Anger and Disgust:

Discrete or Overlapping Categories?

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Abstract

Preschoolers and members of pre-literate societies confuse facial expressions of anger and disgust, despite distinct differences in facial features. Although adult English-speakers' (N = 75) free labeling performance for anger and disgust expressions was high, there was evidence that these two categories were overlapping: In two identification tasks, almost half of participants included the 'disgust' faces in the anger category, and a quarter included the 'anger' faces in the disgust category. This finding questions the discreteness of anger and disgust emotion categories.

The study of emotion has a strong tradition of viewing facial expressions as discrete signals of discrete emotions – fear, anger, disgust, etc. (Ekman, 1994; Izard, 1994) – each produced by a separate brain program (e.g., Damasio, 1994). This research tradition has been called the 'Facial Expression Paradigm' (Russell & Fernandez-Dols, 1997).

Research conducted within the Facial Expression Paradigm has asked participants to label the emotion conveyed by various faces. For example, participants might be asked to pick one label from a set of three. Results were typically dichotomized as either correct or "errors" or "confusions." This method and its scoring presupposes that the emotion categories are mutually exclusive. Ideal support for the paradigm's assumptions would be a one-to-one correspondence between label and face (100% correct), with no "errors." Of course, due to random chance alone, some errors would be expected. Performance near ceiling levels was consistently found, and interpreted as strong support for the assumptions that facial expressions signal discrete emotions, and that people's emotion categories are mutually exclusive.

Although English-speaking adults' free labeling performance is high, systematic errors have been reported in two groups: Children and members of illiterate societies have been reported to show more overlap in their emotion categories. For example, Ekman and Friesen (1971) found that the Fore people of Papua New Guinea 'confused' the anger and disgust faces. Preschoolers in North America have been found to do likewise (Widen & Russell, 2003).

From the theoretical assumptions of the Facial Expression Paradigm, overlap between anger and disgust is curious, as the two facial expressions are dissimilar. Anger (Figure 1) and disgust (Figure 2) do not share any muscle movements according to the

Figure 1. 'Angry'

Facial Action Coding System (Ekman & Friesen, 1978). Furthermore, the two facial signals presumably evolved to convey qualitatively different messages (e.g., Fridlund, 1994): The anger face signals threat; whereas the disgust face signals distaste.

In this study we question whether the emotion categories of anger and disgust are mutually exclusive. Perhaps, the overlap seen in preschool children and in Fore adults reveals the overlapping nature of these two categories. Alternatively, perhaps preschool children are insufficiently skilled in language, and the Fore might have a culture-specific way of thinking of emotion. We therefore asked if educated, American adult native-English speakers treat these two facial expressions as mutually exclusive or as overlapping. The conventional method, of participants picking one label from a set, maximizes the chance of a one-to-one correspondence. Here, we asked participants to free label facial expressions instead, and we provided two additional tasks that allow more opportunity for expression of category overlap.

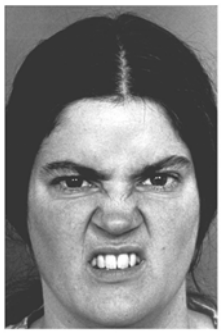

Figure 2. 'Disgust'

Method

Participants

Participants were 75 Boston College students.

Materials

There were five sets of 6 prototypical facial expressions of emotion (happiness, sadness, anger, fear, surprise, disgust), from Ekman and Friesen (1976). There were also three sets of 4 prototypical facial expressions (happiness, disgust, anger, fear), from Hess (cite).

Procedure

The study had three phases.

Phase 1: Free labeling. Participants were asked to free label two sets of six facial expressions (happiness, sadness, anger, fear, surprise, disgust). Figures 1 and 2 show the anger and disgust faces, respectively, used in the free labeling task. Free labeling was always presented first so that participants labeling was a reflection of their spontaneous interpretation of the facial expressions. Phases 2 and 3 were presented in counter-balanced order.

Phase 2: Yes/No task. Participants responded to each of the four facial expressions (happy, disgust anger, fear) in a set individually. For each face in that set, they answered the same question. Thus, on one trial, for all four pictures, the question was, "Is this person disgusted?" On another trial, "Is this person angry?" And on the other trial, "Is this person happy?" Trials were presented in different random orders.

Phase 3: Choice-from-Array task. On each of three trials (angry, disgust, happy), participants were presented with a different array of six facial expressions (happiness, sadness, disgust, anger, fear, surprise). Participants were instructed to, "Read the question at the top of the page (e.g., "Who feels angry?"). Then put a '1' in the circle for the face that best expressed that emotion. If there is another face that expresses that emotion, put a '2' in the circle for that face. And so on, if there are other faces that express the emotion, in order from best to worst. Do not put numbers in the circles of the faces that do not express that emotion." Thus, participants could potentially include one to all six faces in each category. Trials were presented in different random orders.

Results

Free Labeling

On the free labeling task, 100% of participants labeled at least one of the two anger expressions as *angry* (means for the individual anger faces were .96 and .84), and 92.0% labeled at least one of the disgust faces as *disgusted* (means for the individual disgust faces were .70 and .81). These results replicate prior free labeling results for facial expressions of anger and disgust: Participants can recognize and label them at near ceiling levels of performance.

Are the Anger and Disgust Categories Mutually Exclusive or Overlapping?

Yes/No task. When asked, "Is this person angry?," 94.6% of participants said 'yes' for the 'anger' face, and 41.3% also said 'yes' to the 'disgust' face; some participants even said 'yes' to the fear (9.3%) and happiness (2.6%) faces (Figure 3). The proportion who included the 'disgust' face in the anger category was significantly higher ($p < .001$) than the proportion expected by chance (estimated as the mean of the other two faces for this trial = .06).

Figure 3. Participants said 'yes' to the 'anger' faces and half of the 'disgust' faces on the Yes/No task.

When asked, "Is this person disgusted?," 92.0% of participants said 'yes' to the 'disgust' face, and 26.7% also said 'yes' to the 'anger' face; few said 'yes' to the fear (6.7%) or happiness (4.0%) faces (Figure 4). The proportion who included the anger face in the disgust category was significantly higher ($p < .001$) than the proportion expected by chance (mean of the other two faces = .06).

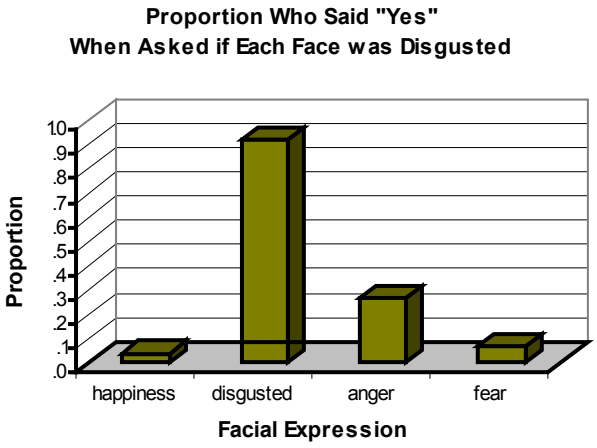

Figure 4. Participants said 'yes' to the 'disgust' faces and a quarter of the 'anger' faces on the Yes/No task.

When asked, "Is this person happy?," 92.0% said 'yes' to the happiness face, 9.3% said 'yes' to the angry face, and no one said 'yes' to the fear or disgust face.

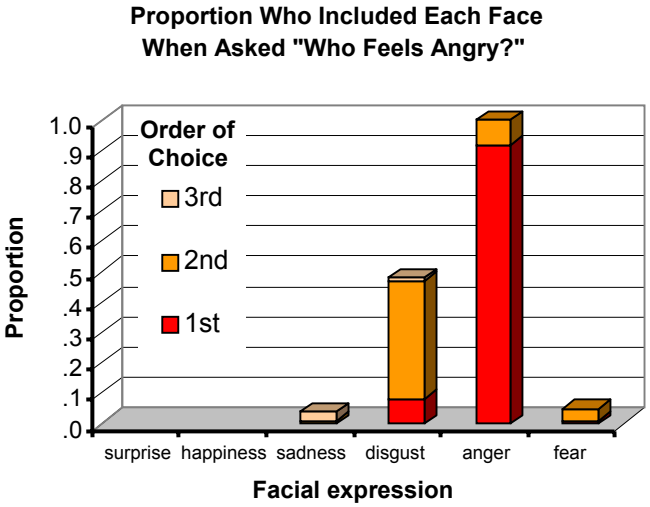

Figure 5. Participants included 'anger' and half of the 'disgust' faces on the Choice from Array task.

Choice-from-Array task. When asked to select all angry people from an array of six, 100% chose the 'anger' face; 92.0% of them chose it first, and the remaining 8.0% chose it second (Figure 5). But, 48.0% also chose the disgust face; of these, 16.7% chose it first, 80.5% second, and 2.8% third. Few chose the remaining faces (range = 1.3% to 6.7%, mean = .03). The proportion who chose the 'disgust' face as an exemplar of anger was significantly higher ($p < .001$) than the proportion expected by chance (mean of the other four faces = .03).

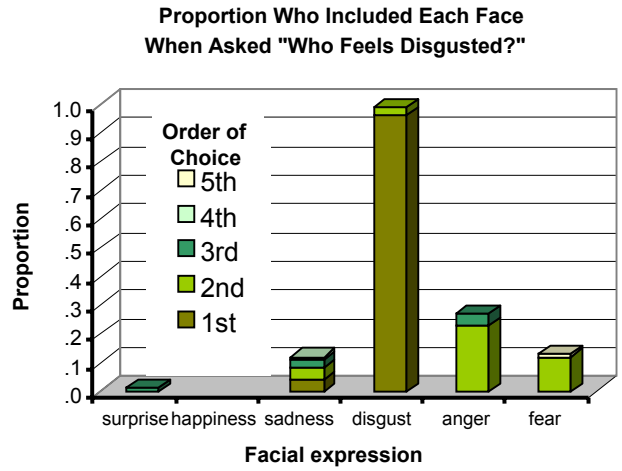

Figure 5. Participants included 'disgust' and a quarter of the 'anger' faces on the Choice from Array task.

When asked to select all disgusted people from an array of six, 98.6% chose the 'disgust' face; of these, 97.3% chose it first, and the remaining 2.7% chose it second (Figure 6). 26.7% also chose the anger face; of these, 85.0% chose it second, and 15.0% third. 13.3% also chose the fear face, and 12.0% chose the sadness face. Few chose the happiness (1.3%) or surprise (1.3%) faces. The proportion who chose the anger face as an exemplar of disgust was significantly higher ($p = .001$) than the proportion expected by chance (mean of the other four faces = .08).

When asked to select all happy people from an array of six, 100.0% chose the happiness face; 100.0% chose it first. 1.3% chose the surprise face, and no one chose the sadness, anger, fear or disgust faces.

Do Anger and Disgust Overlap?

Adults' categories of anger and disgust are overlapping: In the Yes/No task, many agreed that the person with a disgust face was angry and that the person with an angry face was disgusted. In the Choice-from-Array task, when selecting angry people, many included the disgust face, and when selecting disgusted persons, included the angry face.

Are Anger and Disgust Equal in Width?

Overall, fewer "erroneous" faces were placed in the disgust category than in the anger category, but a greater *variety* of faces was placed in the disgust than in the anger category. On both the Yes/No and the Choice-from-Array tasks, participants included more 'disgust' faces in the anger category (Figures 3 and 5) than they included 'anger' faces in the disgust categories (Figures 4 and 6). In addition, on the Choice-from-Array task, participants included only 'anger' and 'disgust' faces in the anger category: The anger category more consistently included 'disgust' faces (48%), but was narrow – it only "erroneously" included disgust faces (Figure 5). On the same task, participants included 'disgust,' 'anger,' 'fear,' and 'sadness' faces in the disgust category: The disgust category was broader, including many different faces, than the anger category (Figure 6). 'Disgust' faces are more consistently categorized as 'angry,' while other faces are clearly excluded, implying that the prototypical 'disgust' face may be seen as a subtype of anger by some participants. When provided with the label of 'disgust,' 'anger' faces were included less often, but the boundaries of the category are fuzzier, including 'sad' and 'fear' faces more often, implying the definition of the disgust category is less discrete than anger. Thus, adults' anger and disgust categories are overlapping but nonetheless different.

Discussion

When someone perceives anger in another's face, what does that face look like? Theorizing and research in psychology would lead us to believe that the face looks like Figure 1 (prototypical anger face). We found that when given the opportunity, almost half

of the educated, adult native English speakers also perceived anger in a face that looks both quantitatively and qualitatively different, Figure 2 (prototypical disgust face). In parallel, when someone perceives disgust in another's face, theory and research predicts that it would look like Figure 2. However, we found that around a quarter of our participants also included a face that looks like Figure 1 in the disgust category.

These results suggest that the process of "recognizing" anger or disgust in another's face is not the simple detection of a discrete signal. Anger and disgust categories are overlapping: Participants include disgust faces in the anger category, and anger faces in the disgust category. The categories are neither discrete nor mutually exclusive. These "errors" are systematic and reliable. Future research might usefully explore whether other emotion categories overlap in a similar way.

The clear overlap of anger and disgust categories found here implies that not only children and illiterate participants but also university-educated, English-speaking adults interpret at least some emotions and facial expressions loosely and in a nondiscrete manner. Discreteneses implies mutual exclusivity, that one expression communicates one and only one emotion. Our findings demonstrate that educated adults will categorize both anger and disgust faces as either angry and/or disgusted. Emotion categories are 'fuzzy' and overlapping, providing a flexible system of interpretation, allowing an observer to consider other cues in the environment before labeling an emotional expression. Further research is required to establish whether anger and disgust categories also overlap for other aspects, such as causes and consequences or if only facial expressions provide interpretive leeway.

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