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AUTHOR Bullock, Merry; Russell, James A.
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ABSTRACT

This report discusses three studies of 2- to 5-year-old children's interpretations of facial expressions in terms of (1) the structure of the emotional domain and (2) prototypic example, overlap, and range of emotion categories. In the first study, 78 children were asked to make similarity judgments about 10 photographed facial expressions by sorting the photographs into two, three, and five piles. Results suggested that children as young as 2 years structure the emotional domain in roughly the same way as older children and adults and that they may perceive emotion in terms of pleasure and arousal. In the second study, 60 pre-schoolers at each of four age levels and a comparison group of 60 adults were asked to tell which of two facial expressions corresponded to an emotion label. In general, children's choices indicated that their categories of emotion are broader than adults', although children and adults usually shared the same prototype. In the last study, 48 children and 20 adults were asked to tell whether or not each of the 10 facial expressions corresponded to an emotion label. Results indicated that, for each emotion word, several faces apply; in addition, each face was seen as an example of several emotions. In both cases, the range narrowed with age. It was concluded that it is more useful to describe carefully children's behavior in interpreting facial expressions than to assess children's responses against an adult norm. (Author/CB)

THE EMOTION CONCEPTS OF YOUNG CHILDREN

Merry Bullock and James A. Russell

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Poster presented at the Meetings of the

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Requests for further information may be sent to either author, Psychology Department, University of British Columbia, Vancouver, B.C., Canada V6T 1W5.

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Merry Bullock and James A. Russell

University of British Columbia

What meanings do children attach to the emotional expressions of others, and what meanings do they attach to emotion words?

By the preschool years, children use emotion labels when identifying their own and others' emotional (e.g., facial) expressions, but it is not until the grade school years that they are as consistent as adults in identifying referents for such terms as angry, surprised, disgusted, happy and sad. A question that arises from this well documented observation concerns the nature of the emotion concepts that underlie young children's performance. Are words and faces taken as expressions of discrete, qualitatively different emotions, implying that the emotion domain is represented in terms of categories? Or, alternatively, are words and faces interpreted in terms of variation along more quantitative dimensions such as pleasure/displeasure, arousal, or intensity?

Each of these two views of emotion concepts capture aspects of the meanings adults give to emotion. For adults, emotions often have prototypical expressions (consistent with a category view), but many expressions, even prototypical ones, are also interpreted as belonging to more than one category. Further, adults structure the entire emotion domain in an organization which can be characterized as a combination of values on the dimensions of pleasure/displeasure and arousal (consistent with the dimensional view).

The studies to be reported here are part of a project on children's understanding of emotion. In this part, we have asked several hundred preschoolers, between the ages of 2 and 5, to provide their interpretations of

emotional expressions (faces) and emotion words. Across tasks, they have matched facial expressions to words, judged whether each of a set of facial expressions does or does not illustrate an emotion, and provided nonverbal similarity ratings across different emotion expressions. The results from our studies suggest that by the age of 5 children are remarkably adult-like in their interpretation of facial expressions. Older preschoolers agree with adults on the prototypes for most emotion categories, although their categories are more broad. They also interrelate different emotions according to the same dimensions of pleasure and arousal. The pattern of changes across the preschool years suggest that although 2 year olds structure the similarity among emotions according to an order described by the dimensions of pleasure and arousal, they have but precursors to emotion categories. Their "categories" are very broad, sometimes include different facial expressions, and do not always show consistent prototypes. These results lead us to suggest that the interpretation of emotions as qualitatively distinct states (ie., categories) emerges out a prior classification in terms of dimensions. Three studies illustrate part of the basis for this conclusion.

STUDY 1: THE STRUCTURE OF THE EMOTION DOMAIN

The purpose of this study was to assess the ways in which children perceive similarity and differences across different emotions. This extended prior work of ours with older subjects in which we found that the emotion domain could be represented in terms of a circular ordering, defined by 2 dimensions as illustrated in Figure 1.

Insert Figure 1 about here

In this task, subjects were asked to put faces they saw as expressing similar feelings into 2, 3 and 5 piles. Results of these sortings were then

analyzed by multidimensional scaling.

Subjects. Seventy-eight children participated, ranging in age from 2 to 4 years.

Procedure: Children were asked to make similarity judgments about the 90 facial expressions illustrated in Figure 2 plus one neutral expression. Prior to the experimental task, subjects selected "anchors" by choosing first one face, and then one "most different"; then by choosing three "most different". The anchors were used in two of the 3 sorting tasks.

Insert Figure 2 about here

Task 1: Sorting into 2 piles. The anchors chosen previously were placed in front of the child. The remaining 8 photos were presented one at a time and the child was asked to place each with the anchor photo who "feels most like" the test photo.

Task 2: Sorting into 3 piles. The above procedure was repeated with 3 different anchors.

Task 3: Sorting into 5 piles. One of the 10 pictures was chosen at random and the subject was asked to find another who "feels most like" it. These two were set aside and the procedure repeated with the remaining 8, then 6, then 4 photos.

Results. The measure of similarity was a sum of the times two facial expressions were placed in the same pile, weighted in accordance with the number of piles. This produced a similarity matrix (all pairwise comparisons of the 10 pictures) for each child, which was averaged across age groups. Each matrix was analyzed by Guttman-Lingoes smallest space program SSA-1.

This analysis supported a two-dimensional solution (stress test) for each age group. The resulting solutions are illustrated in Figure 3, with

analogous solutions from two older age groups for comparison (from Russell & Bullock, 1983).

Insert Figure 3 about here

At each age level, the overall patterns were similar, although the specific placement of expressions within each quadrant varied. We also correlated the present results with independently obtained (adult) ratings for each expression on the dimensions of pleasure and arousal. Pleasure correlated .80, .88 and .89 with the horizontal dimensions for the solutions of the 2, 3 and 4-year olds respectively, and arousal correlated .84, .95 and .87.

These results suggest that children as young as 2 years structure the emotion domain in roughly the same ways as older children and adults. This structure, in turn, may be derived from values along bipolar dimensions of pleasure and arousal. The perception of emotion in terms of pleasure and arousal may, therefore, represent basic methanisms in the interpretation of affective state.

STUDY 2: CATEGORIES OF EMOTION

Children may perceive emotion in terms of pleasure and arousal, but do they go further and delineate discrete categories such as anger, fear and disgust (all unpleasant, high arousal states), or happiness, excitement and surprise? To address this question we asked children to pick facial expressions for emotion words. We used the 9 expressions illustrated in Figure 1. The labels we used were ones familiar to preschoolers: happy, sad, excited, surprised, scared, mad, disgusted, calm and sleepy and each labelled one expression, a "target". Over trials, the target was paired with every other photo as an alternative. On a given trial the subject was told a word

and asked to pick the one of two faces (target and alternative) which illustrated the emotion named. The 8 trials for each of 9 words resulted in a total of 72 trials.

We hypothesized that responses over the 8 trials per word would give us a rough estimate of children's categories of emotion. If children share adult categories and facial expression prototypes they should pick the target 100% of the time, or show only random error. Alternatively, if children have broader categories or represent categories by different prototypes their "errors" (choice of alternative vs. target) may be orderly. Based on the idea that emotion categories are overlapping, not discrete categories, we predicted that the probability of an error should increase as the alternative was more similar to the target, where "more similar" is defined as distance in the circular ordering seen in Study 1. We therefore labelled the trials in terms of "Steps". Step 1 trials were ones where the target was paired with an alternative adjacent to it in the circular ordering; Steps 2, 3 and 4 trials involved alternatives progressively distant.

Subjects. There were 60 subjects at each of 5 age levels: 2-year olds, 3-year olds, 4-year-olds, 5-year-olds and adults.

Procedure. The subject was shown 2 facial expressions, with position randomly determined. He/she was asked "Which person is (emotion word)?". Each subject was given 18 trials, 2 for each of the 9 emotion words. For half the subjects the target was paired with Step 1 and Step 2 alternatives. For the other half, the target was paired with Step 3 and Step 4 alternatives.

Results. The subjects' choices were scored as correct (picked target) or not for each trial. The figure below illustrates the patterns of errors across all trials for comparisons where the alternative was 1,2,3 or 4 steps from the target. As can be seen, errors were most likely to occur when the alternative was an adjacent expression, and decreased with increasing distance

between target and alternative. The effect of step was signficant for every age group except the 3-year-olds.

Insert Figure 4 about here

To find out what faces the children picked when they did not choose the target, we plotted histograms of choices for each word below. Figures 5 and 6 show two examples, for the words mad and surprised. In general, children's choices indicated that their categories of emotion are broader than adults', although in most cases they share the same prototype. There were exceptions to this, as noted in the results for surprised. Here, the children's prototype (or modal choice) appeared shifted toward expressions of pleasure (Face B, and to some extent A, I and H). We noted similar shifts for disgusted (from Face F to E).

Insert Figures 5 and 6 about here

STUDY 3: THE RANGE OF EMOTION CATEGORIES

To assess the range of expressions children see as being examples of a particular emotion, we designed a sample task: children were shown a set of facial expressions and asked, for each expression "is this person X" with X replaced by one of a list of emotion terms, including happy, excited, surprised, scared, mad, disgusted, sad, sleepy, and calm.

Subjects: Sixty-eight subjects participated. These included 12 3-, 4- and 5-year-olds and 20 adults.

Procedure: Subjects were shown a set of facial expressions, including those illustrated in Figure 2, one at a time. For each run through the set they were queried about one emotion, chosen from the list of emotion words. Each

subject repeated this task for an emotion word.

Results: The frequency with which each picture was selected for each word was tallied within age groups. These results are presented in the Tables 1 through 4, with choices of 50% or more underlined.

Insert Tables 1-4 about here

These data provide a window on the breadth of children's categories. For each emotion word, several faces apply, with the range narrowing with age. Similarly, each face is seen as an example of several categories of emotion, again with the range narrowing with age.

CONCLUSIONS

Until recently, children's interpretation of facial expressions have been investigated by assessing their accuracy against an adult norm. The implicit notion was that the skills underlying interpretation of emotions must yield adult categories: children were seen as inaccurate adults. The conceptual notions of structure, overlapping sets, and dimensions, we believe, provide a richer and fuller account of the development of the interpretation of emotion. These ideas are not the whole story, however. Phenomena such as broader category boundaries and shifted focal points suggest that children's processing of emotional information differs in even more fundamental ways from that of adults. So, perhaps the primary lesson to be learned from the results of the present studies is that an "inaccurate adult" provides a poor model of a child, and that it will be more useful to describe children's behavior carefully than to assess it as accurate or inaccurate.

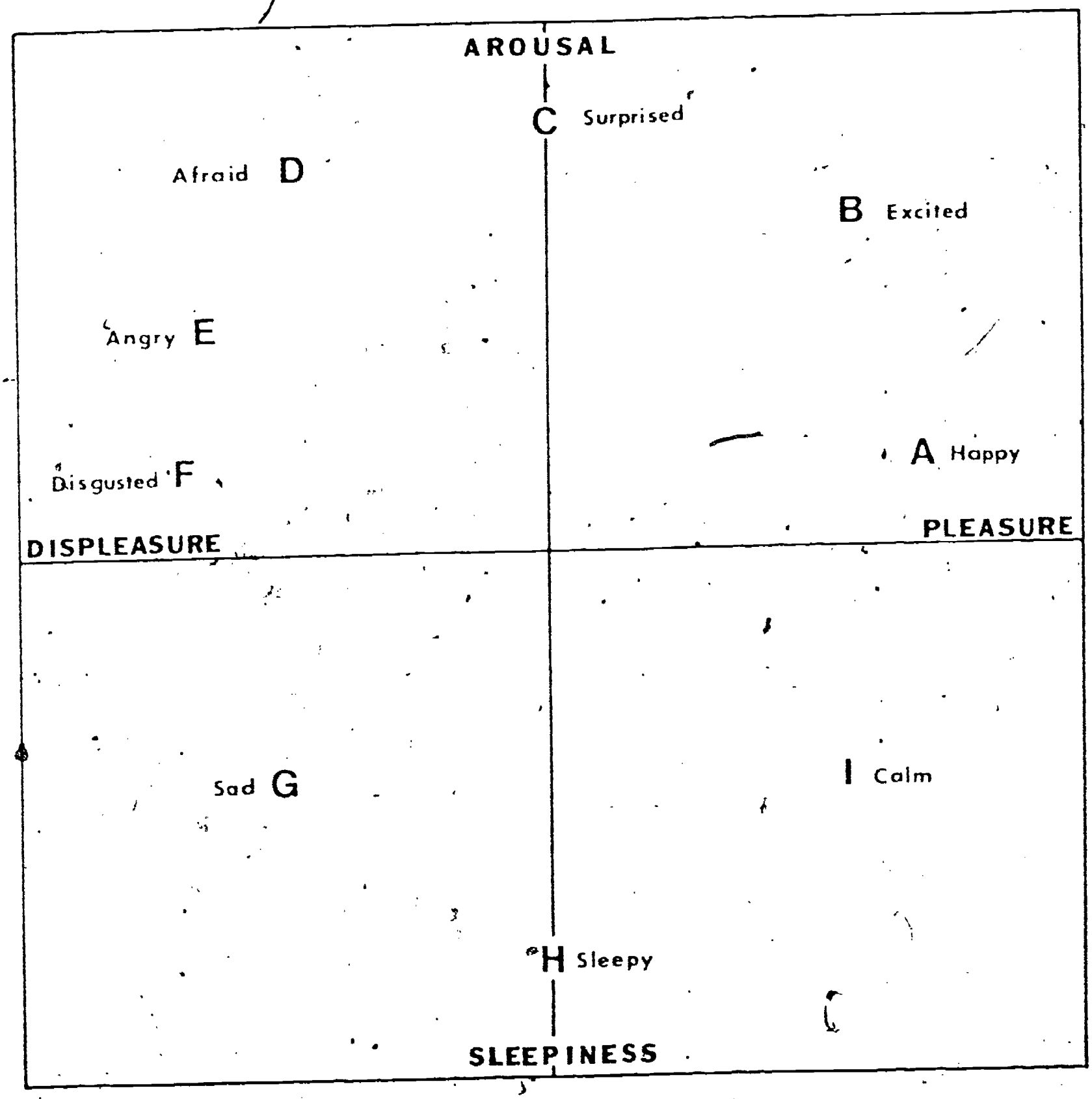


FIGURE 1. Idealized illustration of the structure of emotions in terms of the dimensions on pleasure/displeasure and arousal/sleepiness.

A B C D E F G H I

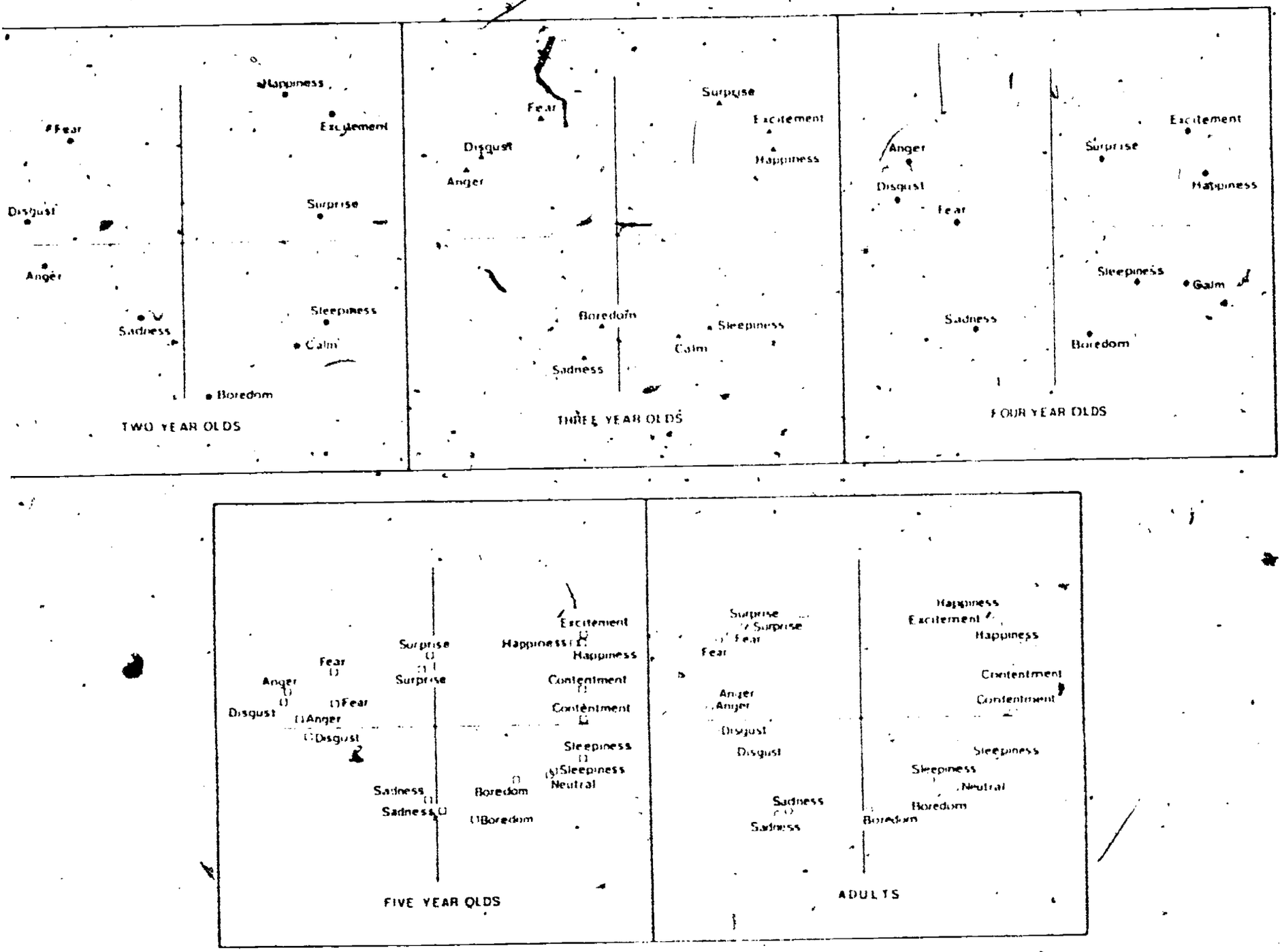


FIGURE 3. Multidimensional solutions for Sorting Study (Study 1) and comparison results from Russell & Bullock(1983). Note: stimuli for comparison results involved two facial expressions for most emotions.

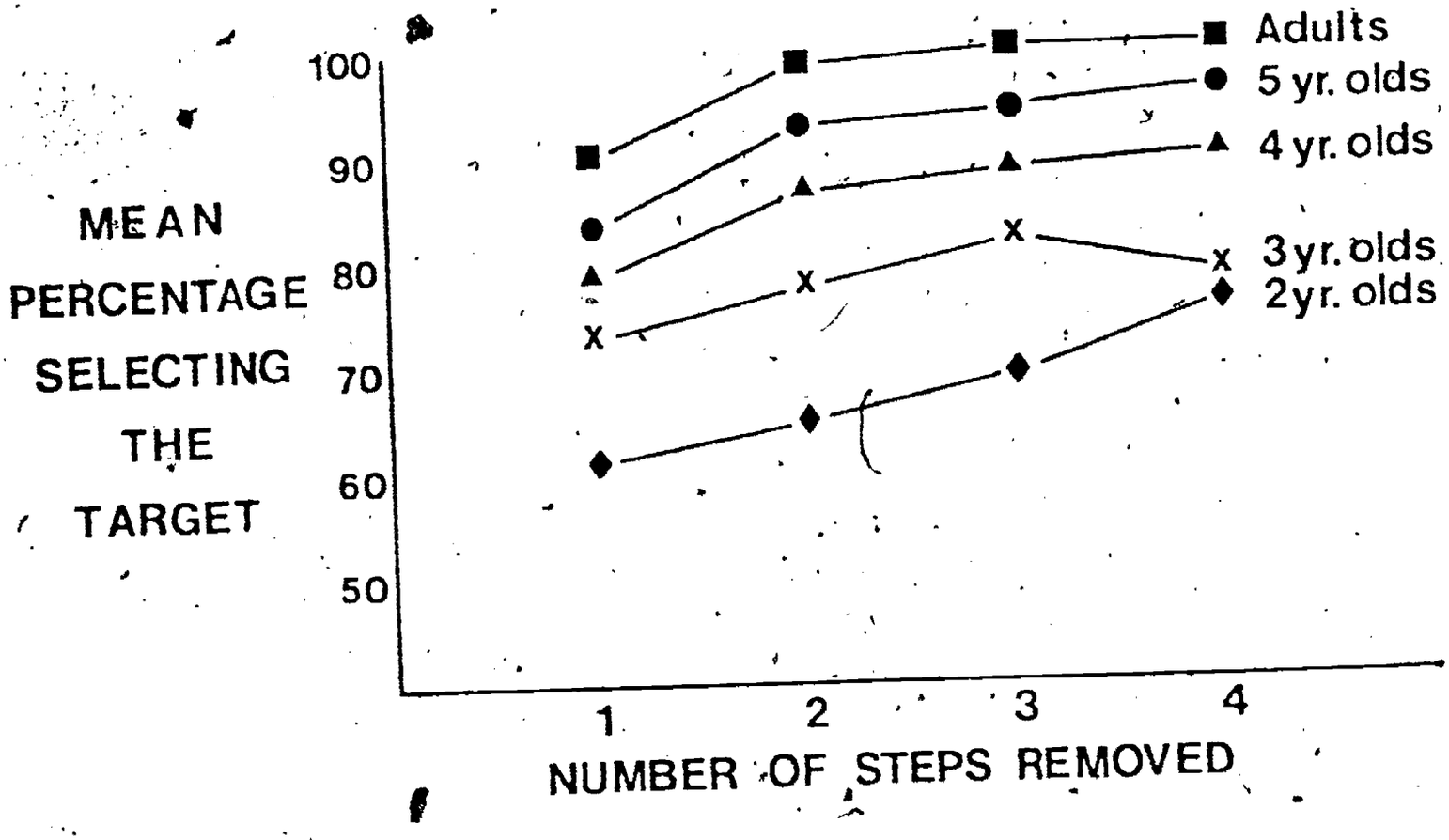
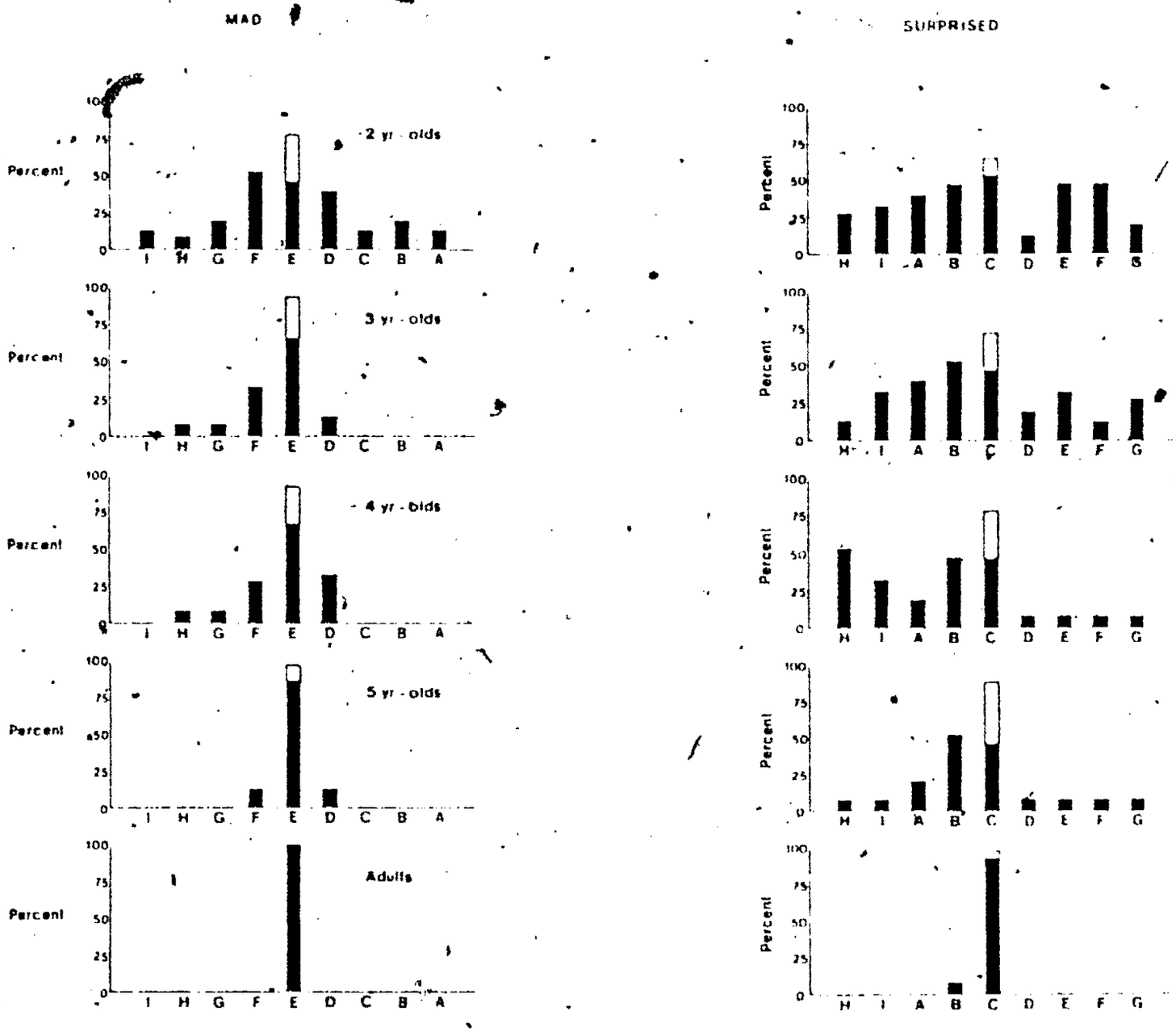


FIGURE 4. MEAN PERCENTAGE CORRECT CHOICES AS A FUNCTION OF DISTANCE BETWEEN ALTERNATIVE AND TARGET



FIGURES 5 AND 6. HISTOGRAMS SHOWING PERCENTAGE OF TIMES EACH FACE CHOSEN FOR THE WORDS MAD (Fig 5) AND SURPRISED (Fig 6).

TABLE 1.
PERCENTAGE OF 3-YEAR-OLDS CHOOSING EACH FACE AS AN EXAMPLE OF EACH OF 9 EMOTIONS

	FACIAL EXPRESSION								
	A	B	C	D	E	F	G	H	I
HAPPY	92	100	17	0	0	8	8	67	92
EXCITED	58	67	25	17	17	17	8	25	42
SURPRISED	67	67	33	17	8	8	8	42	50
SCARED	8	0	50	50	25	17	8	0	8
MAD	0	0	17	42	92	75	25	0	0
DISGUSTED	17	8	25	50	58	67	33	25	25
SAD	0	0	25	42	17	25	67	0	0
SLEEPY	33	25	33	25	33	33	50	42	42
CALM	42	25	42	8	17	25	42	83	75

TABLE 2
PERCENTAGE OF 4-YEAR-OLDS CHOOSING EACH FACE AS AN EXAMPLE OF EACH OF 9 EMOTIONS

	FACIAL EXPRESSION								
	A	B	C	D	E	F	G	H	I
HAPPY	92	92	8	0	0	0	0	17	67
EXCITED	50	83	33	0	8	0	0	0	8
SURPRISED	50	67	42	8	0	0	8	17	25
SCARED	0	0	25	57	17	0	8	0	0
MAD	0	0	8	17	92	92	8	0	0
DISGUSTED	0	0	42	33	42	42	33	25	8
SAD	0	0	17	17	0	0	75	8	0
SLEEPY	0	0	8	17	8	8	58	42	8
CALM	25	33	17	8	0	0	17	58	67

TABLE 3
PERCENTAGE OF 5-YEAR-OLDS CHOOSING EACH FACE AS AN EXAMPLE OF EACH OF 9 EMOTIONS

	FACIAL EXPRESSION								
	A	B	C	D	E	F	G	H	I
HAPPY	92	92	8	0	0	0	0	25	75
EXCITED	58	75	17	8	0	8	0	0	17
SURPRISED	33	58	67	17	0	0	0	0	17
SCARED	0	0	42	100	0	0	8	0	0
MAD	0	0	0	8	100	83	0	0	0
DISGUSTED	0	0	25	25	50	75	8	25	17
SAD	0	0	0	0	0	0	100	17	0
SLEEPY	0	8	0	0	0	0	42	50	17
CALM	25	0	0	0	0	0	33	83	83

TABLE 4
PERCENTAGE OF ADULTS CHOOSING EACH FACE AS AN EXAMPLE OF EACH OF 9 EMOTIONS

	FACIAL EXPRESSION								
	A	B	C	D	E	F	G	H	I
HAPPY	100	96	0	0	0	0	0	4	96
EXCITED	48	88	20	28	32	8	0	0	0
SURPRISED	16	76	100	56	16	4	0	0	0
SCARED	0	0	76	92	12	0	20	4	0
MAD	0	0	8	44	96	48	12	8	0
DISGUSTED	4	0	4	16	56	92	16	28	0
SAD	0	0	8	8	4	8	100	52	0
SLEEPY	4	0	4	0	0	0	24	88	24
CALM	84	32	12	0	0	16	32	80	96