Development of Pointing as a Social Gesture

Eleanor H. L. Leung and Harriet L. Rheingold
University of North Carolina at Chapel Hill

This study sought to discover the age at which infants call interesting objects to another's attention by pointing, to relate their ability to follow another's pointing to their own use of the gesture, and to compare the uses of pointing and reaching. Infants between 10.5 and 16.5 months of age were studied with their mothers in a setting containing six special stimulus objects. By 12.5 months, a majority of infants pointed, usually vocalizing or looking at their partner while pointing. The communicative function of the gesture was further established by the partner's response of verbal acknowledgment and looking at the object. The ability to follow another's points seemed to be acquired before the infants began to point but improved with their own use of the gesture. Reaching partook of the behaviors associated with pointing but developed earlier and decreased as pointing increased. The data show that at an early age infants exhibit an elementary form of the ability to take the visual perspective of others.

When adults point to an event or object of interest at some distance, they extend an arm and index finger toward it, usually comment briefly on what is being singled out, and then check to see that their partner is looking in the correct direction. Thus, the act of pointing can be said to consist of three components: the gesture itself, a relevant verbal utterance, and visual monitoring of the intended recipient of the message. At what age do children begin to point spontaneously for apparently the same purpose as adults do, that is, to share their discovery of an interesting event with others? And does their pointing consist of the same components as that of adults?

In reports of infants pointing to objects at a distance, the behavior of interest here, the observations were not the primary focus of study (e.g., Anderson, 1972; Bridges, 1933); were reported on only a few children—as early as 1787 by Tiedemann (cited in Murchison & Langer, 1927) and more recently by others (Bates, Camaioni, & Volterra, 1976; Bruner, 1978; Guillaume, 1926/1971); or were reported at only a few ages (Murphy & Messer, 1977; Rheingold, Hay, & West, 1976). In contrast, the purpose of the present study was to trace the developmental course of such pointing between the ages of 10.5 and 16.5 months.

Looking where others point was noted by Guillaume (1926/1971) to be fully developed by 22 months. Recently, the ability to follow another's points to nearby objects has been reported by the age of 9 months (Lem pers, 1976) and to distant objects by 14 months of age (Murphy & Messer, 1977). However, the temporal relationship between the infants' pointing and their comprehension of the gesture as performed by another was not determined. To pursue this problem, half of the mothers were requested to point to the stimulus objects during only the second of the two trials in the present study. Thus, the effect of the mothers' pointing on the children's own pointing could be directly assessed, a factor not controlled in studies (Murphy & Messer, 1977) in which the mothers were free to point and did so frequently.

Reports on the use of reference gestures (Bruner, 1978; Murphy & Messer, 1977; Werner & Kaplan, 1963) presented evidence...
that children may reach toward objects not only to demand them but also to share with others their interest in them. To further an understanding of pointing, we measured reaches in addition to points, as well as the accompanying infant behaviors of vocalization and visual regard of the mothers and the maternal responses to both points and reaches.

Method

Subjects

Forty-eight normal infants, chosen on the basis of age and sex from hospital and public records, were studied. They formed four age groups comprising 8 at a mean age of 10.6 months, 16 at a mean age of 12.6 months, 16 at a mean age of 14.5 months, and 8 at a mean age of 16.6 months (with a range of 1 month on either side of the mean), equally divided by sex; hereafter, they are referred to as the 10.5, 12.5, 14.5, and 16.5 groups. Because preliminary work showed that few infants as young as 10 months would point in the setting provided and that most as old as 16 months might, the number of infants at the two intermediate ages was doubled.

Of the mothers contacted by telephone, 91% agreed to participate. The infants came from homes above average in educational level; years of education ranged from 13 to 20 (M = 17.8) for the fathers and from 12 to 18 (M = 15.4) for the mothers. The records of all children studied were used.

Experimental Environment

The study was conducted in a 2.8 X 3.5 m laboratory room with a one-way window in one of the shorter walls. The infant sat in a high chair at a table in the middle of the room facing the one-way window. The mother also sat at the table to the infant’s left.

Six stimulus objects were provided to increase the likelihood of an infant’s pointing. Five of these were evenly spaced around the room within an arc of 180° from the child’s right to left and at a distance from the child of approximately 1.5 m. In order from the child’s right, the objects were a colored poster on the wall, a Bobo doll, slide presentations on a screen set in a clear glass insert in the one-way window, a large colorful clock with moving hands, and at the left end of the arc a chime mobile hung from the ceiling. The sixth stimulus, a set of small colored rings, was attached to the microphone over the infant’s head. Eight different colored slides of people or scenes were rear-projected on the screen, each for 15 sec, and the mobile was rung four times by a string activated in the adjoining observation room; these 12 presentations were spaced throughout the 10-min. trial on a variable interval schedule. The same stimuli obtained in the two trials of the study. To keep the infants content, a few simple toys were placed on the table. The infants’ and mothers’ behaviors and their vocalizations were videotaped by a camera in the observation room.

Procedure

During the first of two 10-minute trials, the mother was instructed to respond as she normally would if the infant looked at, vocalized, or pointed to anything, but not to draw the infant’s attention to any object by pointing or any other means. During the second trial, half of the mothers (the control group, chosen by random assignment) were asked to behave as they had in Trial 1. The other half (the experimental group) was told that at certain times the experimenter would direct them via the intercom to point to one of the five stimulus objects; the chime mobile was omitted because it attracted so much attention in its own right. The mothers’ pointing was scheduled to occur at approximately 1-minute intervals during the first 5 minutes of the trial. A mother was told to catch the child’s attention by pointing to the target object, to say “Look” or “See” while pointing, but not to name the object (because the child might have already learned its name). In all other respects, the stimulus objects as well as the schedules of slide presentations and activation of the chime mobile were the same for both groups.

Measures

The following behaviors of the infants were recorded: duration of visual regard of the stimulus objects, the number of points, extensions of the arm and index finger toward a stimulus object while looking at it, and the number of reaches, extensions of the arm toward a stimulus object with a closed or open hand while looking at it. Other measures were vocalizations and looking at the mother’s face accompanying the arm extensions and, for experimental infants, looking at the stimulus pointed to by the mother. The measures of the mother’s behavior were looking at the object the infant pointed or reached to and vocalizations occurring during the infant’s points or reaches.

Analysis of vocalizations. To test whether the infant’s points or reaches served to attract the mother’s attention to an interesting object or to request that object, the infants’ and mothers’ vocalizations were analyzed. Three categories of infant vocalizations were established: Category 1 had a positive affect and a lifting quality or partook of a labeling or demonstrative tonal quality, hereafter labeled positive for brevity; Category 2 consisted of grunting or whining sounds commonly associated with infants’ demands for toys beyond their reach, hereafter labeled demanding; and Category 3 consisted of vocalizations that because of brevity and bare audibility could not be classified. Two observers were trained to distinguish among these three categories and then classified the infants’ vocalizations without seeing the videotapes. Their judgments were then assigned to the points or reaches that actually occurred.

Two categories of the mothers’ speech (divided into utterances by pauses longer than 2 sec) in response to the child’s points and reaches were set up. Category 1 included naming or describing the object, questioning
or verbalizing the infant's behavior, and acknowledging the gesture by a word. Category 2 contained sentences such as "Do you want the chimes?" and were judged to show that the mother interpreted the gesture as a request.

**Measures of Observer Agreement**

All measures were recorded independently by two observers. The median percentage of agreement for total duration of visual regard was 96 (range = 89–100). For points and reaches, the median percentages of agreement, based on occurrence at the same time, were 98 and 86, respectively (range = 0–100 for both). The median percentages of agreement for the infants' looking where the experimental mothers pointed, for deciding whether each agreed-on point or reach was accompanied by an infant vocalization or a look at the mother, or by a mother's verbalization or look at the object, and for categorizing infants' and mothers' speech were 100 (range = 0–100). When disagreements occurred, the events were examined to decide whether to retain or eliminate them.

**Results**

Analyses of variance on the differences in the frequencies of points and reaches between Trials 1 and 2, for each infant, yielded no main effects for age or experimental condition or significant interaction (all $Fs < 1$).

As the experimental mothers' pointing during the first 5 minutes of Trial 2 did not affect the frequency of the children's pointing or reaching, the mean frequencies of points and reaches were summed over trials for the experimental and control infants.

**Pointing**

**Frequency of pointing as a function of age.** The mean frequency of points increased from .2 at 10.5 months to 4.6 at 12.5 months, 7.6 at 14.5 months, and 8.9 at 16.5 months of age. This reliable increase with age (Kruskal-Wallis), $H(3) = 13.65, p < .01$, was associated with the increase in the number of children who pointed: from 1 of 8 infants at 10.5 months to 9 of 16 at 12.5 months, 12 of 16 at 14.5 months, and to all 8 at 16.5 months. The comparison of the proportion of pointers at each age revealed an age-dependent relationship, $\chi^2(3) = 16.68, p < .001$ (Fleiss, 1973). Furthermore, by probit analysis (Finney, 1971), the best estimate for the age when 50% of the infants may be expected to point was 12.56 months, with the 95% fiducial limits ranging from 11.16 to 13.47 months.

When the frequency of pointing for those who pointed was considered, however, the data showed that the three older age groups did not point at reliably different rates, $H(2) = .54$; during a 20-minute period they pointed at mean frequencies of 8.1, 10.1, and 8.9 times, respectively. Thus, at the median age of pointing, about 12.5 months, the infants who pointed used the gesture as frequently as those who presumably had been pointing for a few months.

That most of the 10.5-month-old infants did not point cannot be accounted for by any lack of visual regard of the stimuli because all infants looked at the stimuli for a mean of 338 sec. In fact, the mean duration of visual regard did not increase with age, $f(3, 44) = 1.27$. Moreover, those who pointed did not look at the stimulus objects longer than those who did not, $t(46) = 1.08$.

**Pointing as a social gesture.** Evidence that the children's pointing served as a form of communication was provided by their vocalizing and looking at their mothers while pointing. Even the two points by the youngest child (10.5 months) were social in nature: One was accompanied by a vocalization, the other by a look at the mother, to both of which the mother responded by looking at the object pointed to. On the average, 87% of the infants’ points were accompanied by a vocalization and 38% by a look at the mothers. In fact, during 94% of the children's points, the children vocalized, looked at the mother, or both. Furthermore, the percentage of points associated with either or both of these behaviors did not vary systematically with age, $H(3) = 2.36$.

Why were the children's points less often accompanied by a look at their mothers than by a vocalization? First, children seated so close to their mothers scarcely needed to turn their heads to monitor the mothers' responses. Second, mothers looked at the target object or verbally acknowledged an average of 88% of their children's points, and most responded to the points so readily that the children may not have needed to look at them for any further acknowledgment.

**Comprehension of mothers' pointing.**
Nine of the 24 experimental infants did not point, but 4 of them responded correctly to at least four of the five targets; infants thus responded with some success to the mothers' points before they themselves pointed. And although the mean number of correct responses to the mothers' points was 3.0 for both the 12.5- and 14.5-month-old nonpointers, the corresponding means for the 12.5-, 14.5-, and 16.5-month-old pointers were 4.5, 4.0, and 4.8, respectively. Their better performance indicates that the ability to follow another's points improves not only with age but also with one's own use of the gesture.

Comparison of Reaching and Pointing

Given that the reaching and pointing gestures were characterized by different finger positions, the possibility that they serve different functions may be entertained. We therefore charted the frequency of reaches across the age groups as well as the accompanying infant and maternal behaviors. Comparisons were also drawn between the nature of the infant and maternal vocalizations associated with the two gestures.

Frequency of reaching as a function of age. Six of the 8 infants of the youngest group reached toward the stimulus objects, in contrast to 1 of the 8 who pointed. The mean frequencies of reaches and points for those infants were 2.8 and .2, respectively. Also, unlike pointing, the proportion of children who reached did not show an age-dependent change, \( \chi^2(3) = 1.64 \) (Fleiss, 1973). Nor did the frequency of reaches change with age, \( H(3) = .58 \). Over the age range studied, then, the sequence of development for reaching clearly differed from that for pointing.

Reaching as a social gesture. The infants vocalized, looked at their mothers, or exhibited both of these behaviors during 78%, 45%, and 86% of their reaches, respectively. In turn, their mothers responded to 82% of their children's reaches by looking at the object, making some verbal acknowledgment, or both. Although the infant and maternal behaviors were generally more often associated with points than with reaches, Kruskal-Wallis tests showed that none of the infant or maternal behaviors associated with reaching varied systematically with age (all \( ps > .10 \)).

Nature of infant vocalizations. The 30 infants who pointed to a stimulus at least once vocalized during 236 of the 267 points (88%), and the 37 who reached at least once vocalized during 163 of the 219 reaches (74%); the percentages differ slightly from those reported earlier that were calculated by individual infants. Of the vocalizations accompanying the points, 86% were judged by the observers, who did not see the videotapes, as positive (Category 1), 5% as demanding (Category 2), and 9% as unclassifiable (Category 3). The comparable distribution by categories for the reaches was 53%, 25%, and 22%, respectively. Although Category 1 more often described the vocalizations associated with points than those with reaches, it still characterized the majority of the vocalizations of both gestures. Moreover, although the proportion of Category 2 vocalizations accompanying reaches was greater than that for points, they characterized the majority of the vocalizations for only 6 of the 37 (16%) reachers. Therefore, if a Category 1 vocalization occurred, an observer would have been unable to identify the accompanying gesture as a point or a reach. But if a Category 2 vocalization were heard, the observer could have guessed correctly, more often than not, that a reach had taken place.

Nature of mothers' speech. In only 8 of the mothers' 236 utterances associated with the infants' points and 4 of the 183 associated with their reaches did the mothers respond as if the children were asking for an object (Category 2). All remaining verbalizations fell into Category 1. Mothers, therefore, seldom interpreted the arm extensions to the stimulus objects as requests for them, and on the whole the differences in the mothers' verbal responses to the points and reaches were small.

Summary of Comparisons of Points and Reaches

The main difference between pointing and reaching appeared in the temporal course of their development. Furthermore, for the 41 infants who either pointed, reached, or did
both, the proportion of gestures that were points increased with age, and that of reaches declined, \( H(3) = 13.11, p < .01 \). Moreover, the percentage of infants who pointed more often than reached increased with age, and the percentage of those who reached more often than pointed decreased.

Points and reaches also differed on one other measure: Demanding vocalizations were more often associated with the infants' reaches, whereas positive vocalizations more often accompanied their points. In other respects, over the age range studied, reliable differences did not appear.

**Supplementary Data**

**Effectiveness of the stimuli.** Although the stimuli were chosen on an intuitive basis, they proved to be effective evokers of pointing and reaching. Only 5 points and 15 reaches (13 by one infant) to other than the stimulus objects were observed. The three stimuli that recruited more attention—the slides, chime mobile, and Bobo doll—were also accorded more points and reaches, a finding that attests to the relationship between the gestures and the interestingness of objects.

**Sex differences.** Inspection of the measures of male and female infants for points and reaches (both number of infants and mean frequency) and the associated behaviors, as well as of maternal responses, revealed no consistent differences by sex.

**Discussion**

Infants at about 12 months of age called interesting objects to the attention of their mothers by pointing with the index finger. Even at this early age, pointing partook of all characteristics of its display by the older infants, both in rate and in the accompanying behaviors of vocalizing and looking at the mother. The latter behavior appeared to serve, as it does in adults, the function of checking whether their mothers were looking at the designated object. Of the 272 points exhibited by all 48 infants, only 5 were directed to objects other than the stimuli chosen for study, attesting to the stimuli’s evoking properties and supporting the proposal that infants do not point indiscriminately but rather to objects that arouse their interest.

The infants' pointing successfully recruited the mothers' attention; the mothers looked at the object, and their verbalizations did more than just acknowledge the gesture. They supplied the infants with names and properties of the stimulus objects and with descriptions of their own and the infants' behavior.

Looking where others point appeared to be not yet fully developed at 10.5 months but was present in the repertoire of some infants this young. The ability to follow another's points thus seemed to have been acquired before an infant began to point and then to improve with age and their own use of the gesture.

The points and reaches measured in the present study shared certain properties but differed in others. On the one hand, both gestures seemed to serve the function of directing their partner's attention to an object that had aroused the infant's interest. On the other hand, pointing and reaching followed different temporal courses of development. In the laboratory, pointing was first displayed by a majority of children at 12.5 months of age and was a common gesture of all infants by 16.5 months. Reaching, in contrast, was already a characteristic behavior of a majority of the infants at 10.5 months, the youngest age group studied. Furthermore, as a proportion of all arm extensions, reaches declined and points increased. Thus, although the age for the onset of reaching was not determined, reaching as a gesture to call a partner's attention to an object was in time superseded by pointing.

Even though the setting and the mothers' behavior in the present investigation differed from those of Murphy and Messer (1977), they too suggested that pointing and reaching may serve similar functions and showed that reaching of the kind studied here is part of an infant's repertoire before pointing.

The development of both gestures, it may be surmised, depends on a long history of experience for both the agent (the infant) and the recipient (here, the mother). As for the infants, before they learned to look where
others point, they had already learned to follow the gaze of others (Scaife & Bruner, cited in Bruner, 1978). Moreover, they soon learn that others will look where they look or point because the partner usually responds by naming or describing the designated object.

It has been proposed (Bruner, 1978; Murphy & Messer, 1977; Werner & Kaplan, 1963) that reaching progresses through several phases before attaining the stage reported here. Although informal observation reveals that points may also be used as a demand and to request the name of an object, it eventually replaces reaches as a reference gesture. What accounts for the extension of the index finger if the whole hand is as effective? One can speculate that as the children grow older, the greater is their opportunity to observe older persons using the index finger. They then model their pointing after that of adults, using a form that becomes reinforced with repeated usage by their partners' responses.

The results, in summary, show that pointing is a well established behavior by the time children are about 1 year of age, and that at this time the gesture resembles that exhibited by adults in both appearance and function. The infants have learned not only to look where others point but also that others will look where they point and will find what they see worthy of comment. We therefore propose that at a very early age infants have acquired the ability not only to take the visual perspective of others but also to share with them their own perspective of the world.

References


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