brief Psychiatric Rating Scale, S.M. scored in the normal range (7). The patient's behavior was notable for emotional lability and irritability, with no evidence of depression on either observation or formal assessment. Her visual-perceptual discrimination, assessed using the Benton object discrimination task, was normal (9). S.M. exhibited a marked inability to recognize emotion and faces, which were normal. The patient's ability to recognize emotion and faces was normal.
The human face conveys information about a person's identity, expression, emotion, and often social and emotional status, as revealed by detailed neuroanatomical analysis of her computed tomography (CT) and magnetic resonance imaging (MRI) scans (Fig. 1).

Fox et al. have shown that the representation of an emotion, as judged by typical expressions of that emotion, rating scales, or the emotional word for which the face was a prototype, can be classified into one of two categories: an emotion category. Data from 52 brain-damaged subjects (48 males and 4 females) with normal controls were used. The results were compared with S.M.'s, and no significant differences were found. Most human beings are able to express emotions, and the ratings given by brain-damaged subjects (+0.1) compared with the ratings given by normal controls (+0.2) were correlated with the ratings given by brain-damaged controls (+0.2) and with S.M.'s (+0.4). All normal controls rated themselves with a score of 0.1 or 0.2 for every emotion category.

The results were compared with those from the studies of facial expression in monkeys, which indicates that the facial expression is the same as in humans. However, the monkeys were not tested for their ability to recognize other emotions, and the results from the experiments were interpreted as showing that the facial expression is the same as in humans.

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of emotional faces with a multiaimensional scaling (MDS) technique, a technique for perceived similarity among expressions commonly used to illustrate perceptual continua, derived a two-dimensional representation of emotion (Fig. 3). For example, surprised and happy faces are rated similarly, and both are distinct from angry and sad faces. This is shown in the MDS plot of our controls (Fig. 7), which is similar to what has been published for normal subjects. For judgments of emotional facial expression, this three-dimensional model of emotion is sufficient for checking and testing the results of the MDS model. This suggests that a single emotional expression is represented by a single vector in a multi-dimensional space. The results of this study are consistent with the hypothesis that emotional expressions are represented by a single vector in a multi-dimensional space. The results of this study are consistent with the hypothesis that emotional expressions are represented by a single vector in a multi-dimensional space.

Does S.M. fail to recognize similarities between expressions of different emotions? In the MDS model, S.M. is unable to recognize similarities between expressions of different emotions. In the MDS model, S.M. is unable to recognize similarities between expressions of different emotions. In the MDS model, S.M. is unable to recognize similarities between expressions of different emotions. In the MDS model, S.M. is unable to recognize similarities between expressions of different emotions. In the MDS model, S.M. is unable to recognize similarities between expressions of different emotions. In the MDS model, S.M. is unable to recognize similarities between expressions of different emotions. In the MDS model, S.M. is unable to recognize similarities between expressions of different emotions. In the MDS model, S.M. is unable to recognize similarities between expressions of different emotions. In the MDS model, S.M. is unable to recognize similarities between expressions of different emotions. In the MDS model, S.M. is unable to recognize similarities between expressions of different emotions. In the MDS model, S.M. is unable to recognize similarities between expressions of different emotions. In the MDS model, S.M. is unable to recognize similarities between expressions of different emotions. In the MDS model, S.M. is unable to recognize similarities between expressions of different emotions. In the MDS model, S.M. is unable to recognize similarities between expressions of different emotions. In the MDS model, S.M. is unable to recognize similarities between expressions of different emotions. In the MDS model, S.M. is unable to recognize similarities between expressions of different emotions. In the MDS model, S.M. is unable to recognize similarities between expressions of different emotions. In the MDS model, S.M. is unable to recognize similarities between expressions of different emotions. In the MDS model, S.M. is unable to recognize similarities between expressions of different emotions. In the MDS model, S.M. is unable to recognize similarities between expressions of different emotions. In the MDS model, S.M. is unable to recognize similarities between expressions of different emotions. In the MDS model, S.M. is unable to recognize similarities between expressions of different emotions. In the MDS model, S.M. is unable to recognize similarities between expressions of different emotions. In the MDS model, S.M. is unable to recognize similarities between expressions of different emotions. In the MDS model, S.M. is unable to recognize similarities between expressions of different emotions. In the MDS model, S.M. is unable to recognize similarities between expressions of different emotions. In the MDS model, S.M. is unable to recognize similarities between expressions of different emotions. In the MDS model, S.M. is unable to recognize similarities between expressions of different emotions. In the MDS model, S.M. is unable to recognize similarities between expressions of different emotions. In the MDS model, S.M. is unable to recognize similarities between expressions of different emotions. In the MDS model, S.M. is unable to recognize similarities between expressions of different emotions. In the MDS model, S.M. is unable to recognize similarities between expressions of different emotions.

From our results, the amygdala appears necessary both to recognize the basic emotions from facial expressions, and to recognize many of the blander emotions that the human face can signal. The amygdala may be an important component of the neural networks underlying social cognition in part because it guides recognition of emotional expressions by faces is essential for successful behavior in a complex social environment.

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