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Words versus faces in evoking preschool children's knowledge of the causes of emotions

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Children ($N = 160$), aged 3 to 4 years, generated stories describing the causes of six different emotions: happiness, surprise, fear, anger, disgust, and sadness. The emotion was specified to the child either by a word (such as *scared* or *disgusted*) or by a photograph of a facial expression said to be a universal, biologically based signal for that emotion. For no emotion did the face produce significantly better performance than did the word. For fear and disgust, the word produced significantly better performance than did the face.

Children rapidly acquire knowledge about what causes specific emotions—they know that mother is afraid of speeding automobiles and disgusted at worms. How does this knowledge develop? For instance, how does the child know that it is fear that is evoked by speeding automobiles and disgust that is evoked by worms, rather than vice versa?

Harris (1989) has spelled out a plausible and widely shared account of a child's acquisition of knowledge about emotion. His account begins with the ability to recognise specific emotions from facial and vocal expressions. Some writers have speculated that infants recognise a half dozen or so specific emotions from facial expressions (Bowlby, 1982; Field & Woodson, 1982; but see also Kaitz & Meschulach-Sarfaty, 1988; Nelson & Dolgin, 1985). The ability to recognise emotional expressions is then assumed to provide a foundation for their later acquisition of additional information about each emotion, such as its causes and consequences, its more subtle manifestations, social rules regarding the emotion, and the label for the emotion used in the particular language to which the child is exposed. Giving voice to this view, Denham (1998) wrote, "Comprehension of emotional expression can be seen as the perceptual bedrock for further understanding of emotions. As such, it stands preschoolers in good stead, giving them an initial ability to think and talk about emotional issues, including their eliciting situations" (p. 61). Thus, to return to the question we raised at the outset, to learn which situations evoke which emotions, a child presumably witnesses someone in a particular situation and then relies on that person's facial expression to determine which emotion was evoked.

As intuitively appealing as the perceptual bedrock hypothesis is, it requires empirical scrutiny. Although there is evidence to support many of its assumptions (Denham, 1998; Harris, 1989), some evidence has begun to accumulate pointing to its shortcomings (Camras, 1992; Carroll & Russell, 1996; Fernandez Dols & Ruiz Belda, 1995, 1997; Fridlund, 1994; Russell, 1994, 1995). For instance, 2- and 3-year-olds appear to interpret facial expressions in global terms, rather than in terms of specific emotions (Bormann-Kischkel, Hildebrand-Pascher, & Stegbauer, 1990; Bullock & Russell, 1986; Gross & Baliff, 1991). The empirical study reported in this article was designed to explore another possible limitation of the perceptual bedrock hypothesis.

The perceptual bedrock hypothesis suggests what might be called a Face Superiority Effect. That is: (a) if children innately recognise specific emotions from facial expressions, and (b) if this ability matures early in life, thereby giving children much practice with this skill, and (c) if their ability to recognise specific emotions from facial expressions is the foundation for acquiring other information about these emotions, including their labels, then one would anticipate that children would find facial expressions easy to understand. In contrast, words such as *happy* and *sad* are said to be "acquired much later" (Plutchik, 1994, p. 213) and on the basis of the associated facial expressions. If so, facial expressions should more easily tap children's knowledge of emotion than would the corresponding emotion words. "More easily" might be operationally defined by response latency, likelihood of error, or other such standard means. Based on just such methods, there is now evidence that speaks against a Face Superiority Effect, at least for older preschoolers.

Camras and Allison (1985) told children, ranging in age from preschool to second grade, very brief stories about a fictitious teenager (e.g., "Her mother has died"). Children were asked what emotion the teenager was feeling, with answers gathered with one of two formats. Children generally did better when their options were presented to them in a word format (*happy*, *angry*, *sad*) than in a photographic format of prototypical facial expressions (smiling, frowning, or crying) of the same emotion. The advantage of words over faces was strongest for fear and disgust.

Russell (1990) turned Camras and Allison's task around. The emotions of happiness, sadness, anger, fear, and surprise

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were presented to preschoolers as a word, a face, or both. The children (4 or 5 years of age) were asked to complete a story by telling what caused the emotion or what happened next. Words were found to be at least as good as faces in tapping the children's knowledge of specific emotions, and a word had a significant advantage in the case of fear. (Disgust was not tested.)

The absence of a Face Superiority Effect, and the suggestion of a Word Superiority Effect for fear and disgust, if proved valid and general, raises questions about what role facial expressions actually play during the acquisition of knowledge about emotions and at what ages they play that role. Even if facial expressions are understood first, they might not continue for long to play a major role in the child's acquisition of emotion knowledge. The present study thus sought to replicate Russell's (1990) findings and extend them to younger children. The basic method was retained, but altered in several ways. Russell had used one facial expression per emotion and it was important to ascertain whether similar results occur with another set of faces. Here, we used different faces, posed by a male rather than a female model, and we added an expression of disgust.

Because the production task Russell (1990) used was not an easy one for younger preschoolers, we also took steps to help them: Children's emotion vocabulary and their recognition of facial expressions were both primed so that the children were highly familiar with these materials once the experiment proper began. In Russell's study, children were better at telling about the causes of an emotion than about its consequences; in the present study, only causes were asked for. We used the minimal number of facial stimuli: one per emotion, all posed by the same model, to emphasise differences between the expressions *per se* and to keep the task as simple as possible for these younger children. Finally, we always began with the happy trial, because it was the easiest for the children.

Method

Participants

These were 160 children, all proficient in English and enrolled in day care. There were 40 boys and 40 girls in each of two age groups: 3-year-olds (36 to 47 months) and 4-year-olds (48 to 59 months).

Materials

Photographs of facial expressions. There were fourteen 5 inch × 7 inch black and white glossy photographs of posed prototypical facial expressions of basic emotions (happiness, sadness, anger, surprise, fear, disgust) and neutral expressions. Seven photographs of a 13-year-old girl were used for priming, seven of a 12-year-old boy in actual testing. The photographs were provided by Dr Linda Camras. Camras, Grow, and Ribordy (1983) described the development of the photographs, their use in a study on recognition of facial expressions, and their coding according to Ekman and Friesen's (1978) Facial Action Coding System. Each photograph shows the predicted pattern of facial action units said to be a universal signal for the specified emotion (Ekman & Friesen, 1978). A sample of normal children (mean age 5;0 years) associated the faces with the predicted emotion between 73.5% and 100% (mean = 83.8%) of the time; these results are similar to those obtained with other samples of prototypical facial expressions with this age group.

Procedure

First visit: Priming. The experimenter first spent time playing with a child until the child seemed comfortable with the experimenter. The experimenter then asked the child for the names of two people at home with whom the child played games (call them X and Y). The experimenter introduced the six target emotions words (*happy*, *sad*, *angry or mad*, *scared*, *surprised*, *disgusted*, or *yucky*) by asking, for example, ''Do you sometimes feel *angry or mad*?'' or ''Does X ever feel *sad*?'' or ''Does Y ever feel *scared*?'' The experimenter then showed the child the six photographs of a girl posing facial expressions of emotion (one at a time), and asked the child a similar set of questions, but without emotion words, thus: ''Do you ever feel this way?'' The experimenter did not discuss *when* or *why* these emotions, presented either verbally or visually, might occur. If the child spontaneously offered an example of when someone had felt a particular emotion, the experimenter listened but did not comment on the child's story or encourage further explanation. Every effort was made throughout the experiment to use a neutral tone of voice when presenting the emotion words. When faces were shown, the experimenter did not use emotion labels and did not comment on labels offered by the child. Approximately equal amounts of time were spent on the verbal and on the visual priming procedures.

Second visit: Testing. On the experimenter's next visit, several days later, the priming procedure—both verbal and visual—was quickly repeated, and a storytelling game introduced. The experimenter began, ''First, it's my turn. I'll give the boy a name. Should it be Jesse or John? I think that I will call him Jesse. Now, it's your turn''. The experimenter invited the child to choose the colour of Jesse's hair. The experimenter and child took turns deciding on the colour of Jesse's house and what kind of pet Jesse should have. The experimenter then said, ''Let's make up a story about a day. First, it is going to be morning and Jesse is getting out of bed'', and invited the child to tell what Jesse did next. The experimenter and the child continued taking turns telling the story until the experimenter was confident that the child understood the game. The experimenter then began the emotion trials.

Up to this point, all the children had been treated identically. Children were now randomly assigned to one of two modes of presentation—Word or Face—which was thus a between-subjects condition. The child's task was to describe why Jesse felt each emotion. In both modes of presentation, the happy trial came first; other trials were randomly ordered.

In the word mode of presentation, the experimenter said, ''Here's a picture of Jesse [holding up the neutral face]. I'm going to pretend that one day Jesse was feeling very, very *happy*. He was feeling so *happy* that everyone could tell he was feeling *happy*. His mom could tell, his dad could tell, and all his friends could tell he was feeling *happy*''. The experimenter then asked, ''Why do you think Jesse was feeling *happy*?'' The remaining five emotions were represented by the words *surprised*, *scared*, *disgusted*, *angry*, and *sad*.

In the face mode of presentation, the experimenter said, ''Here are some pictures of Jesse. I'm going to pretend that one day Jesse was feeling this way [holding up one of the

photographs of Jesse posing a facial expression (a smile on the first trial)]. He was feeling so much this way [pointing to face] that everyone could tell he was feeling this way [pointing to face]. His mom could tell, his dad could tell, and all his friends could tell he was feeling this way [pointing to face]". The experimenter then asked, "Why do you think Jesse was feeling this way [pointing to face]?" The face was visible throughout and remained so while the child responded.

In both modes of presentation, if the response was a "nonstory", the experimenter prompted the child. (A "nonstory" was a response devoid of any information about why Jesse would have any emotion: e.g., silence, "No", "It's a tricky one", or "Let's put this one aside".) The first prompt was repeating the question ("What made Jesse feel this way?"). The second prompt was to begin a sentence with "Jesse felt this way because ..." followed by a pause to let the child complete the story. The third was "What would make *you* feel ...?" The fourth was the experimenter offering to take a turn and providing a predesignated (neutral) setting for the story (e.g., at home having dinner with his family for happiness; at the playground with other children for sadness). The experimenter then said, "It's your turn. What do you think would happen to make Jesse feel ...?"

If the child still did not respond to this last prompt, the child's response was scored as a "nonstory". The experimenter then completed the story with a predesignated ending (e.g., for happy, "His mom brings out his favourite dessert, chocolate cupcakes, and that makes Jesse feel very happy/like this"; for sad, "He falls off the swing and hurts himself and that makes Jesse feel very sad/like this").

When each trial ended, the experimenter praised the child and the next emotion trial was introduced with, "Let's make up a new story. A long time later ..."

Scoring of responses

Collectively, the children had 960 opportunities to tell a story. Of these, 175 were nonstories. The remaining 785 were stories, which were read to three raters (blind to mode of presentation, the child's age, and the target emotion), who made two judgements: (a) their best guess as to the emotion to which the child was responding; and (b) (no longer blind to the target emotion) a yes/no judgement of the plausibility of the child's story for the actual emotion to which the child was responding.

Due to a clerical error, only the group decision was recorded; that is, the raters' individual responses were not recorded for either rating procedure. To test inter-rater reliability, three different raters carried out the identical procedure for 253 stories generated by 50 of the participants. Selection of these 50 was random, with the proviso that each participant had generated at least two stories. The procedure was identical to the procedure followed by the original raters. The inter-rater reliability we report is the percentage of stories for which the two groups of judges' consensual best guess or plausibility rating agreed.

Best guess. For the best-guess procedure, each rater chose from a list (happiness, surprise, fear, disgust, anger, sadness) the emotion that best suited the child's story. If the raters did not agree as to which emotion label best fitted a story, they came to a consensus through discussion. Inter-rater reliability between the two panels of three judges each was 66%.

Plausibility ratings. For the plausibility rating, the three raters were first given the correct emotion label, and each was then asked to decide whether the story was a plausible cause of that emotion. If the raters did not agree as to whether or not a story was plausible, they came to a consensus through discussion. Inter-rater reliability between the two panels of three judges each was 84%.

Examples of a few of the stories generated by the children are: "'Cause his present broke" for sadness; "He has garbage in his mouth" for disgust; and "A monster was coming" for fear. For each of these examples, the raters' best guess was correct and the stories were judged to be plausible. For some of the stories, however, the precise emotion was difficult to guess even when it was judged plausible for the given emotion. For example, "His mom yelled at him" is plausible for sadness, anger, and fear, and therefore it was difficult to guess one specific emotion.

The number of nonstories and modest inter-judge reliability for the best-guess judgement shows that the task of generating stories is difficult for this age group and probably cannot be extended to younger children. Russell (1990) argued that the best-guess and plausibility ratings estimate upper and lower bounds, respectively, of children's knowledge. Convergence of results across the two measures is the best indication of a valid finding.

Results

Of the 960 responses, the 175 "nonstories" were automatically scored as incorrect. Of the remaining 785 stories, the raters were able to guess the correct emotion for 366 (47%); and they judged 554 (70%) to be plausible causes for the target emotion. Thus, of the total 960 responses, 38% were scored as correct by the best-guess criterion, 58% by the plausibility criterion.

In two parallel repeated-measures ANOVAs (alpha = .05), mode of presentation (word, face), age (two levels), and sex (two levels) were between-subjects factors, and emotion (happiness, surprise, fear, disgust, anger, sadness) was a within-subject factor.[1] The dependent variable was whether the story was correct or not, scored 1 or 0. In the first analysis, correctness was determined by the best-guess criterion; in the second, by the plausibility criterion. The results are summarised in Table 1.

A significant main effect for mode of presentation occurred in both analyses. Contrary to the prediction of a Face Superiority Effect, the children's overall performance in the word mode was significantly higher than in the face mode (.44 vs. .32 for best guess, .64 vs. .51 for plausibility).

The main effect for mode must be qualified by the mode × emotion interaction effect, significant in both analyses. In both

[1] In order to ensure that our results reflected children's understanding of the causes of different emotions, rather than their ability to perform the storytelling task itself, and because the happy trial was not counterbalanced in its order, we reanalysed the data excluding those children who failed the happy trial (i.e., gave either a nonstory or an implausible one). In the reanalysis, the responses of 48 children were excluded, reducing the number of participants to 112, the number of emotion trials to five, and the number of responses to 560. Overall, the pattern of results was the same as in the original analysis: The main effects for age, mode, and emotion were significant in both analyses, as was the mode × emotion interaction; and the significant age by mode interaction by the plausibility criterion was replicated. The advantage of the word over the face mode for fear and disgust was again significant ($p < .001$).

Table 1
Analyses of variance for two criteria of correctness

		Best guess		*Plausibility*	
Source	*df*	*MS*	*F*	*MS*	*F*
A (Age)	1	11.70	55.57**	17.07	56.48**
B (Mode)	1	3.75	17.80**	4.00	13.25**
AB	1	0.15	0.71	0.15	0.50
C (Sex)	1	0.01	0.02	0.04	0.12
AC	1	0.34	1.60	0.15	0.50
BC	1	0.42	1.98	1.20	3.98*
ABC	1	0.42	1.98	0.42	1.38
S—Within	152				
D (Emotion)	5	9.08	57.77**	5.20	31.28**
AD	5	0.26	1.68	0.71	4.30**
BD	5	1.62	10.27**	1.05	6.30**
CD	5	0.04	0.28	0.07	0.42
ABD	5	0.26	1.65	0.27	1.61
ACD	5	0.14	0.91	0.13	0.77
BCD	5	0.17	1.06	0.14	0.82
ABCD	5	0.06	0.39	0.25	1.53
CS—Within	760				

*$p < .05$; **$p < .001$.

analyses, the difference between modes was significant only for fear ($p < .001$) and disgust ($p < .001$).[2] The word mode resulted in a higher proportion correct for four of the five emotions. By the best-guess criterion (Figure 1a), anger was the exception, but the reversal was not significant. By the plausibility criterion (Figure 1b), surprise was the exception, but the reversal was again not significant.

Performance improved significantly with age. Indeed, the improvement with age occurred with each emotion separately (Table 2). The significant main effect for emotion, present in both analyses, showed that children were better able to generate causes for some emotions than for others (Table 2, column means). The rank order of emotions was only slightly different by the two criteria.

Two interaction effects were significant only by the plausibility criterion. First, the mode × sex interaction was significant: the overall superiority of a word over face was present for both boys and girls, but significant only for the boys. Nonetheless, for the girls, the Word Superiority Effect replicated for both disgust ($p < .001$) and fear ($p = .06$). Second, the age × emotion interaction (Table 2) was significant. For each emotion, the proportion correct increased with age. The interaction was due to the different rates of increase for the different emotions. The age × emotion interaction was not significant by the best-guess criterion, although the same trend was present.

Previous studies (Bullock & Russell, 1985, 1986; Russell, 1990) had found that children's implicit definition of the word *surprised* was more like the adult definition of *excited* or *happy* than of *surprised*—a child's sense of the word *surprised* has a positive valence. In contrast, their implicit definition of the surprise face is neutral in valence. The present results showed a similar effect (Table 3). The stories the children produced for the word *surprise* was more often positive than negative, whereas stories they produced for the surprise facial expression were rated positive and negative about equally often.

Discussion

The results of this study replicated with a larger sample the findings of Russell (1990) and extended them to younger children (3-year-olds), to an additional emotion (disgust), to new facial stimuli, and to a boy rather than girl poser of the expression. The results also replicated, with a different method, Camras and Allison (1985). Although limited to one laboratory method and to one set of facial expressions, our findings appear robust across at least some changes in method and in the person showing the facial expression.

The Word Superiority Effect was clearest for fear and disgust. Children also have more difficulty labelling fear and disgust than other facial expressions (Harrigan, 1984; Hosie, Gray, Russell, Scott, & Hunter, 1998; Markham & Adams, 1992; Wiggers & van Lieshout, 1985). Perhaps fear and disgust expressions are more difficult for children to understand, or perhaps they are less common in everyday experience, or perhaps recognition of these expressions matures more slowly. Interestingly, children's difficulty labelling such facial expressions has been attributed to their vocabulary. The Word Superiority Effect speaks against this interpretation. Superiority of the word *disgusted* over the corresponding face is especially interesting in light of evidence that the word *disgusted* is acquired later than *happy*, *sad*, *angry*, and *afraid* (Bretherton & Beeghly, 1982).

We found little evidence of a Face Superiority Effect. For no emotion was a facial expression significantly better than the corresponding word. We did find a possible Face Superiority Effect for anger and surprise, but these results may not be

[2] The age × mode and the age × mode × emotion interactions were not significant in the analysis of either the best-guess or plausibility ratings. However, because *post hoc* analysis indicated that the difference between the word and face modes was significant only for fear and disgust, we repeated the ANOVAs with only these two emotions to investigate whether age would interact with mode for either of these emotions. It did not.

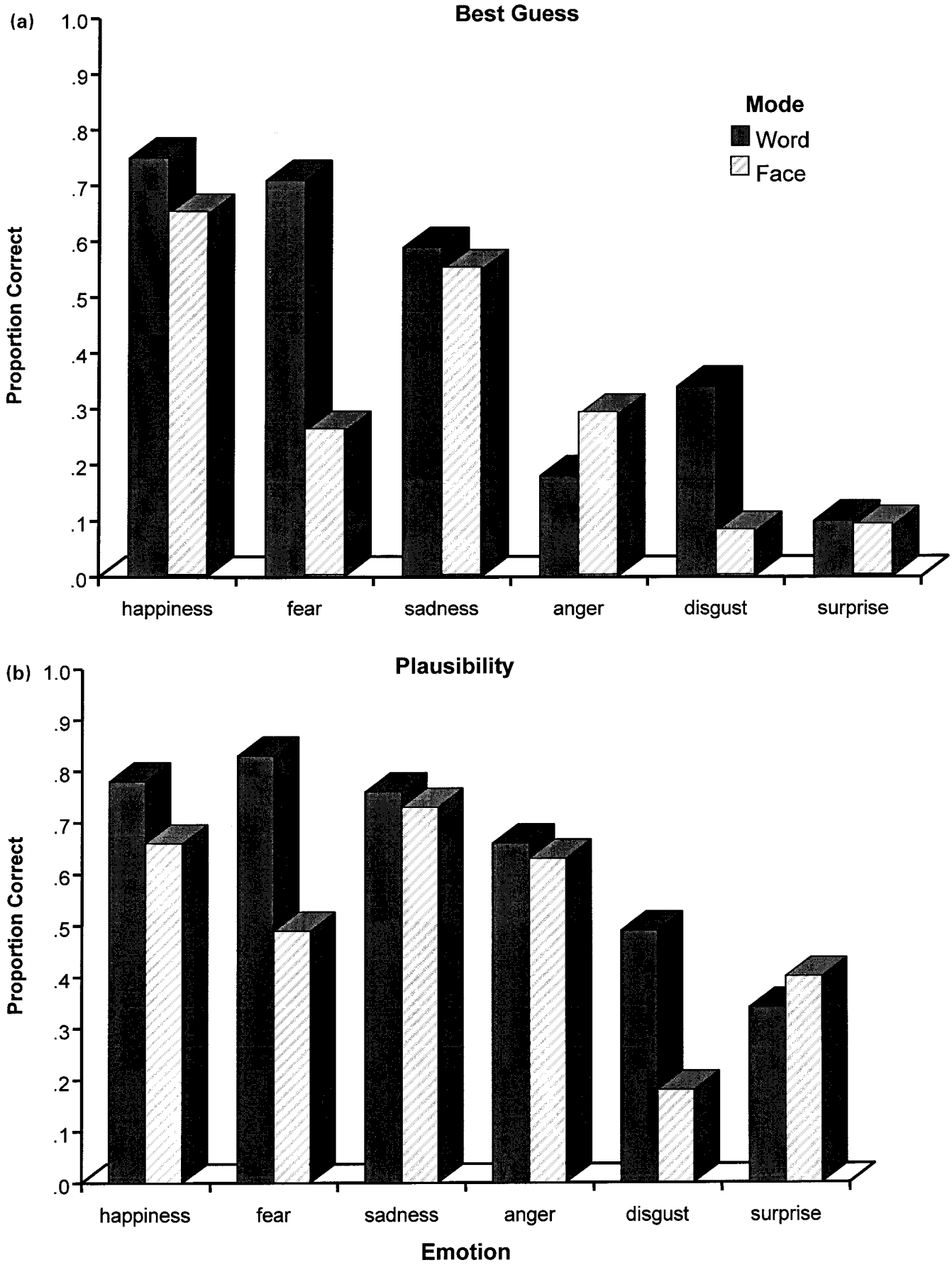

Figure 1. Effect of mode of presentation (word or face) on proportion correct for each emotion: (a) shows results when correctness was determined by best guess; (b) shows results when correctness was determined by a rating of plausibility.

Table 2
Effect of age and emotion in children's generation of a cause for the emotion

	Emotion						
Age	*Happiness*	*Fear*	*Sadness*	*Anger*	*Disgust*	*Surprise*	*Mean*
Proportion correct by best-guess criterion							
3	0.56	0.40	0.41	0.13	0.08	0.05	0.27
4	0.84	0.58	0.73	0.34	0.34	0.14	0.49
Mean	0.70	0.49	0.57	0.23	0.21	0.09	
Proportion correct by plausibility criterion							
3	0.60_{a}	0.58_{a}	0.55_{a}	0.41_{c}	0.28_{b}	0.25_{b}	0.44
4	0.84_{de}	0.74_{d}	0.94_{e}	0.88_{e}	0.39_{ab}	0.49_{a}	0.71
Mean	0.71	0.66	0.74	0.64	0.33	0.37	

Note: Alpha = .05 for all Tukey's Least Significant Differences (LSD) comparisons. For the best-guess criterion, the age × emotion interaction was not significant, and no *post-hoc* analyses were calculated. For the plausibility criterion, means in the same row that do not share a subscript differ at $p < .03$. Means in the same column that do not share a subscript differ at $p < .03$.

reliable: they were small, nonsignificant, and limited to the best-guess criterion (for anger) or to the plausibility criterion (for surprise). In addition, both Camras and Allison (1985) and Russell (1990) had found the opposite result for these two emotions.

In everyday contexts, children do not hear stories in which an emotion word, such as *scared*, is repeated five times within four sentences. Nor do children stare at black and white still photographs of faces. They hear emotion words embedded in conversations and see dynamic facial movements embedded in a rich set of other cues to emotion. One cannot automatically generalise from the present results to events in everyday contexts. Our results should stimulate research about the power of more ecologically representative portrayals of facial expressions. However, we doubt that such portrayals will reverse our findings. There is little evidence, for example, that children routinely witness the intense, prototypical emotional displays shown in our black and white photographs. Milder displays with only some of the facial components of the full pattern might be more representative of what is seen in everyday situations (Carroll & Russell, 1996). If so, it is possible that facial expressions are a more powerful stimulus in the laboratory than in the home. There also remains the possibility that the Word Superiority Effect is limited to certain tasks. Specifically, perhaps the word mode of presentation provided children an advantage because the response required here and in Russell's (1990) earlier study was verbal. This possibility requires further investigation.

Evidence so far is limited to children 3 years of age and older. Relative power of faces and words at younger ages remains unknown. Still, lack of a Face Superiority Effect for those aged 3 and older challenges the perceptual bedrock hypotheses as the best account for acquisition of knowledge during a period when much of that acquisition takes place (Harris, 1989). We can envision a variety of developmental accounts that incorporate the importance of specific facial expressions (especially smiling and crying at younger ages), the importance of dimensions such as valence and arousal, and the importance of words such as *scared* and *disgusted*, at older ages. Perhaps during that period a child typically learns that mother is afraid of speeding automobiles and disgusted at worms rather than vice versa by hearing how her reaction is labelled (Dunn, Brown, & Beardsall, 1991; Miller & Sperry, 1987). A re-examination of the general assumption that an early ability to recognise specific basic emotions from facial expressions is the foundation for acquisition of knowledge about all the emotions across a significant portion of the relevant developmental period is required. Thus, the present results raise important questions and suggest the need for a specific account that can provide a rapprochement between different perspectives and the evidence cited in support of each.

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Table 3
The number of surprise stories rated as positive or negative in each mode of presentation

	Mode of presentation	
Rating	*Word*	*Face*
Positive	47	24
Negative	12	29

Note: $N = 124$. All stories in response to the emotion surprise that were incorrect by the best-guess criterion were analysed. Those stories for which the raters' best guess was *happy* were classifed as positive; those stories for which the best guess was anger, fear, sadness, or disgust were classified as negative. $\chi^2_{df=1} = 14.22$, $p < .001$.

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