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YOUNG CHILDREN'S PRODUCTION AND COMPREHENSION OF NONVERBAL DEICTIC BEHAVIORS*1

Iowa State University

JACQUES D. LEMPERs

SUMMARY

The production of pointing, the understanding of pointing and the comprehension of another's line of regard was investigated in 36 male and female infants 9-, 12-, and 14-months-old. Production of pointing was present in eight out of twelve 12-month-olds and in eleven out of twelve 14-month-olds; only a few of the youngest Ss pointed. For the youngest infants comprehension of pointing was a function of the distance between the person pointing and the object pointed to. All 12- and 14-month-old children comprehended the pointing to a nearby object and most of them also understood the pointing to a distant object. Ten out of twelve 12-month-olds and eleven out of twelve 14-month-olds were able to tell where another person was looking if both the cues of movement and orientation of the head and the eyes were present; their performance was less perfect with only the cue of orientation present or with only the eyes moving. Never more than three out of the twelve youngest Ss succeeded on any of these percept-diagnosis tasks.

A. INTRODUCTION

The production and comprehension of pointing and their developmental relationship in the young child have been neglected research areas despite their obvious importance in the preverbal communicative interactions of the young child (1). Information about the production of pointing is almost totally contained in baby biographies (9, 11, 12, 14, 15), although more

1 This paper is based on a Doctoral dissertation submitted to the Institute of Child Development, University of Minnesota, in partial fulfillment of the requirements for the Ph.D. degree. Appreciation is extended to the members of the dissertation committee, Dr. J. H. Flavell, Dr. W. W. Hartup, Dr. M. Maratsos, Dr. J. Rest, and Dr. M. Snyder. This research was supported by a National Institute of Child Health and Human Development program project grant (HD-05027) to the Institute of Child Development, University of Minnesota.
recently Cole (2), Lempers, Flavell, and Flavell (5), Leung and Rheingold (6), and Murphy and Messer (8) have investigated the phenomenon more systematically.

Interest in the young child's comprehension of pointing and his ability to read another's direction of gaze is of very recent origin (3, 5, 7, 10). In these recent studies, however, the effects of movement cues and orientation cues on the understanding of pointing were not examined separately within the same study.

The major aim of the present investigation was to assess the separate and combined effects of these cues and of the cue of distance upon the young child's comprehension of certain nonverbal deictic gestures. The relation between the production of pointing and the comprehension of pointing was also investigated.

B. Method

1. Subjects

The Ss were 36 children, 12 in each of the following age groups: 8½-9½, 11½-12½, and 13½-14½ months. The two youngest age groups consisted of six boys and six girls, while the oldest group consisted of seven boys and five girls. All children were from white, middle-class families. At least one and in most cases both parents had some college education. All children were observed in their homes in the presence of their mothers. Two additional Ss participated initially, but were eliminated because of a total lack of attention and cooperation.

2. Tasks

a. Comprehension of pointing.

Task 1. Comprehension of pointing to a nearby object, with movement. Child and E were both seated on the floor, at a distance from each other of approximately 1.5 meters. Between the child and the E was a toy panel consisting of a board on which were permanently fixed a doll, a car, and a dog; the distance between adjacent toys was 35½ cm. The E looked at the child, engaged his attention and called his name. When assured from eye-to-eye contact that the child was attending, the E pointed to either the toy at his right- or left-hand, while continuing to look straight at the child. The distance between the E's finger and the object pointed to was approximately 50 cm. Sometimes, in order to re-establish eye-to-eye contact the E would say: "What is that?" never mentioning the object's name. The same was done in the other tasks.
Task 2. Comprehension of pointing to a nearby object, without movement. While the child's attention was diverted the E pointed again either to the left- or right-hand toy, holding his arm fully extended and his index finger pointed to the toy at a distance of 50 cm. Continuing this motionless posture he engaged the child's attention by calling his name. Again the E looked only at the child, not at the object pointed to.

Task 3. Comprehension of pointing to a distant object, with movement. After engaging the child's attention in the usual way, the E pointed to an object located at a distance from the child of at least 2½ meters, while continuing to look straight at the child. The object pointed to was to the left or to the right of the child in a lateral direction, never in front of him.

b. Comprehension of direction of gaze.

Task 4. Eyes-face convergent, with movement. The setting was as described in Task 1. The E, having obtained eye-to-eye contact by calling the child's name, then turned his head to the left- or right-hand toy on the toy panel. The E looked at the toy for approximately four seconds and then turned back to face the child.

Task 5. Eyes-face convergent, without movement. The child's attention was directed elsewhere. The E looked at one of the toys, his eyes and head faced in the same direction. After calling the child's name he kept this orientation for a few moments and then looked back to the child.

Task 6. Eyes-face divergent, with eye-movement. After having established eye-to-eye contact with the child, the E moved his eyes—but not his head—towards one of the toys, holding this fixation for approximately four seconds.

c. Production of pointing.

Task 7. Spontaneous pointing. The mother was asked to say to the child: "Where is X?" using an object in the room known to the child. She also was requested to watch for any pointing by the child between testing sessions and to report it to the E with a specification of the conditions under which it took place.

3. Procedure

All the testing was done in the homes of the children with their mothers present. Each child was visited at least two times; in case of uncooperativeness, a third visit was added. Each visit lasted approximately a half hour. The different testing sessions occurred within the span of no more than two weeks; the great majority were scheduled within one week.

All the tasks were administered several times. Tasks 1-6 were given to
both the left-side and right-side toys on the panel. The attempt was made to try each task at least twice each session if the child's attention and cooperativeness permitted. The administration of the tasks was not random. The Lempers et al. (5) study provided clear evidence that the eyes-face divergent task was distinctly more difficult than the eyes-face convergent task, especially for 1- and 1½-year-olds. Of the Ss in that study who did not succeed on the eyes-face convergent task, none succeeded on the eyes-face divergent task. Furthermore, it would seem reasonable to assume that if a child does not respond to both the cues of movement and orientation (task 4), the chance that he will respond correctly to the cue of orientation alone (task 5) is very small indeed. Ten children not succeeding on the easier task (task 4) were tested on the more difficult tasks 5 and 6 and none of them responded correctly. Although these three tasks were presented in a fixed order, they never followed each other directly but were interspersed between the comprehension and production of pointing tasks.

For a child to be scored as performing correctly on the pointing tasks he had to continue to look directly at the object for a few seconds; mere glancing at the object was not sufficient. A correct score on the eyes-face tasks indicates that the child either looked for a few seconds at the same toy as the E or that the child went immediately for the particular toy upon seeing the E's eyes-face movements and/or orientations. A short glance again did not count as a correct response. The child's looking had to occur or continue after the E looked back to face the child.

Observer reliability was assessed by the use of the following formula: Number of agreements divided by Number of agreements and number of disagreements. The unit for assessing reliability was the individual response. Of the 36 children 12 were observed by two observers. The reliabilities for the seven tasks were as follows: task 1, .88; task 2, .89; task 3, .95; task 4, .87; task 5, .80; task 6, .60; and task 7, .88.

C. RESULTS

Chi square contingency correlations of the left- and right-hand variations for task 1 through task 6 showed all to be significant. For a child to pass on task 1 through task 6 he had to respond correctly to both the left- and right-hand variations for each of the tasks. If the S performed correctly on one variation and incorrectly on the other, a joint score of incorrect was given so as to exclude performance based on change.

Task 1. The results for this task are shown in Table 1. Nine out of twelve 9-month-olds and all 12- and 14-month-olds looked at the object the E pointed to.
### TABLE 1
**AGE DISTRIBUTION OF RESPONSES ON TASKS**

<table>
<thead>
<tr>
<th>Task</th>
<th>9 months</th>
<th></th>
<th>12 months</th>
<th></th>
<th>14 months</th>
<th></th>
</tr>
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<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
<td>Total</td>
<td>Male</td>
<td>Female</td>
<td>Total</td>
</tr>
<tr>
<td>Task 1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
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<td>1</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Correct</td>
<td>5</td>
<td>4</td>
<td>9</td>
<td>6</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>Task 2</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incorrect</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Correct</td>
<td>5</td>
<td>3</td>
<td>8</td>
<td>6</td>
<td>6</td>
<td>12</td>
</tr>
<tr>
<td>Task 3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incorrect</td>
<td>6</td>
<td>5</td>
<td>11</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Correct</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>Task 4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incorrect</td>
<td>5</td>
<td>4</td>
<td>9</td>
<td>1</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Correct</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>Task 5</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not tested</td>
<td>4</td>
<td>3</td>
<td>7</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Incorrect</td>
<td>2</td>
<td>3</td>
<td>5</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Correct</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>2</td>
<td>6</td>
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<tr>
<td>Task 6</td>
<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not tested</td>
<td>5</td>
<td>3</td>
<td>8</td>
<td>2</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>Incorrect</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>Correct</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Task 7</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Not observed</td>
<td>6</td>
<td>3</td>
<td>9</td>
<td>4</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Observed: Points</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>5</td>
</tr>
<tr>
<td>Observed: Points + looks</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Reported by mother</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>2</td>
</tr>
</tbody>
</table>
Task 2. Eight 9-month-olds and all 12- and 14-month-olds looked at the object pointed to (see Table 1). Only one 9-month-old was correct on task 1 and incorrect on task 2, while all other 9-month-olds had the same (eight correct; three incorrect) score on task 1 and task 2. All 12- and 14-month-olds had a score of correct on task 1 and task 2. Thus it appears that as far as pointing to a nearby object is concerned, the cue of orientation by itself provides sufficient information for young children to comprehend this non-verbal deictic gesture.

Task 3. As can be seen in Table 1, only one 9-month-old achieved an overall score of correct on this task. Eight 12-month-olds and nine 14-month-olds responded correctly. In the Lempers et al. (5) study this task was administered without the cue of movement being present. Seven of the 12-month-olds and all twelve 1½-, 2-, 2½-, and 3-year-olds responded correctly in that study. Together, these data suggest that adding a strong redundant cue like movement might be needed for very young infants when distance increases, but not for infants 12 months and older.

Task 4. As Table 1 shows only three 9-month-olds passed this task. Ten out of twelve 12-month-olds and eleven out of twelve 14-month-olds responded correctly.

Task 5. The category “not tested” on this and the following task includes two subcategories: one pertains to those 9-month-olds who were not tested because they did not respond at all on several administrations of task 4, and the other refers to the 12- and 14-month-olds whom the E attempted to test, but could not do so in a satisfactory way. Of the five 9-month-olds who were tested, none succeeded (see Table 1). Of the nine 12-month-olds tested, six succeeded; of the eight 14-month-olds, five performed successfully.

Task 6. None of the four 9-month-olds tested succeeded (see Table 1); five out of eight 12-month-olds tested and five out of ten 14-month-olds tested looked immediately at the object the E was looking at.

Task 7. Three 9-month-olds, six 12-month-olds, and eleven 14-month-olds were observed to point, either spontaneously or as a result of the request by the mother (see Table 1). Of those Ss, only one 9-month-old and one 12-month-old looked at their mother and/or the E, during their pointing, while seven out of eleven 14-month-olds did so. An additional two 12-month-olds pointed as reported by their mothers (see Method section), but they never did so in the presence of the E—even when requested.

Table 2 shows the relation between age and the tasks and the correlations between the tasks themselves. Task 5 and task 6 were not included in these correlational analyses because not every S in each age-group was or could be
tested on them. Each of the remaining five tasks was significantly related to age. In Table 2 it can be seen that the child's understanding of pointing to a nearby object and to a distant object are not related, while the child's understanding of pointing, either to a nearby or distant object, is related to the ability to determine where another person is looking. However, a test of the relation between the tasks with the variable of age controlled was not possible given the lack of variability on most of the tasks within age-groups. Because the relations of these tasks with age were significant, the relation between understanding of pointing and comprehension of direction of gaze, as well as the relation between pointing with and without the cue of movement being present (task 1 and task 2), must be interpreted with caution. The interrelations of these tasks might be due to their correlations with age, although the level of significance of the correlation between task 1 and task 2 relative to the level of significance of the relation of each of these tasks with age makes that possibility unlikely.

D. DISCUSSION

The results indicate that the infant first understands only presymbolic or prereferential pointing in which the finger and the object pointed at are in close physical proximity and can be seen simultaneously by the child. Later, the infant manages symbolic or referential pointing in which the point indicates the presence of an object, person, or event outside the visual field. The lack of a relation between comprehension of pointing to nearby objects and to distant objects suggests that different skills are involved in assessing these two classes of events. Murphy and Messer (8) also found that 9-month-olds understood their mother's pointing only when the finger and the object were in the same field, a situation involving what Flavell (4) calls "quasi- or pseudo-pointing."

<table>
<thead>
<tr>
<th>TASK</th>
<th>C</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>.39*</td>
<td>.65***</td>
<td>.29</td>
<td>.39*</td>
<td>.07</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>.45**</td>
<td>.33</td>
<td>.44**</td>
<td>.04</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>.51***</td>
<td>.51***</td>
<td>.32</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>.53***</td>
<td>.30</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>.48***</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* $p < .05$
** $p < .01$
*** $p < .001$
Three kinds of failure were observed on the task involving pointing to a distant object. The infants either looked at the E or looked away from his pointing finger to a single wrong object or a group of wrong objects. The nature of these mistakes suggests possible explanations for the observed performance. An infant who does not look away from the pointing finger clearly does not understand the referential nature of this deictic gesture. More interesting, however, are the other mistakes which indicate that, even for children understanding the gesture, its referential functions are not well understood. One problem might be distance. Young children might have learned to expect to see an object immediately and at a relatively short distance if somebody points for them. In observations in this study and also in the Murphy and Messer (8) investigation, it was noticed that mothers would orient their infants to various objects by touching the object. That is, the mothers decreased the distance involved if they realized that their pointing was not understood. Another difficulty could be the presence of other objects near to the designated object so that the child takes them as being intended. Children were observed to look away from the pointing finger, but to lose track, attending to several objects in the location indicated rather than a single object. It might be that these factors separately do not impair young children’s understanding of clear referential pointing, but that children this young do not succeed in determining which object was intended, only if both factors are involved simultaneously. In other words, the probability of noncomprehension increases the farther away the object pointed at is, and the greater the number of objects which surround the intended one.

Pointing by the child himself was observed in three out of twelve 9-month-olds, in eight out of twelve 12-month-olds, and in eleven out of twelve 14-month-olds. These results accord rather well with several other studies of pointing by the young child. Shirley (13) placed the median age of the appearance of pointing at 10½ months. Cole (2) observed four 9-, four 10-, four 11-, four 12-, and four 15-month-olds and found spontaneous pointing in none of the 9-month-olds, in one 10-month-old, in three 11-month-olds, in three 12-month-olds, and in all 15-month-olds. Observing the 9- and 12-month-olds again when they were 12- and 15-months-old respectively, he also found pointing in three 12-month-olds and in all four 15-month-olds. Lempers et al. (5) found pointing in ten out of twelve 12- and 18-month-olds and in all twelve 2-, 2½- and 3-year-olds. Leung and Rheingold (6), testing 48 infants between 10 and 17 months of age, found that the majority pointed at 12.5 months.
The data of the Lempers et al. (5) study did not provide clear evidence about the relation between comprehension and production of pointing. The absence of a relation between them in this study, however, suggests that the understanding of pointing and its production do not form interrelated and simultaneously developing skills.

When do children start to understand another person's line of regard? Successful following of another person's gaze was low in the 9-month-olds under all conditions tested, while the 12- and 14-month-olds were successful when both the cues of movement and orientation were present. Scaife and Bruner (10), who tested infants ranging from 2 to 14 months in age, obtained very similar findings. All Ss between 11- and 14-months-old looked in the same direction as the E who silently turned his head through 90 degrees to fixate a small concealed signal light. These infants, however, did not have to appear to be fixating exactly the same point. Of the 8- to 10-month-olds, 66.5% were judged as following the adult's line of regard in one or both trials. Together, these data indicate that the skill to determine correctly what another person is looking at, emerges very early. Scaife and Bruner state: "Insofar as mutual orientation implies a degree of knowledge in some form about another person's perspective, then the child in his first year may be considered as less than completely egocentric" (10, p. 266).

Comprehension of pointing and following another's line of regard were found to be related developments. This empirical relation suggests that the capacity for symbolic referential functioning which underlies the child's comprehension of pointing to an object outside the visual field also underlies following another's line of regard.

Werner and Kaplan call pointing "the specialized motoric means for the expression of reference" (16, p. 79) and see the child's own pointing as resulting from a process of differentiation between him and the objects surrounding him, in which the latter are no longer "ego-bound things of action" but also "ego-distance things of contemplation" (16, pp. 44). Pointing by the child himself is described by them as "the culmination of a series of predeictic and globally deictic patterns of behaviors" (16, p. 77-78) of which they mention the child's turning to look at an object, his reaching towards it, and his touching of it. The comprehension by the child of the referential nature of someone else's looking and pointing is here viewed as also originating in a presymbolic behavioral pattern. In such patterns, another's pointing acquires its meaning for the child from having resulted in touching the object. Looking, then, becomes indicative of the presence of an object by being part of and coordinated with the pointing and touching behavior.
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