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ABSTRACT

The experiment was designed to see whether children differ from adults in the ability to understand nonverbal responses of other children. Ten third-grade children were secretly filmed while watching a very easy and a very hard math lesson. Third graders, sixth graders, and adults (college students) were asked to judge, based on a film of each child's face, whether the subject understood a lot, a little, or none of the lesson. The children were more successful at this than the adults, although the degree of accuracy in an absolute sense was not particularly high for either adults or children. Participants also found it easier to tell whether males were watching difficult or easy lessons. The results should not be taken to indicate that children encode all nonverbal responses better than adults, but rather that their familiarity with the social situations of their peers helps them infer the meaning of different facial expressions of other children. The results of this experiment have clear implications for classroom teaching and tutoring by children. (CD)

Technical Report No. 365

DECODING OF CHILDREN'S NONVERBAL RESPONSES

by

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Report from the Project on
Conditions of School Learning and Instructional Strategies

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I

INTRODUCTION

The human face is capable of producing a rich and subtle set of responses which express the full gamut of affect and emotions. The expression or production of nonverbal responses by the face (human or nonhuman) has been a topic of scientific interest since Darwin's (1872) early writing. It was not until recently, however, that the process of decoding nonverbal behavior received systematic attention (Ekman, 1971; Mehrabian, 1971). It is now well established that humans are capable of correctly inferring the affective states held by other persons from their nonverbal behavior, whether by viewing still pictures (Zaidel & Mehrabian, 1969) or video tape recordings of ongoing behavior (Lanzetta & Kleck, 1970). The ability to decode accurately has been shown to exist in chimpanzees, who are reliably able to detect facial expressions indicative of fear in others of the same species (Miller, Banks, & Ogawa, 1963).

However, there is still a paucity of research regarding development of decoding skills and, for that matter, the development of nonverbal behavior in general. One of the very few studies directly examining developmental trends in the decoding of nonverbal behavior was conducted by Dimitrovsky (1964), who investigated the identification of emotional content of an adult's vocal expressions by children ranging in age from 5 to 12. Subjects were asked to discuss the emotions of happiness, sadness, anger, and love as verbally encoded by an adult. Results showed a significant increase with age in children's ability to identify correctly the emotional content of the encoded responses. Teresa (1972) compared the accuracy of teachers and fourth, fifth, and sixth grade students in decoding a film of an actress who displayed several different emotions. There was some variation in performance by the different groups: teachers seemed to show slightly greater accuracy than students, and there were some significant differences between the grade levels on correct identification of particular emotions. In general, though, the results were inconclusive.

A few other studies have looked specifically at age trends in the ability to decode nonverbal behavior. However, they were primarily concerned with comparing the degree to which simultaneous variations in verbal, vocal, and visual channels produced differential evaluations in adults and children (Bugental, Kaswan, Love, & Fox, 1970). In sum, it appears that there is little theoretical explanation in current literature on age differences in decoding behavior, and the results of most studies are not consistent with each other.

The present study examined systematically the relative decoding ability of adults and children in drawing inferences from the nonverbal behavior of a set of stimulus children. Our approach to the problem was based upon a social skills theory of interpersonal behavior (Argyle, 1969). According to this theory, individuals differ in their interaction skills in different social settings and in their sensitivity to the cues emitted by others. It is assumed that social skills are learned in the course of a person's interaction with others.

Two opposing predictions can be drawn from the social skills approach, depending on the nature of the encoding of children's nonverbal behavior. If children's encoding differs in some fundamental way from that of adults--either qualitatively or quantitatively--then children should be superior to adults in their ability to decode nonverbal cues from other children. The rationale for this prediction is that children have considerably greater social experience in interacting with other children than do adults, and thus children should be more adept at decoding the nonverbal behavior of their peers.

The opposite prediction can also be derived from the social skills orientation. If it is the case that children's nonverbal encoding is similar to that of adults, then adults should be more accurate than children in the decoding of nonverbal behavior since they have had considerably more opportunity to interact with and interpret other person's behavior. The same prediction may be derived from a simple cognitive development approach to the decoding process: one would expect adults, who operate at a higher cognitive level, to show greater skill in the cognitive task of decoding.

In this study, adults, third graders, and sixth graders observed silent, 30-second samples of third grade stimulus persons on videotape. Each stimulus person was shown listening to either a very easy or very difficult lesson. The subjects were asked to rate the degree of understanding of the stimulus person by drawing inferences from their nonverbal responses. It was hypothesized that children and adults would differ in accuracy.

II

METHOD

PREPARATION OF STIMULUS MATERIALS

Stimulus persons consisted of five male and five female third graders who were each paid $1.50 for their participation in an unspecified educational study. Each child, upon arrival, was brought into a room containing a chair, table, blackboard, and a video tape camera. After being seated in front of the table (facing the camera), the subject was told that he or she was going to listen to two lessons on a tape recorder. The child was instructed to listen very carefully, since later he or she would be asked some questions on the content of the lesson. The camera was then pointed out and he or she was informed (falsely) that it would be used only to take a picture before the lessons began. The child was asked to pose for the picture, at which time the experimenter focused and positioned the camera so that the child's face was completely in view of the camera. This ruse was used to make the stimulus person believe that the camera was not recording his or her expressions while he or she was actually listening to the lessons later.

The experimenter then turned on one of the tape recorded lessons and left the room. In the lesson the teacher referred to material on the blackboard located directly in front of the child. Thus, the child's attention was focused on one specific area of the room, and the camera was able to record the nonverbal behavior from a consistent angle.

The stimulus person first heard one of two different lessons--an easy lesson or a difficult lesson. Half the stimulus persons heard the easy lesson first followed by the difficult lesson; the order was reversed for the other half. At the end of the lesson that was presented first, the experimenter returned and told the child that he or she would hear a second lesson. The blackboard was inverted so that material referring to the second lesson was shown. The experimenter then started the tape recording of the second lesson and left the room.

Content of the easy lesson was at a first grade level and consisted of information on the concepts of "less than," "greater than," and "equal." The difficult lesson was obtained from a sixth grade textbook and explained the concept of negative numbers. Each lesson lasted four and one-half minutes.

Following the presentation of the lessons, the stimulus person was given a brief questionnaire concerning the level of difficulty of the lessons just heard. The stimulus persons responded on two five-point scales labeled "very easy," "easy," "not easy and not hard," "hard," and

"very hard." The results showed that the easy lesson was rated significantly easier than the difficult lesson by the stimulus persons ($t = 4.98$, $p < .001$).

The nonverbal responses of the 10 stimulus children to the two lessons were video taped. The same 30-second segment from each child's nonverbal responses to both the easy and difficult lessons was copied from the original video tape; each segment consisted of the 30 seconds of the stimulus person's behavior which began 45 seconds after the start of each lesson. Since there were 10 stimulus persons, each of whom heard an easy and difficult lesson, there were a total of 20 samples of nonverbal behavior.

The 20 samples were spliced together on a new video tape in a partially random order that was subject to two systematic restrictions. First, male and female stimulus person samples were alternated and, second, no more than two of the same type of lesson (easy or difficult) appeared consecutively. Thus the final set of stimuli consisted of 20 30-second segments, with five male stimulus persons listening to an easy and a difficult lesson and five female stimulus persons also listening to an easy and difficult lesson. Two stimulus tapes were prepared; one tape showed the 20 segments in one order, and the other tape showed the segments in the reverse order. This procedure allowed us to examine the possibility of sequence effects in the decoding process.

SUBJECTS

Subjects were 45 third graders (28 males and 17 females), 51 sixth graders (26 males and 25 females), and 36 college students (12 males and 24 females). The college students were enrolled in graduate education courses at the University of Wisconsin, and most were experienced teachers. The children attended suburban Wisconsin elementary and middle schools. Subjects of the same age level were shown the stimulus video tape on large television monitors in groups ranging in size from 9 to 29 students.

DEPENDENT MEASURES

Subjects rated each stimulus person in the 30-second segments on a six-point, Likert scale which asked, "How much did the student understand about the lesson?" The six points on each scale were labeled "understood everything," "understood very much," "understood a lot," "understood some," "understood a little bit," or "did not understand at all." Subjects were given a booklet containing the 20 six-point scales, with one scale on each page.

PROCEDURE

Subjects were told that they would view a number of short film segments of children sitting alone in a room listening to a new kind of arithmetic lesson. Subjects were informed that the stimulus persons were not aware that

they were being video taped. The experimenter then explained that subjects would be shown one film segment at a time without any sound, and after seeing each film they would be asked to respond to the dependent measure which asked how much the student understood about the lesson. The experimenter emphasized the importance of carefully and closely viewing each video tape segment completely before responding to the dependent measure. Subjects were then shown the 20 segments, with a pause after each to rate the perceived understanding of the stimulus person. Half the subjects viewed the tapes in one order, and the other half in the opposite order.

METHOD OF ANALYSIS

Data from the Likert scales were analyzed in a 3x2x2x2x2x10 mixed design analysis of variance. The between-subjects factors were age of subject (third grade, sixth grade, college level), sex of subject (male, female), and sequence of presentation of stimulus tape (forward, reverse). Within-subjects factors were lesson difficulty (easy, difficult), sex of stimulus persons (male, female), and stimulus persons (10 stimulus children). The stimulus persons factor was nested within levels of the sex of stimulus person factor. A preliminary analysis of the data showed that the sequence of presentation of the stimulus tape had no systematic effects, so this variable was collapsed for the final analysis of the data.

III

RESULTS

Table 1 presents results for the decoding data. The analysis of variance revealed three significant main effects. The type of lesson being listened to (easy or difficult) affected the subjects' ratings of understanding: the mean rating for the easy lesson stimuli was 3.88, compared to 4.24 for the difficult lesson. This difference resulted in a significant lesson difficulty main effect ($F = 71.48$, $p < .0001$). The sex of the stimulus persons (those hearing the lessons) also produced differential overall ratings: female stimulus persons were perceived as understanding significantly more than male stimulus persons ($F = 62.08$, $p < .001$). Mean rating was 3.88 for female stimuli and 4.23 for males (on a six-point scale). In addition, there was a main effect for stimulus persons nested within sex of stimulus person ($F = 60.61$, $p < .0001$). This effect reflects the fact that each of the 10 stimulus persons elicited differential ratings from the observing subjects. The main effects for age of observer and sex of observer were not statistically significant.

Most important to this study are findings reflecting significant interactions between age of subject and type of lesson (easy or difficult). Such interactions would indicate differential accuracy among the three age groups in decoding understanding of the stimulus persons. Three interactions involving these factors emerged: age x type of lesson ($F = 4.17$, $p < .02$), age x type of lesson x sex of stimulus person ($F = 5.65$, $p < .005$), and age x type of lesson x stimulus persons within sex of stimulus person ($F = 3.75$, $p < .0001$).

Looking first at the basic age x type of lesson interaction, it can be seen in Figure 1 that subjects in all age groups rated stimulus persons hearing the easy lesson as understanding more than stimulus persons hearing the difficult lesson. However, the third and sixth grade children were more accurate in their ratings than the adult subjects. In fact, analysis of the ratings within each age group showed that only the third and sixth graders successfully discerned the differential understanding of the stimulus persons between easy and difficult lessons (third graders: $t = 1.64$, $p < .06$; sixth graders: $t = 2.19$, $p < .025$; adults: $t = .68$, n.s.). Thus, overall, only the children were able to decode the nonverbal behavior of the stimulus persons.

The higher order interactions involving age and type of lesson indicated that the nature of the particular stimulus persons was responsible for differential ratings. Analysis of the age x type of lesson x sex of stimulus person interaction showed that, although the sixth grade subjects were equally accurate in their perception of male and female stimulus

TABLE 1

ANALYSIS OF VARIANCE FOR DECODING NONVERBAL RESPONSES

Factor	F	p
Between Subjects		
Grade	1.15	ns
Sex	.01	ns
Grade x Sex	1.56	ns
Within Subjects		
Stimulus Sex	62.08	.0001
Type (Easy or Difficult)	71.48	.0001
Stimulus/Stimulus Sex	60.61	.0001
Stimulus Sex x Grade	4.67	.01
Stimulus Sex x Sex	4.23	.04
Grade x Type	4.17	.02
Sex x Type	.34	ns
Stimulus/Stimulus Sex x Type	29.53	.0001
Stimulus Sex x Type	9.87	.002
Sex x Stimulus/Stimulus Sex	.37	ns
Grade x Stimulus/Stimulus Sex	2.48	.002
Grade x Stimulus Sex x Sex	.08	ns
Grade x Sex x Type	.39	ns
Grade x Stimulus Sex x Type	5.65	.005
Stimulus Sex x Type x Sex	.19	ns
Grade x Sex x Stimulus/Stimulus Sex	1.28	ns
Type x Grade x Stimulus/Stimulus Sex	3.75	.0001
Type x Sex x Stimulus/Stimulus Sex	.86	ns
Type x Stimulus Sex x Grade x Sex	.90	ns
Type x Grade x Sex x Stimulus/Stimulus Sex	.55	ns

persons, both the third graders and the adults seemed to be more accurate in decoding the male stimulus persons than the female stimulus persons. These data are presented in Table 2. In fact, the third graders showed a nonsignificant difference between ratings given to female stimulus persons listening to easy and difficult lessons. Although the adult subjects were more accurate in decoding male than female stimulus persons, the difference between their ratings of easy and difficult stimuli was not significant with either male or female stimulus persons.

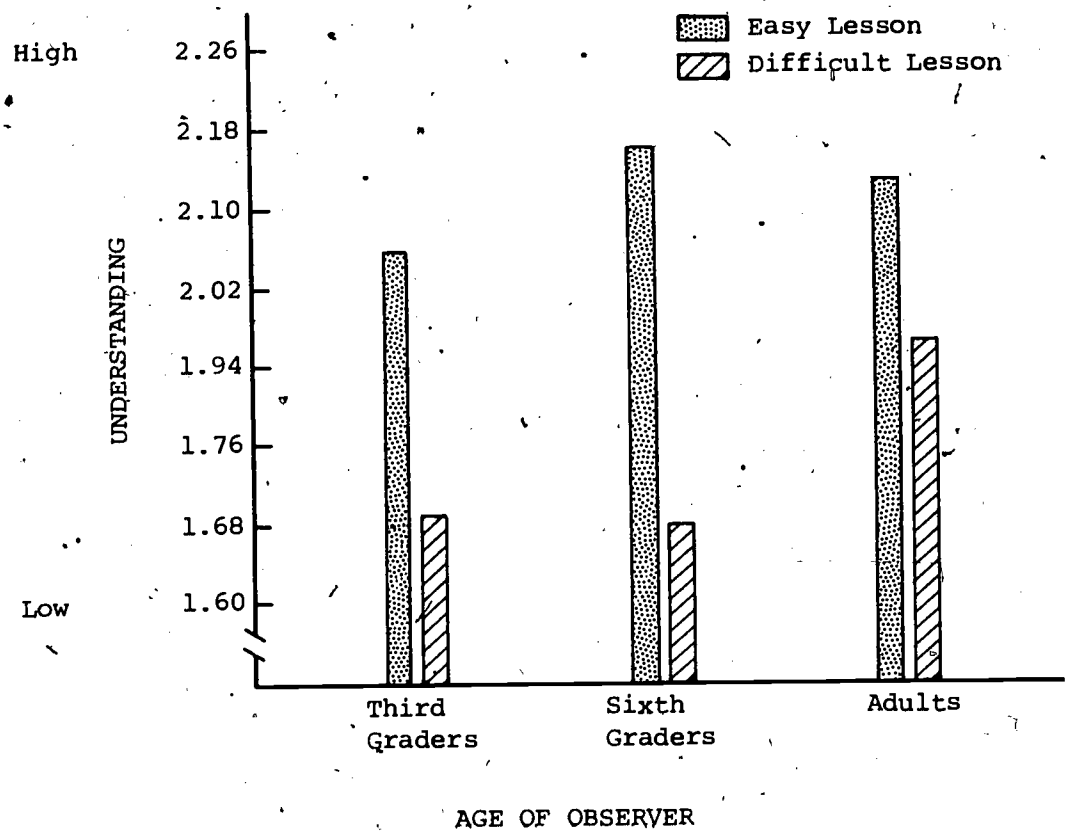

Figure 1. Ratings of understanding by age and lesson type. Higher numbers indicate greater inference of understanding.

The significant interaction of age x type of lesson x stimulus persons within sex of stimulus person showed further differences between particular stimulus person. Examination of Table 2 shows wide differences in the accuracy with which the various stimulus persons were decoded. In fact, one male stimulus person was consistently decoded erroneously by all age groups of subjects; he was rated as understanding more when listening to the difficult lesson than the easy lesson. There were also some reversals in the ratings of specific persons by subjects of certain ages, but overall most

mean ratings of stimulus persons listening to easy and difficult lessons were at least judged in the proper relative direction. Unfortunately, no easily interpretable systematic age x stimulus person trends emerged from the analysis.

TABLE 2

MEAN RATING OF UNDERSTANDING BY STIMULUS PERSONS LISTENING TO EASY AND DIFFICULT LESSONS

Age of Observers	Stimulus Persons	Male	Female	Mean
Third Grade				
	Difficult	4.59	4.04	4.31
	Easy	3.90	3.97	3.94
	Difference	.69	.07	.37
Sixth Grade				
	Difficult	4.56	4.06	4.31
	Easy	4.10	3.57	3.84
	Difference	.46	.49	.47
Adults				
	Difficult	4.23	3.86	4.04
	Easy	3.94	3.80	3.87
	Difference	.29	.06	.17

Variations in subjects' ratings of particular stimulus persons were also manifested in significant interactions for sex of stimulus person x type lesson, and stimulus persons within sex of stimulus person x type of lesson ($F = 9.87$, $p < .002$; and $F = 29.53$, $p < .0001$, respectively). These interactions indicate that subjects reacted differently in their differentiations of degree of understanding of particular stimulus persons. It appears that the difference between ratings of male stimulus persons listening to an easy or difficult lesson is somewhat more pronounced than that for female stimulus persons. The mean difference between easy and hard lessons for male subjects was .49, as compared to .22 for females. The stimulus persons within sex of stimulus person x type of lesson interaction is a reflection of the strong differences between the ratings given to the various stimulus persons.

A number of other significant interactions were found, but they are of less importance to the questions of interest here. There was a sex of stimulus person x grade interaction ($F = 4.67$, $p < .01$), a sex of stimulus person x sex of subject interaction ($F = 4.23$, $p < .04$), and a stimulus person within sex of stimulus person x grade interaction ($F = 2.48$, $p < .002$). In general, it appears that differential reactions to stimulus persons varied according to the age and sex of subjects. These complex interactions do not bear directly on the nature of age trends in decoding abilities; thus, they will not be closely examined.

IV

DISCUSSION

The results indicated that clear differences exist in the decoding accuracy of adults and children. Though third and sixth graders could accurately discern the difference between stimulus children listening to an easy or difficult lesson, adults were unable to make the same distinction with a significant degree of accuracy. The indications that only children were able to decode the nonverbal behavior of other children suggest that perhaps children encode nonverbal cues differently from adults.

Although the results of this study are clear-cut, a number of possible explanations can be offered. In terms of social skills, interpretation rests on the assumption that children encode nonverbally in a different manner (either qualitatively or quantitatively) from adults, and that adults are unable to interpret successfully this different type of behavior. This is probably the most parsimonious explanation of the data, but we have no evidence to support such a notion.

In fact, convincing data from other studies suggest similarities in the encoding of emotions across persons of entirely different cultures (Ekman, 1971). Furthermore, evidence shows that children (and even infants) display nonverbal reactions to stimuli similar to those displayed by adults. For instance, a smile response has been shown to correlate with feelings of positive affect in young children (Wolff, 1963). These findings suggest some universal characteristics in the encoding of nonverbal behavior across cultures and ages. It is entirely possible, then, that the cause of differential adult and child encoding lies not in differences in nonverbal encoding of adults and children, but rather in differences in the decoding process among subjects of various ages.

If there are differences between adults and children in the nature of the decoding process itself, a number of factors may contribute to differential accuracy of decoding. Least likely is the possibility that children are intrinsically better able to decode accurately all nonverbal behavior, whether encoded by other children or adults. A more plausible explanation is that adults and children are equally accurate in their decoding ability, but that they differ in their perception of the social situation of the stimulus person. These differences may lead to variation in interpretation of the children's nonverbal behavior. Thus, a smile may be interpreted as meaning various things in different situations (e.g., happiness, sarcasm, or insolence). If children and adults systematically differ in their interpretations of the social setting, then differential decoding accuracy might result.

Similarly, it is possible that the interpretation of particular types of encoded nonverbal behavior varies according to the psychological relationship that exists between the encoder and decoder. Thus, an individual may interpret a category of behavior (such as a smile) differently depending on his similarity to the encoder. If this is the case, it is clear that different categories or interpretations would be used when an adult decodes a child and when a child decodes a peer.

It is obvious that the precise explanation for our findings has not yet been determined; much work will be necessary for a complete understanding of the development of the decoding process over age. Rather than concentrating on finding simple differences in decoding skills between different aged individuals, future studies should try to determine the psychological processes involved in the decoding of nonverbal behavior.

Several features of this study should be noted. The nonverbal responses of stimulus persons were obtained under natural conditions: no actors were used. Frijda (1970) has noted that actors tend to exaggerate typical nonverbal behavior, making the decoding process much simpler for the observer. In this study stimulus persons were allowed to react under completely natural conditions; they were alone and not aware of being filmed. As a result, the nonverbal encoding appeared to be quite subtle, and certainly enhanced the difficulty of the decoding task for the subjects. In point of fact, some subjects informally reported that the task was very difficult, and that they were not sure what particular cues led them to make the judgments of understanding.

The use of several stimulus persons is also atypical of most studies of nonverbal behavior. Most experiments in this area use only one encoder, thus severely limiting the generalizability of the results. In contrast, the present study used ten children as stimuli, approaching what Brunswik (1956) has called "representative sampling of the social ecology." The use of relatively many stimuli increases confidence that the results are not due to the idiosyncratic behavior of one encoder.

Another departure from typical nonverbal experimentation is the type of question we asked our subjects. Traditionally, studies on decoding of nonverbal behavior have looked at expression of emotions and affect. The present experiment asked subjects to infer the degree of understanding displayed by the stimulus persons, which is of a more cognitive nature than the typical question asked. It is not clear whether the results would have been the same had we asked a question regarding, for instance, the happiness of the stimulus persons.

It should be pointed out that although the results clearly showed that the children were able to discern to a significant degree whether the stimulus persons were listening to an easy or hard lesson, the degree of accuracy in an absolute sense was not particularly high. The lessons heard by the stimulus persons were designed to elicit responses on the extremes of the six-point rating scales (i.e., "understood everything" or "did not understand at all"). However, less than 16 percent of the total ratings made by all subjects were in the two extreme categories. The mean difference between the easy and difficult lessons for the most accurate subjects (the sixth graders) was only .47 on the six-point scale of understanding. Thus, it is clear that subjects' accuracy was not high in an absolute sense.

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