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# Can An Anger Face Also Be Scared? Malleability of Facial Expressions

Sherri C. Widen and Pamela Naab
Boston College

Do people always interpret a facial expression as communicating a single emotion (e.g., the anger face as only *angry*) or is that interpretation malleable? The current study investigated preschoolers' ($N = 60$; 3–4 years) and adults' ($N = 20$) categorization of facial expressions. On each of five trials, participants selected from an array of 10 facial expressions (an open-mouthed, high arousal expression and a closed-mouthed, low arousal expression each for happiness, sadness, anger, fear, and disgust) all those that displayed the target emotion. Children's interpretation of facial expressions was malleable: 48% of children who selected the fear, anger, sadness, and disgust faces for the "correct" category also selected these same faces for another emotion category; 47% of adults did so for the sadness and disgust faces. The emotion children and adults attribute to facial expressions is influenced by the emotion category for which they are looking.

*Keywords:* facial perception, emotion, child development, malleability, categorization

In their day-to-day experiences, people see and interpret others' emotional reactions, including emotional facial expressions. In traditional emotion theory, such facial expressions are assumed to communicate single, discrete emotions (e.g., Ekman, 1980). Other evidence suggests that interpretation of facial expressions is more malleable—that is, a person may interpret the same face as expressing a variety of emotions in different contexts (e.g., Carroll & Russell, 1996; Aviezer et al., 2008). This study is part of a larger project investigating children's understanding of emotion. It asked how children understand facial expressions: Do facial expressions communicate only one emotion for children? Or are the emotions that a facial expression communicates more malleable for them?

The malleability of facial expressions suggests that, while faces remain preeminent, the information they communicate is limited (e.g., where the person is looking or staring, whether the person is crying, smiling, grimacing, etc., and the person's levels of valence—feels good vs. feels bad—and arousal; Carroll & Russell, 1996). For example, when presented with an "anger" face, young preschoolers interpret it as "feels bad" rather than "feels good." They may also interpret this face as having high rather than low arousal levels. The valence and arousal dimensions help to explain which faces children "incorrectly"[1] include in an emotion category (e.g., Bullock & Russell, 1984; Widen & Russell, 2008a). On categorization tasks, children include the target face in the category, but also include other faces of the same valence and similar levels of arousal. As age increases, children are more likely to exclude "incorrect" facial expressions, indicating that their emotion concepts are becoming narrower and more adult-like. For example, when young preschoolers are asked to find the angry faces on a categorization task, they will include many negative valence emotions: The angry face and also the disgust, fear, and sad faces (Widen & Russell, 2008a). As age increases, children exclude the low arousal sad face first from the high arousal anger category. Then they begin to exclude the other higher arousal faces—the fear face, and finally the disgust face.

An additional factor that may influence which faces children "incorrectly" include in an emotion category, or which faces are more malleable, is perceptual similarity. Facial expressions that look most similar, although assumed to express different emotions, are more likely to be included in the same category. For example, anger and disgust look similar though they share only incidental muscle movements such as wrinkles around the brow and possibly raising of the upper lip (Widen & Russell, 2008b).

## Overview of the Study

This study investigated how children and adults categorized high and low arousal facial expressions of happiness, sadness, anger, fear, and disgust. There were two facial expressions for each emotion: an open-mouthed (high arousal) expression and a closed-mouthed (low arousal) expression. To test the assumption that the open-mouthed expressions were perceived as having higher

Sherri C. Widen, Department of Psychology, Boston College; and Pamela Naab, Department of Counselling, Developmental, & Education Psychology, Boston College.

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Correspondence concerning this article should be addressed to Sherri C. Widen, Department of Psychology, McGuinn Hall, 140 Commonwealth Avenue, Boston College, Chestnut Hill, MA 02467. E-mail: widensh@bc.edu

[1] On our perspective, we believe that children's nontarget responses reveal a great deal about their understanding of emotion categories and that it is important to analyze all of children's responses on emotion tasks, both "correct" and "incorrect."

arousal than the closed-mouthed expressions, adults ($N = 20$)[2] rated (on a 7-point Likert scale: 0 = *extreme sleepiness* to 7 = *extremely high arousal*) the arousal level of the photographs used in the current study. Open-mouthed facial expressions were judged as more highly aroused ($M = 4.65$) than closed-mouth facial expressions ($M = 3.57$), $t_{19} = 8.75$, $p < .001$. This pattern held for each of the pairs: happiness (high: $M = 4.75$, low: $M = 3.25$), $t_{19} = 8.82$, $p < .001$; sadness (high: $M = 4.00$, low: $M = 2.60$), $t_{19} = 3.56$, $p = .002$; anger (high: $M = 4.70$, low: $M = 3.05$), $t_{19} = 5.05$, $p < .001$; fear (high: $M = 5.15$, low: $M = 4.70$), $t_{19} = 2.65$, $p = .02$; and marginally for disgust (high: $M = 4.65$, low: $M = 4.25$), $t_{19} = 2.03$, $p = .06$. The rank order of each of the 10 facial expressions (from high to low arousal) was: open-mouthed fear, open-mouthed happiness, closed-mouthed fear, open-mouthed anger, open-mouthed disgust, closed-mouthed disgust, open-mouthed sadness, closed-mouthed happiness, closed-mouthed anger, and closed-mouthed sadness. The midpoint of the scale (3.5) was used as the neutral point between high and low arousal. Thus, three faces in this array were low arousal (closed-mouthed happiness, closed-mouthed anger, and closed-mouthed sadness) and the other seven were high arousal.

On each of five trials (happy, sad, angry, scared, disgusted), the child saw all 10 facial expressions at once and was asked to find the one(s) that felt the target emotion (e.g., Which one of these people feels happy?). The child continued to make selections until he or she indicated that none of the remaining faces displayed the target emotion (e.g., "Does anyone else feel happy? Or did you get them all?" This phrasing was intended to reduce demand characteristics on the child to select more faces if he or she felt that all the target faces had been found). We also included the instruction, at the beginning of the procedure, "Look at these faces. See how some of them feel the same but some of them feel different?" to encourage children to notice the similarities and differences between the faces before the trials began. Together, these instructions reduced the likelihood that children would select all the faces while allowing them the flexibility to include different faces in each emotion category.

Adults were included as a comparison group to illustrate the end-point of development. That is, if adults included faces in addition to the target face for any of the emotion categories, then it would be unreasonable to expect children to include only the target faces for those categories.

Our first prediction was that children would include both the high arousal (open-mouthed) and low arousal (closed-mouthed) target facial expressions on all trials. That is, when asked find the happy people, children would include both the open- and closed-mouthed happiness facial expressions. Similar categorization studies have reported children's inclusion of target faces (e.g., Bullock & Russell, 1984; Widen & Russell, 2008a).

Our second prediction was that nontarget facial expressions would be included in each category: High arousal (open-mouthed) expressions would be included in the high arousal categories of happiness, anger, disgust, and fear; low arousal (closed-mouthed) expressions would be included in the low arousal category of sadness (e.g., Widen & Russell, 2008a). For example, for the anger category (a high arousal emotion), the high arousal (open-mouthed) sadness face would be a more likely selection than would the low arousal (closed-mouthed) sadness face.

Our third prediction was that these inclusions would be mediated by perceptual similarity. For example, disgust and anger have similar levels of arousal as well looking similar; these faces should be "incorrectly" included in the other's category with high frequency.

## Method

### Participants

Participants were 60 children, all proficient in English and enrolled in daycares in the Greater Boston area. There were 15 boys and 15 girls in each age group: 3-year-olds (36 to 47 months, mean age = 42.1 month, $SD = 3.5$ months) and 4-year-olds (48 to 65 months, mean age = 57.0 months, $SD = 5.0$ months). Of the total sample, 71% were Caucasian, 13% Hispanic, 8% Asian, 8% other ethnicities. A group of 20 university-aged adults (mean age = 18.9 years; 15 female) was also included as a comparison group; course credit was given in exchange for participation. Of the total adult sample, 55% were Caucasian, 25% Asian, 10% Hispanic, and 10% other ethnicities.

### Materials

The facial expressions were 10 black-and-white 3" × 5" photographs of women posing prototypical facial expressions of emotion, selected from Ekman and Friesen's (1976) Pictures of Facial Affect. Only photographs of Caucasian women were included because we did not want to confound differences in children's attributions of emotion to males and females (e.g., Widen & Russell, 2002) or race (e.g., Tuminello & Davidson, in press) with the malleability of their emotion concepts. There were two photographs for each emotion: One set was high arousal (open-mouthed) (happiness JM1−4: AUs 6 + 12 + 25; sadness C1−18: AUs 1 + 4 + 11 + 25 + 26; anger MF2−7: AUs 4 + 5 + 23 + 25 + 26; fear C1−23: AUs 1 + 2 + 5 + 11 + 25 + 31; disgust NR2−7: AUs 9 + 25) and one set was low arousal (closed-mouthed) (happiness PF1−6: AU 12; sadness A2-6: AUs 1 + 4 + 18; anger C2−12: 4 + 24; fear MF1−30: AUs 1 + 2 + 5 + 11; disgust JM2−8: AUs 9 + 17).

## Procedure

The experimenter spent the first visit at each preschool getting to know each child who had received parental consent. On a subsequent visit, the experimenter invited each child, individually, to play a game (participate in the study) with her.

### Choice-From-Array Task

In the choice-from-array task, the 10 facial expressions were presented at once, and the child was encouraged to look closely at each one. The experimenter introduced the faces by saying, "Look at these people [pointing]. See how some of them feel the same but

[2] The adult sample was composed of five males and 15 females. The mean age of was, mean age = 18.9 years, $SD = .9$ years. Of the total sample, 55% were Caucasian, 25% Asian, 10% Hispanic, and 10% other ethnicities.

some of them feel different? I'm going to ask you to pick the people that feel a certain way. Only pick the people that feel that way. Remember: not all the people feel the same." The experimenter then began the first trial by asking the child, "Which one of these people feels X? (happy, sad, angry, scared, disgusted)." When the child had made a selection, he or she was mildly praised, and the experimenter removed that photograph. The child was 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. Thus, throughout the experimental trials every effort was made to both let the child select all the faces he or she felt fit in a particular category and also to be clear that not all faces felt the same and that another selection was not required. The experimenter shuffled the photographs, displayed them on the floor, selected a different emotion word ("Which one of these people feels Y?"), and continued the procedure until all of the emotion trials were completed. The order of the trials was random as was the order of the facial expressions within the array.

### Adult Comparison Group

The adults completed the choice-from-array task in a questionnaire format. The 10 faces for each trial were displayed in an array of two rows. On each trial (happy, sad, angry, scared, disgusted), participants were asked to put an X in the circle(s) for the face(s) that displayed the target emotion. The order of the trials was random as was the order of the facial expressions within the array.

### Scoring

On the choice-from-array task, all the faces that each participant selected on a given trial were given a score of 1, all remaining faces were given a 0.

## Results and Discussion

### Preliminary Analysis of Category Breadth

To investigate the effects of age and sex on the breadth of children's emotion categories, the number of faces each child included on each trial was totaled. In a mixed-design ANOVA ($\alpha = .05$), age group (2 levels: 3 years, 4 years) and sex (2 levels) were between-subjects factors, and emotion-category (5 levels: happy, sad, angry, scared, disgusted) was a within-subject factor. The dependent variable was the total number of faces included on each trial (range = 0–10).

The main effect for emotion-category was marginally significant, $F(4, 224) = 2.20$, $p = .07$. Children included the most faces in the happy (3.12) and angry categories (3.12), followed by disgusted (2.88), scared (2.67), and sad (2.55). The main effect for age was also significant, $F(1, 56) = 4.81$, $p = .03$. Both of these main effects were qualified by the significant Age × Emotion-Category interaction, $F(4, 224) = 2.75$, $p = .03$, which indicated that the main effect for age was due primarily to differences between age groups on the happy and scared categories. The difference between age groups was significant for the happy (3 years: 3.97, 4 years: 2.27; Least Significant Difference comparisons, $p = .003$) and scared (3 years: 3.37, 4 years: 1.97; $p = .01$) categories and marginally significant for the anger category (3 years: 3.63, 4 years: 2.60; $p = .06$). The differences between age groups for sad (3 years: 2.83, 4 years: 2.27) and disgust (3 years: 3.03, 4 years: 2.73) were not significant but followed the same trend. For each category, 4-year-olds included fewer faces than 3-year-olds, indicating that emotion categories narrowed with age.

The Age × Sex × Emotion-Category interaction was also significant, $F(4, 224) = 2.81$, $p = .02$, but only one comparison between sexes was significant: For the 3-year-olds, boys included more faces than girls in the happy category (boys: 4.87, girls: 3.07; $p = .02$). In addition, one comparison was marginally significant: For the 4-year-olds, boys included more faces than girls in the disgust category (boys: 3.40, girls: 2.07; $p = .09$). There was no general trend for the boys to include more faces than the girls and the main effect for sex was not significant, $F(1, 56) = 1.51$, $p = .22$.

### Setting a Criterion for "Incorrect" Inclusions

Our primary interest was the malleability of children's interpretations of facial expressions—that is, whether they included the same facial expression in more than one category. The first step was to set a criterion against which children's "incorrect" inclusions could be compared. Table 1 shows the percentage of children who included each face in each category.[3] Each face was "incorrectly" included in a category by at least one child. To identify the base rate of incorrect inclusions for each face, the mean incorrect inclusion for that face was tallied. For example, for the high intensity happy face, the base rate was 9.2% ([5.0%+15.0%+5.0%+11.7%]/4 = 9.2%).

The second step was to compare the percentage of "incorrect" inclusions for each face on each trial to the base rate for that face using dependent samples $t$ tests. Four of the 40 "incorrect" inclusions (8 possible incorrect inclusions × 5 emotion trials) were significantly higher than that facial expression's base rate (see Table 1): Including the low arousal sad face in the scared category, $t_{59} = 2.69$, $p = .009$, the high arousal disgust face in the angry category, $t_{59} = 8.69$, $p < .001$, the low arousal disgust face in the angry category, $t_{59} = 7.46$, $p < .001$, and the high arousal anger face in the disgust category, $t_{59} = 3.07$, $p = .003$. Two inclusions were marginally significant: Including the high arousal sad face in the scared category, $t_{59} = 1.70$, $p = .09$, and the low arousal scared face in the disgust category, $t_{59} = 1.86$, $p = .07$. These six "incorrect" inclusions were included in the analysis of malleability.

This process was repeated with the faces that the adults "incorrectly" included in each category. Two inclusions were significantly higher than the base rate for adults (see Table 1): Including the high arousal sad face in the scared category, $t_{19} = 2.39$, $p =$

[3] When the percentage of children who selected each face on their first choice was analyzed, the same pattern as is shown in Table 1 was found, though the percentages were lower. Specifically, children's modal responses for the happy, sad, and scared trials were the target expressions faces (range: 23%−47%). For the disgust trial, children chose anger faces more frequently (27%−38%) than the disgust faces (13%−18%). For the anger trial, they chose the two disgust faces and the high arousal anger face more frequently (13%−22%) than the low arousal anger face (7%).

Table 1
*Proportion of Participants Who Included Each Face in Each Category*

| Facial expression | Intensity | Category | | | | | Base rate "incorrect" Inclusions |
|---|---|---|---|---|---|---|---|
| | | Happy | Sad | Disgusted | Angry | Scared | |
| | | | | Children | | | |
| Happiness | High | **88.3** | 5.0 | 15.0 | 5.0 | 11.7 | 9.2 |
| | Low | **86.7** | 8.3 | 8.3 | 5.0 | 6.7 | 7.1 |
| Sadness | High | 20.0 | **66.7** | 26.7 | 11.7 | 33.3$^{+}$ | 22.9 |
| | Low | 13.3 | **76.7** | 18.3 | 6.7 | 35.0$^{*}$ | 18.3 |
| Disgust | High | 11.7 | 10.0 | **40.0** | 76.7$^{*}$ | 16.7 | 28.8 |
| | Low | 18.3 | 13.3 | **45.0** | 71.7$^{*}$ | 8.3 | 27.9 |
| Anger | High | 8.3 | 10.0 | 40.0$^{*}$ | **78.3** | 23.3 | 20.4 |
| | Low | 16.7 | 28.3 | 35.0 | **31.7** | 20.0 | 25.0 |
| Fear | High | 31.7 | 11.7 | 28.3 | 16.7 | **53.3** | 22.1 |
| | Low | 16.7 | 25.0 | 31.7$^{+}$ | 8.3 | **58.3** | 20.4 |
| | | | | Adults | | | |
| Happiness | High | **100.0** | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Low | **90.0** | 5.0 | 0.0 | 5.0 | 0.0 | 2.5 |
| Sadness | High | 0.0 | **90.0** | 0.0 | 0.0 | 35.0$^{*}$ | 8.8 |
| | Low | 0.0 | **90.0** | 0.0 | 0.0 | 15.0 | 3.8 |
| Disgust | High | 0.0 | 0.0 | **55.0** | 70.0$^{*}$ | 0.0 | 17.5 |
| | Low | 0.0 | 0.0 | **95.0** | 15.0 | 0.0 | 3.8 |
| Anger | High | 0.0 | 0.0 | 10.0 | **95.0** | 0.0 | 2.5 |
| | Low | 0.0 | 0.0 | 15.0 | **40.0** | 10.0 | 6.3 |
| Fear | High | 0.0 | 0.0 | 0.0 | 0.0 | **85.0** | 0.0 |
| | Low | 0.0 | 0.0 | 0.0 | 0.0 | **85.0** | 0.0 |

*Note*. "Correct" responses are in bold.
$^{+}$ "Incorrect" inclusions were marginally higher than that facial expression's base rate ($.05 < p < .10$). $^{*}$ "Incorrect" inclusions were significantly higher than that facial expression's base rate ($p < .01$).

.03, and the high arousal disgust face in the angry category, $t_{19} = 4.99$, $p < .001$.

## Malleability of the Interpretation of Facial Expressions

Next, we focused on the malleability of children's interpretations of facial expressions. First, we looked at whether children included the same face in more than one emotion category. Table 2 focuses on the six facial expressions that were "incorrectly" included above the base rate for that face. For each of these faces, it shows the percentage of children who "correctly" selected a face on the target trial and then also "incorrectly" selected the same face on another trial. For example, 40 children selected the high arousal sadness face as sad. Of these, 14 (35.0%) also selected this face as scared. On average, when these six faces were included in the "correct" category, they were also included in an "incorrect" category on 48.1% of the trials. These results indicate that children

Table 2
*Percentage of Adults and Children Who Included Faces in the "Correct" Category and Another Category*

| Face included in "Incorrect" category | Intensity | "Correct" Category | | | | |
|---|---|---|---|---|---|---|
| | | Happy trial | Sad trial | Disgusted trial | Angry trial | Scared trial |
| | | | | Children | | |
| Sadness | High | | | | | 35.0 (14/40) |
| | Low | | | | | 34.8 (16/46) |
| Disgust | High | | | | 75.0 (18/24) | |
| | Low | | | | 70.3 (19/27) | |
| Anger | High | | | 39.1 (18/46) | | |
| Fear | Low | | | 34.1 (13/35) | | |
| | | | | Adults | | |
| Sadness | High | | | | | 38.9 (7/18) |
| Disgust | High | | | | 54.5 (6/11) | |

*Note.* Only those faces that were included in an "incorrect" category above the base rate for that face are included in this table. In parentheses is the number of times a face was selected for an "incorrect" category over the number of times it was selected for the "correct" category.

were interpreting these facial expressions anew on each trial: The emotion that facial expressions communicate was influenced by the emotion category for which the child was looking.

The one unexpected "incorrect" inclusion was the low arousal sad face in the scared category. Adults rated this sad face as having the lowest arousal (2.6/7) of the 10 faces. Fear is typically considered to be a high arousal emotion (e.g., Russell, 1980). To further investigate this inclusion, we compared each age group's inclusions of this face in the scared category. There were 21 inclusions: 14 (46.7%) by 3-year-olds and seven (23.3%) by 4-year-olds. This difference was significant, independent groups $t_{59} = 8.69$, $p < .001$. Thus, the inclusion of the low arousal sad face in the scared category was due primarily to the 3-year-olds broad fear category.

Table 2 illustrates another point: Some categories were broader than others. The happy and sad categories included no nontarget faces—at least not above the base rate. The remaining three categories each included two faces other than the target faces: Angry included both of the disgust faces, which is a common "error" for both children and adults. Scared included both sadness faces. And disgusted included the high arousal anger face and the low arousal fear face. This varying breadth corresponds to the emotion categories that children acquire early (happiness, sadness) versus late (fear, disgust) (Widen & Russell, 2008a). (Anger is an early acquired category, and so did not fit the pattern. The results of this trial are discussed further below.)

Adults also showed some malleability in their interpretations of facial expressions, at least on the disgusted and scared trials (see Table 2). They selected the high arousal sadness face as scared and the high arousal disgust face as angry. On average, on 46.7% of the trials, when these two faces were included in the "correct" category, they were also included in an "incorrect" category.

## Angry Trial

As predicted, children included both of the target faces for each category—except on the anger trial (see Table 1). When children were asked to find the angry expression(s), significantly more selected the high arousal anger expression than the low arousal one, dependent measures $t_{(59)} = 5.80$, $p < .001$.

In addition, the angry trial was the only one on which the frequency of "incorrect" inclusions of any of the faces was higher than the inclusions of a target face. Compared to the low arousal anger face, significantly more children included the high arousal disgust face, $t_{(59)} = 5.37$, $p < .001$, and the low arousal disgust face, $t_{(59)} = 5.55$, $p < .001$.

Adults also showed this pattern (see Table 1): Significantly more selected the high arousal anger expression than the low arousal one, $t_{(19)} = 4.82$, $p < .001$. Compared to the low arousal anger face, more adults included the high arousal disgust face but this difference was not significant, $t_{(19)} = 1.55$, $p = .13$.

## Conclusion

In the current study, the emotion that facial expressions communicated was malleable: Children (and even adults) included the same faces in different emotion categories. Facial expressions of basic-level emotions do not communicate a single discrete emotion as assumed by the traditional theory of emotion (e.g., Ekman, 1994). Instead, the emotion that facial expressions communicate is influenced by their context. In the current study, that context was the emotion category for which a person was looking. This result supports Carroll and Russell's (1996) suggestion that the information people read most easily from facial expressions is not a specific discrete emotion. Instead, the specific emotion attributed to a facial expression is malleable because people most easily read levels of pleasure and arousal as well as physical information (e.g., gaze direction, whether the person is crying, talking, smiling, shouting, grimacing, etc.; Carroll & Russell, 1996; Aviezer et al., 2008).

The malleability of children's interpretation of facial expressions was evident in the finding that at least one child included every face in each "incorrect" category, and that these inclusions were significantly above base rates for four faces and marginally so for two others. About one third of children who selected the fear face as fear, the anger face as anger, and the sad faces as sad also selected these same faces for another emotion category; up to three quarters did so for disgust faces. Thus, even children who had categorized facial expressions "correctly" also categorized these faces "incorrectly" as another emotion.

The majority of children and adults included the high arousal angry face in the angry category but excluded the low arousal one. This finding suggests that judgments about the anger facial expression may be influenced by whether participants (children or adults) are presented with the high arousal (open-mouthed) anger face or the low arousal (closed-mouthed) version. This possibility requires further investigation and should also alert researchers to be aware of the specific faces they choose when investigating people's understanding of the anger face—using a low arousal anger face may result in the underestimation of children's (and adults') understanding of anger.

One explanation for the faces that children "incorrectly" include in different emotion categories is that they base their judgments on the broad dimensions of valence and arousal (e.g., Bullock & Russell, 1984; Widen & Russell, 2003). The number of faces that children admitted to each category varied with emotion. They included the most faces when asked to find the happy and angry faces and the fewest faces when asked to find the sad people. In addition, the number of faces that children included in each category decreased with age, especially for happy, scared, and angry. The current study provides some support for this view, but also raises some questions especially about the development of children's understanding of arousal. First, children did not "incorrectly" include faces of the opposite valence above base rate levels. Instead, children "incorrectly" included faces of similar valence. These faces also had similar levels of arousal to the target emotion (except for the inclusion of the low arousal sad face in the scared category). Children included both of the disgust faces in the angry category, the high arousal anger face in the disgust category, the high arousal sadness face in the scared category, and the low arousal fear face in the disgust category. Both of the faces adults "incorrectly" included were of the same valence and similar arousal to the category in which they were included.

Four of the children's "incorrect" inclusions were also influenced by perceptual similarity. The high arousal sad and fear faces shared a number of muscle movements (both had raised inner brows, upper lip pulled laterally [nasolabial deepener], and lips parted) making the perceptual similarity of these two faces readily

evident. The perceptual similarity of the anger and disgust faces—though they share only incidental muscle movements—was already mentioned. It is not possible, in the current study, to tease arousal (open vs. closed mouth) and perceptual similarity apart to assess which is stronger for these four inclusions.

The inclusion of the low arousal sad face in the scared category was not predicted by either of our hypothesis that related to nontarget target inclusions. First, this was a low arousal face—indeed, the lowest arousal face of the 10 faces presented—included in a high arousal category. Second, the low arousal sad face did not share perceptual similarity with either of the fear faces. Thus, this inclusion was not predicted but neither was it unprecedented. In prior categorization studies, young preschoolers have included low arousal faces (sad, sleepy, serene) in high arousal categories (scared, surprised) and vice versa (Bullock & Russell, 1984; Bullock & Russell, 1985; Székely et al., 2011; Widen & Russell, 2008a). In each study, this effect decreased by four years. The same pattern occurred in the current study: 3-year-olds made the majority of these inclusions; 4-year-olds were significantly less likely to do so. It is not clear why young preschoolers include low arousal faces in high arousal categories. This question provides is an avenue for future research.

The inclusion of disgust faces in the anger category suggests that for children, both of the disgust faces are better exemplars of anger than is the prototypical low arousal anger face. Thus, the current study joins with prior studies (e.g., Bullock & Russell, 1984; Camras & Allison, 1985; Gosselin, 1995; Gosselin & Laroque, 2000; Markham & Adams, 1992; Russell & Widen, 2002; Widen & Russell, 2002, 2003, 2004, 2008a, 2008b, 2010) in finding that children interpret the prototypical disgust face as anger. On this trial, adults also included the high arousal disgust face more frequently than the low arousal anger face. Thus, with development, children should become less likely to interpret the low arousal disgust face as anger, but continue to do so for the high arousal disgust face at least when asked to look for anger expressions.

The sample in the current study had limited ethnic diversity. Although there no reason to expect that other groups of children might be more or less malleable in their categorization of facial expressions, this is an empirical question. One exception that has been demonstrated is due to neither race nor culture but to individual differences: Children who have been abused are more likely to attribute anger to a variety of facial expressions (e.g., Pollack, Cicchetti, Hornung, & Reed, 2000; Pollak, & Sinha, 2002).

All of the facial expressions used in the current study were posed by Caucasian women. This selection of stimuli was a conscious decision to prevent any confounds of children's categorization of facial expression with gender or race—both of these effects have been demonstrated (e.g., Tuminello & Davidson, in press; Widen & Russell, 2002). Future research might investigate the effects of poser gender or different ethnicities on the malleability of children's (and adults') emotion categories.

The facial expressions used in this study were prototypical facial expressions of basic-level emotions and therefore negative and high arousal emotions were overrepresented. Future studies might include more positive and low arousal facial expressions to investigate whether such faces have different effects on the malleability of children's and adults' interpretation of them. It seems likely that facial expressions that are not assumed to represent specific emotions are even more likely to be included in more than one emotion category.

The current study established that children's interpretation of facial expressions is malleable but did not investigate how this malleability might interact with other areas of development. Another avenue for future research is the potential interaction of children's language, cognitive, or social development with the malleability of their interpretation of facial expressions. Prior research has shown links between language development and emotion understanding (e.g., Pons, Lawson, Harris, de Rosnay, 2003) and between theory of mind development and emotion understanding (e.g., Lagattuta & Wellman, 2001; Rieffe, Meerum Terwogt, & Cowan, 2005).

The current study contributes to the view that young children's understanding of emotion is different from adults'. While children's understanding of emotion is systematic and, at all levels, describes the entire emotion domain, the youngest children have a valence-based understanding of emotion (feels good vs. feels bad; Widen & Russell, 2003, 2008a). Somewhat older children divide their "feels bad" category into two categories: a high arousal category labeled angry and a low arousal one labeled sad—but these categories remain broader than the adult categories of the same names. The process of differentiation continues, as children acquire more categories and labels, but even at the end of preschool, children's understanding of emotion does not yet correspond to our adult understanding of emotion (Widen & Russell, 2003, 2008a).

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