Children’s Understanding of Anger and Disgust: ‘Confusions’ or Overlapping Categories?
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Abstract

Compared to children who don’t use ‘disgusted’ on a labeling task, do those who do better understand of the difference between anger and disgust? Children (N=144; 3 to 7 years) labeled facial expressions, and did two categorization tasks. Children who used ‘disgusted’ on the labeling task were better able to exclude the disgust faces from the anger categories on both the categorization tasks. But using disgusted had little effect on children’s disgust category. Children’s anger and disgust categories are overlapping. This overlap is due to these emotions’ similarity on the dimensions of pleasure and arousal rather than some random error pattern.

Introduction

On emotion tasks, preschoolers frequently select the anger face as disgusted and the disgust face as angry.

- e.g. Preschoolers (3 to 5 years) were asked to choose three facial expressions from an array of nine different facial expressions (Bullock & Russell, 1984, 1985).
  - For angry, one third of the children chose the disgust face first.
- Children were read brief emotion stories which included the emotion label, and were asked to choose the protagonist’s facial expression from an array of six facial expressions (Gosselin & Laroque, 2000).
  - Five-year-olds frequently chose the disgust face for angry and the angry face for disgusted.
- On a free labeling task, when preschoolers labeled a disgust facial expression, they labeled it angry far more frequently than they label it disgusted (Widen & Russell, 2003, 2006).

The question is, how to interpret this response pattern?

- On one perspective, this response pattern has been coined ‘confusions’ between hypothesized universally recognized facial expressions of emotion.
- The assumption of the ‘confusions’ interpretation is that participants’ underlying emotion categories are discrete (e.g., Ekman, 1994; Izard, 1994).
  - But confusions between anger and disgust facial expressions (see Figure 1) are curious if assumptions about their universal nature are accepted.
  - Universality carries with it evolutionary implications: Presumably, each facial expression evolved for different reasons and should therefore communicate different information (e.g., Fridlund, 1994).
Anger is an interpersonal emotion, its function is to regain control of a situation and its action tendency is to attack or threaten (Frijda, 1986); its facial expression communicates aggression and a warning to steer clear (Fridlund, 1994).

Disgust, on the other hand, relates primarily to food: its function is protection and its action tendency is rejection (Frijda, 1986); its facial expression communicates smelling something distasteful or expelling something that tastes bad from one’s mouth.

Thus, in their origins, there is no evidence of overlap in the communicative intent of the anger and disgust expressions.

In addition, the FACS coding (Ekman & Friesen, 1978) of the anger and disgust facial expressions indicates that they do not share anything but incidental action units (e.g., both may have an open mouth).

We suggest an alternative view to explain this pattern of responses: These responses represent genuine, accurate interpretations of the anger and disgust facial expressions based on the underlying dimensions of pleasure and arousal.

These two broad dimensions are the basis of adults’ emotion judgments (e.g., Russell, 1980; 2003) and provide the basis of children's earliest conceptual system for emotion (e.g., Russell & Bullock, 1986a, 1986b).

Similarity on these two dimensions allow emotions to be arrayed in a circular structure in the two-dimensional geometric pleasure-arousal space (Figure 2) (Russell, 1980).

According to this circumplex model, errors are more likely to fall to those emotional facial expressions that are adjacent to the target emotion, and least likely to fall to those emotions opposite the target.

Disgust and anger are adjacent in this model, and thus have similar levels of pleasure and arousal, making ‘confusions’ between these expressions predictable.
The Study

This study was designed to investigate the development of children’s use of labels for anger and disgust, and the nature of their underlying concepts of these emotions.

- Because preschoolers rarely use disgusting on free labeling (Widen & Russell, 2003, under review), we extended our sample to include kindergarten and Grade 1 students, but still included preschoolers (3 to 5 years) to better trace the development of children’s understanding of disgust.

- We also included a group of university-aged adults.

Children first participated in a brief conversation about emotions, to make the target labels/concepts more accessible, then labeled three animals.

- All participants labeled two sets of six facial expressions to establish whether they knew/used ‘disgusted’ (or some close synonym).

- And completed two categorization tasks (yes/no, choice from array) which assessed the nature of their anger and disgust categories.

Method

Participants. Participants were 144 children, all proficient in English and enrolled in daycares in the Greater Boston, MA, area. There were 24 boys and 24 girls in each of three age groups: Young (29 to 48 months; mean = 43.6 months, sd = 3.8) and older preschoolers (54 to 69
months; mean = 61.8 months, sd = 3.3), and Kindergarten and 1st Graders (63 to 94 months; mean = 78.4 months, sd = 8.46). A group of 48 university-aged adults were also included; they received course credit in exchange for their participation.

Materials

*Photographs of animals.* The animal pictures were four color photographs, one each of a cat, dog, horse, and cow.

*Photographs of facial expressions for free labeling.* Two sets of 6 black and white 5” x 7” photographs (each posed by a different woman) of prototypical facial expressions of emotion (happiness, sadness, anger, fear, surprise, disgust) were selected from Ekman and Friesen’s (1976) Pictures of Facial Affect.

*Photographs of facial expressions for yes/no task.* Three sets of 4 facial expressions (happiness, fear, anger, disgust), each posed by a different woman, were selected from the Montreal Set of Facial Displays of Emotion (Beaupré, Cheung, & Hess, 2000).

*Photographs of facial expressions for choice-from-array task.* Three sets of 6 facial expressions (surprise, happiness, sadness, disgust, anger, fear), all posed by women, were selected from Ekman and Friesen’s (1976) Pictures of Facial Affect. No facial expression was used twice in this task, but 4 of the faces used in the choice-from-array task were also used in free labeling.

Procedure

The experimenter spent the first visit getting to know each child. On a subsequent visit, the experimenter invited an individual child to play a game with her.

Priming

The experimenter initiated a conversation in which each of the target emotion labels (happy, sad, angry, scared, surprised, disgusted) was introduced by saying, “Today we are going to play a game about feelings. Feelings are like when you feel happy or sad. Do you ever feel happy? What about sad? Do you ever feel sad?” And so on, until each of the target emotion labels had been mentioned.

Labeling facial expressions

The order of presentation for the two sets of facial expression was counterbalanced: Half the children saw Rhonda first; half Alice. The experimenter introduced the faces then showed the child the six facial expressions, one at a time in a random order. After each picture, the experimenter asked, “How do you think Ronda (Alice) feels in this picture?” Responses were not corrected and all were mildly praised After seeing all six of the first set of faces, the experimenter introduced the second set.

*Yes/No Task*

The two emotion categorization tasks, yes/no and choice-from array, were presented in counterbalanced order. On both categorizations tasks, the happy trial served as a control trial to ensure that children would indeed exclude anger and disgust faces from an emotion category.

The yes/no task was introduced as a game in which the experimenter was trying to be tricky and thus the child had to be particularly careful. In the training trial, the experimenter showed the child photographs of four different animals (dog, cat, horse, and cow), one at a time in random
order. For each photograph, the experimenter asked, “Is this a dog?” The purpose of this training trial was encourage and reinforce the child for correctly saying ‘no’ to the experimenter. Children’s performance on the animal trial was perfect for all four animals. Thus, they understood the task, and were willing and able to say ‘no’ to experimenter when it was appropriate to do so.

The next three trials followed the same format as the training trial, but now with four different facial expressions. On each trial, the four expressions were posed by the same person, and the experimenter asked the same question for all four facial expressions: “Is this person X?” (disgusted, angry, happy) The order of the trials was random, as was order of presentation of the three sets of photographs, and the order of the four photographs within each set.

Choice-from-array task

In the choice-from-array task, six facial expressions (one each for happiness, sadness, anger, fear, surprise, disgust) for a given trial were presented at once, and the child was encouraged to look closely at each one. The experimenter then asked the child, “Which one of these people feels X?” (angry, disgusted, happy). The child’s selection was mildly praised and the experimenter removed that photograph, and then asked, “Does anyone else feel X? Or did you get them all?” This procedure was repeated until the child indicated that no one else felt the target emotion (or until there were no photographs left), and then the next trial was introduced with a new set of photographs.

Results

To investigate whether emotion labels emerged systematically, all children were sorted and grouped, irrespective of age, by the emotion labels they used on the free labeling task. The frequency with which each target combination of emotion labels occurred was counted, and is illustrated by Figure 3. The frequency for each of the other combinations was low. This model accounted for 86.1% of the children – a proportion significantly greater (p < .001) than the 27.1% expected by chance. (If, as the number of labels that children used increased, any label was as likely to be added as any other, then 27.1% would fit this pattern.) Results supported the Differentiation Model, except that, due perhaps slightly older age of the younger preschoolers in our sample, and the opportunity to label two sets of facial expressions, there were no children at Labeling Levels 0 or 1.

In the following analyses, children’s Labeling Level on free labeling was used to predict their performance on the yes/no and choice-from-array tasks. Labeling Levels 2, 3, and 4 were grouped together, as these Levels represent earlier stages of emotion understanding, Labeling Level 5 was considered a transitional level, and Labeling Level 6 was, of course, the focus Level at which children used disgusted, resulting in three groups: Labeling Level 2-4, Labeling Level 5, and Labeling Level 6. The adults were a fourth group. There were 22 participants in each group.

Categorization Tasks

Yes/No task. In a weighted means, repeated measures ANOVA (alpha = .05), children’s Labeling Level (4 levels: Labeling Level 2-4, 5, 6, adults) was the between-subjects factor, and emotion (2 levels: anger, disgust), nested in trial (3 levels: angry, disgusted, happy), was the within subject-
factor for the yes/no task. The dependent variable was whether, or not, participants said ‘yes’ in response to the question, “Does this person feel X?” (scored 1 or 0, respectively). The trial x emotion x Labeling Level interaction was significant, $F(6, 168) = 5.63, p < .001$. The happy control trial established that children, and adults, could and would say ‘no’ to the experimenter: The vast majority of the children (.73 to 1.00), and adults (.88 to .95) excluded both the anger and the disgust faces from the happy category.

![Diagram of emotion labels]

Figure 3. Emotion labels emerged systematically on the free labeling task. Age increased with Labeling Level.

On the disgust trial (Figure 4A), significantly more ($p < .001$) Labeling Level 6s and adults agreed that the disgust face was disgusted than did Labeling Level 2-4, and significantly more ($p = .03$) adults agreed than did Labeling Level 5s.

The most interesting finding was in the angry trial: When asked if each face was angry (Figure 4B), more children in Labeling Levels 2-4 and 5 agreed that the disgust face was angry than they had for the anger face; this difference was significant ($p = .03$) for Labeling Level 5. The major change occurred at Labeling Level 6, when children began using disgusted, where significantly fewer ($p \leq .001$) children agreed that the disgust face was angry than had children at lower Labeling Levels. Even .50 of the adults agreed that the disgust face was angry.
So, the beginning of the use of disgusted coincided not with a change in the disgust category, but with a narrowing of the anger category, and there was no improvement from Labeling Level 6 to adults.

Choice-from-Array task. In two parallel weighted means, repeated measures ANOVAs (alpha = .05), Labeling Level (4 levels: Labeling Level 2-4, 5, 6, adults) was the between-subjects factor, and emotion (2 levels: anger, disgust), nested in trial (3 levels: angry, disgusted, happy), was the within subject-factor. For the first-choice analysis, the dependent variable was whether, or not, on a given trial, the children chose anger or disgust face from the array first (scored 1 or 0, trial (scored 1 or 0, respectively). For the total-choice analysis, the dependent variable was whether, or not, on a given trial, the children chose anger or disgust face from the array over the course of the whole (scored 1 or 0, respectively).

Figure 4. (A) On the Yes/No task, using ‘disgusted’ on free labeling had little effect children’s performance on the disgust trial, but (B) it did predict a narrowing of the anger category.

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The trial x emotion x Labeling Level interaction was significant in both analyses: first choice, $F(6, 168) = 13.12, p < .001$; total choices, $F(6, 168) = 10.78, p < .001$. The happy control trial established that children, and adults, could and would omit the anger and disgust faces from a nontarget category: In both analyses, at all Labeling Levels, all participants chose the anger and the disgust faces at floor levels (range: 0-.09).

On the disgust trial, when children were asked to find the disgust face(s) from the array of six faces, (Figure 5A), in the first choice analysis, the proportion of children who chose the disgust face first increased significantly ($p < .001$) with Labeling Level, and the proportion of adults’ who chose the disgust face first was significantly higher than each of the children’s Labeling Level. However, in the total choices analysis, there was no significant change with age for the children, but the proportion of adults who chose the disgust face first was significantly higher ($p < .04$) than Labeling Levels 2-4 and 5. Few children, and no adults, chose the anger face first on
the disgust trial; this proportion did not change significantly with Labeling Level. But, in the
total choices analysis, although there was no significant change with Labeling Level for the
children, the proportion of children at Labeling Levels 2-4 who chose the anger face first was
significantly higher ($p = .006$) than adults.

Again, the most interesting results occurred on the angry trial (Figure 5B): When asked to find
the angry face(s) from the array, the proportion who chose the anger face first increased
significantly ($p < .003$) with Labeling Level. In the total choices analysis, the proportion of total
choices did not change significantly with Labeling Level. More children at Labeling Levels 2-4
and 5 than at Labeling Level 6 chose the disgust face first than chose the anger face first; this
difference was significant for Labeling Level 2-4 ($p < .001$). But, significantly fewer children at
Labeling Level 6 chose the disgust face as angry than did children at lower Labeling Levels, both
on their first choice ($p < .02$) and for their total choices ($p < .02$).

Thus, on the choice-from-array task, on which all the faces were displayed at once, the children
at lower Labeling Levels treated the anger and disgust faces as equally good signals of anger,
and may even have seen the disgust face as the better exemplar of the anger category. The major
change occurred at Labeling Level 6: the beginning of the use of disgusted coincided with a
narrowing of the anger category.

**Discussion**

In the current study, children’s and adults’ responses on three tasks revealed ‘confusions’
between anger and disgust.

- The pervasiveness of these ‘confusions,’ by both children and adults, and on three different
tasks for anger and disgust, suggests that they are not confusions at all.
  - Indeed, every study that we are aware of that included these pairs of facial expressions and
    reported participants’ ‘errors’ found this pattern of results (Bormann-Kischkel, Hildebrand-
    Ekman, 1972; Ekman & Friesen, 1971; Gosselin & Laroque, 2000; Gosselin, & Simard,
    1999; Hosie, Gray, Russell, Scott, & Hunter, 1998; Markham & Adams, 1992; Russell &
    Bullock, 1984a, 1984b; Widen & Russell, 2003, under review; Wiggers, 1982).
  - Thus, the better explanation is that these emotion pairs are each similar on the underlying
dimensions of pleasure and arousal so that when participants interpret these facial expressions
they sometimes interpret the prototypical disgust expression, for example, as displaying anger.

Although both children and adults showed similar patterns of responses in their anger and disgust
categories, there was also evidence of development in children’s understanding of these
categories.

- Specifically, children who used disgusted on free labeling were better able to exclude the
disgust faces from the anger categories on both the yes/no and the choice-from-array tasks.
  - Surprisingly, using disgusted had little effect on the disgust category: Although the disgust
category narrowed with development, there were no significant differences in categorization
between Labeling Level 5 (children who used five target emotion labels, but not disgusted) and
Labeling Level 6 (children who used all six target emotion labels, including disgusted).
Thus, using disgusted coincided primarily with a narrowing of the anger category.

Future research could further test the pattern of responses for the fear and surprise categories using categorization tasks such as the ones used here.

Another avenue for future research is to investigate whether these patterns occur only for facial expressions or for other aspects of emotion, such as labeling brief stories describing emotion events, for example.

References