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Brief Report

Brief Report: A Longitudinal Examination of the Communicative Gestures Deficit in Young Children with Autism[1]

Luigia Camaioni[2] and Paola Perucchini

University of Rome "La Sapienza"

Filippo Muratori and Annarita Milone

Institute of Child Neuropsychiatry, University of Pisa

There is agreement in the recent literature on the finding that children with autism show a rather severe deficit in the development of gestural communication along with impaired joint-attention skills (cf. Abrahamsen & Mitchell, 1990; Baron-Cohen, 1989; Curcio, 1978; Mundy, Sigman, & Kasari, 1994; Mundy, Sigman, Ungerer, & Sherman, 1986; Sigman, Mundy, Ungerer, & Sherman, 1986; Wetherby & Prutting, 1984). Several investigators have observed that autistic children seem quite able to formulate requests for objects, actions, and social routines and to persist until their goal is satisfied. To make these nonverbal requests they use mainly contact gestures, for example, leading a person by the hand toward a desired object/place or putting the adult's hand on a toy they want to activate. Less frequently they make requests for objects or actions via distal gestures, such as pointing, showing, offering/giving, and ritualized requests.[3] In one of the first

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[2]Address all correspondence to Luigia Camaioni, Department of Developmental and Social Psychology, University of Rome "La Sapienza," Via dei Marsi 78, 00185 Roma, Italy.

[3]Pointing, showing, offering/giving, and ritualized requests are considered *distal* gestures because they do not involve any contact with the recipient, either with respect to the gesture or to the goal (see Bates, Camaioni, & Volterra, 1975; Tomasello & Camaioni, 1997). Some of them (i.e., showing, offering, and giving) require that the object is located in the child's hand; however, almost never is direct contact with the recipient a part of the gesture or a part of the intended result, as is the case for *contact* gestures. As distal signals, these gestures are inadequate to achieve the child's goal mechanically, but they are adequate to communicate the goal to another person informationally (Tomasello & Camaioni, 1997).

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systematic studies, Curcio (1978) found that in a classroom setting autistic children's strategies for eliciting adult assistance relied on a number of contact (and some distal) gestures, ranging from the use of the teacher's hand as a tool by guiding it toward the desired toy, not accompanied by eye contact, to sequences in which the child initiated eye contact with the teacher, gave her an object he wanted to operate, and then waited for her response. Pointing also was observed in some subjects and it always served an imperative or instrumental function. In comparing young autistic children with matched mentally retarded and normal children, Mundy et al. (1986) found no group differences in children's tendency to combine eye contact with reaching or giving to request objects and activities.

What is remarkable in the gestural repertoire of children with autism is the almost complete absence of gestures used for declarative purposes. In two systematic studies of joint attention behaviors, Mundy et al. (1986) and Loveland and Landry (1986) found that autistic children, as compared with control groups of developmentally disabled children, produced very few attempts to share attention with adults for anything other than imperative purposes. These observations have been confirmed by experimental studies showing that children with autism have severe difficulties in producing and in comprehending the declarative but not the imperative, pointing (e.g., Baron-Cohen, 1989). It is important to note that these children do not lack the capacity to use pointing for self, that is, as a self-directing attentional device to pictures in a book (Goodhart & Baron-Cohen, 1993). Thus, the impairment in protodeclarative pointing cannot be attributed to motoric or motivational factors, but is likely due to the special nature of the sociocognitive experience of sharing attention/interest with another person—an experience not involved in the use of pointing for self. Following Werner and Kaplan (1963), it could be said that children with autism are able to appreciate other human beings as "agents of action," capable of assisting with object goals, but they fail to develop an adequate concept of others as "agents of contemplation," who possess independent psychological states such as interest in external objects/events.

Some of the previously quoted studies have considered autistic children with chronological age ranging from 4 to 12 years (e.g., Abrahamsen & Mitchell, 1990; Curcio, 1978; Wetherby & Prutting, 1984). Other studies have focused on older autistic subjects (range: 6–16 years), with high verbal and nonverbal mental ages (e.g., Baron-Cohen, 1989). Some studies have been based on children with autism under 5 years of age, who are still preverbal (Mundy et al., 1986; Mundy, Sigman, & Kasari, 1990, 1994), a group more suitable for comparison with normal preverbal infants. However, longitudinal studies are still needed to test which developmental change, if any, children with autism may exhibit in their gestural communication and especially in their use of pointing gestures. What could be predicted on the basis of previous research on normal

infants (Perucchini & Camaioni, 1993) is a developmental sequence in which the imperative or instrumental function emerges earlier than the more complex declarative or experience-sharing function.

To address this issue, the present study longitudinally investigates the use of protoimperative and protodeclarative pointing gestures in three children with autism ranging in age from 25 to 53 months. A newly devised experimental technique to test for production and comprehension of pointing gestures, without recourse to linguistic instructions, was used with these children in five subsequent testing sessions at about 5-month intervals.

METHOD

Subjects

Three children with autism, all male, served as subjects. They were respectively, 2 years 1 month (MA), 2 years 8 months (DA), and 4 years 6 months (AN) of age at the beginning of the study, with a mean age of 3 years 1 month. All children were second-born and their families had a middle-class background. The diagnosis of each child was made independently of the experimenters by psychiatrists at the "Stella Maris" Center for the Study of Childhood Psychosis according to established criteria (DSM-III-R; American Psychiatric Association, 1987). All subjects were enrolled in an educational program designed for children with autism. These children were selected as having the same cognitive and communicative levels of development, assessed through the instruments specified below.

Cognitive and Communicative Assessment. The Uzgiris-Hunt Scales (1975) were administered for assessing sensorimotor skills in the following areas: object permanence, means–end, imitation, operational causality, spatial relations, and object schemes. At the beginning of the study no child scored below Stage V on the Means–end and Causality scales. This criterion was selected because Stage V performance on these two scales forms a minimal prerequisite for the use of communicative acts in a variety of situations (see Curcio, 1978). Nonverbal communication was assessed asking educators or parents to fill in an Italian questionnaire designed to evaluate the child's communicative-linguistic development in the 2nd year of life, and validated in previous studies on normal samples (QSCL; Camaioni, Caselli, Volterra, & Luchenti, 1992). All autistic subjects performed very poorly on the more advanced measures evaluated by the questionnaire (referential gestures, words, pointing+words). However, their performance was comparable to that of 16-month-old normal children in the measure called "use of adult as instrument" (e.g., when the child is hungry, he/she leads the mother to where the food is).

Procedure and Coding

All experimental sessions took place in a playroom equipped with a one-way mirror and were videotaped through a double camera. Subjects were tested individually by four different experimenters. The experimenter and the child sat at a table facing each other; the mother tried to hold the child on her lap as much as possible. Two contextual features were considered to be related to the different functions of pointing: the type of stimulus (object vs. event) and the stimulus' distance from the addressee (proximal vs. distal). Consequently, two experimental conditions were designed to elicit the imperative and declarative functions of pointing respectively: *proximal object* condition (a manipulable object is located near the addressee and far from the addresser), designed to elicit pointing with imperative function; and *distal event condition* (an event occurs far from both the addresser and the addressee), designed to elicit pointing with declarative function.

The two conditions were used for eliciting both production and comprehension of pointing so that four conditions were administered in each testing session with a fixed order (Table I). In each condition there were four trials with two different target stimuli. The same conditions were administered to each subject in five subsequent testing sessions (lasting approximately 30 minutes), carried out at about 5-month intervals (mean interval: 5.6, range: 3–9).

All the subjects' behaviors related to the stimuli were transcribed from the videorecordings of the sessions. A coding scheme was devised which allows us to interpret the function (imperative or declarative) of the pointing gestures produced/comprehended by the child. Pointing gesture was defined as the extension of the index finger and the arm towards a target object or event. For the production condition, the child's intention was interpreted through his/her reaction to the experimenter's response. For the comprehension condition, the child's understanding of the adult's intention was interpreted through his response to the experimenter's pointing (Table II).

Only those trials in which the target stimuli or the experimenter's gestures at least attracted the subject's attention were coded (the remaining were considered nonvalid). Mean percentages of valid trials on trials administered to the three subjects were 95% (range: 83–100) for production and 66% (range: 41–86) for comprehension. In general, the proportion of valid trials was lower for comprehension compared to production. Comprehension trials were probably more demanding for these children because they required a sustained orientation towards what the experimenter was doing.

Table I. Experimental Conditions

Production	Comprehension
Proximal object → Imperative eliciting	
Experimenter (E) calls the infant and winds up a small car so that it will move for 5-8 seconds. E looks at the car and waits to let the child react to the stimulus. When the infant produces a behavior related to the stimulus (pointing, reaching, vocalizing, etc.), E answers either looking and naming the car or giving the car to the child. E winds up the little car four times, then he/she carries out the same sequence activating a musical-box from which a puppet gets out (four trials).	E calls the infant and shows a small car with a puppet as driver. E takes the puppet out from the car and puts the car on the table near the infant (so that he can take it). E shows the puppet and points/looks at the car while saying "Let me put the puppet in the car." E repeats the trial four times, then he/she carries out the same sequence using a drum with a stick (four trials).
Distal event → Declarative eliciting	
E calls the infant. A group of butterflies hanging from the ceiling moves (invisibly activated by E). E looks silently at the child. When the infant points or makes some other behavior related to the stimulus, E looks, names and comments on the stimulus. E repeats the trial four times, then he/she carries out the same sequence with a piece of animated cartoons, invisibly activated by E (four trials).	E calls the infant. E points at a bird figure appearing on the window for 5 seconds, while continuing to look at the child and at the figure. E repeats the trial four times, then he/she carries out the same sequence pointing and looking in the direction of a musical sound invisibly produced by the camera operator (four trials).

Two independent coders applied the coding scheme on all test sessions. Interrater percentage agreement was 80% for all the categories; the remaining cases of disagreement were discussed further so as to reach a complete agreement.

In addition to pointing gestures, other types of ritualized actions and gestures were produced by each subject during the experimental trials. These actions and gestures were evaluated as having a communicative function when accompanied by other's directed gaze or by vocalizations and coherent facial expressions, and were coded following the coding scheme reported in Table III. Finally, it was deemed important to code gaze direction also independently from any action/gesture produced by the child (i.e., as Mutual Attention and Joint Attention; see Table III).

Table II. Coding Scheme of Pointing Gesture's Communicative Functions

Production of pointing	Comprehension of pointing
Imperative function	
When the experimenter (E) gives the object to the child (C), he takes it	C gives or refuses to give the target stimulus to E
After E's comment, C produces a pointing and/or reaching gesture	C assents or says yes
After E's comment, C cries and/or vocalizes (whining)	C leaves the stimulus near E looking at E and/or at the stimulus
C approaches or tires to approach the object	C throws the stimulus to E
Declarative function	
C points, looks alternatively at E and at the stimulus, smiles and/or vocalizes	C looks at the stimulus and at E, vocalizes or produces onomatopoeic sounds/words
C points, looks at E and produces onomatopoeic sounds or words	C points at the target stimulus
C points and looks alternatively at E and at the stimulus	C looks at E and performs an act of motoric recognition
Inappropriate response	
Response which does not allow to identify the child's intention and which presumably expresses a communicative function different from that elicited by the experimental condition	Response which does not allow to identify the child's comprehension of the experimenter's intention, and which presumably implies a communicative function different from that elicited by the experimental condition

RESULTS

Data presented in Table IV are consistent with previous findings that autistic children are very able to use requesting skills; this was true for each subject at the level of both ritualized request actions and request gestures. Request gestures tended to be less frequent than ritualized actions and were not shown by the youngest child in the first two sessions. Pointing gestures were observed in all subjects since the second (DA and AN) or the third session (MA). Referential gestures were very rare; one child (AN) displayed a few of them, all of the conventional type (head shaking, waving bye-bye, handclapping), clearly learned through imitation during social routines (see Curcio, 1978, for a similar finding). Finally, each child was consistently able to coordinate his own focus of attention to an object/event with the other's attention (experimenter or mother). It is worth noting a tendential increase from the first session to the following ones in those cases in which joint attention was accompanied by vocalizations or by smiling and laughing.

Table III. Coding Scheme of Communicative Actions/Gestures and Gaze Direction

Ritualized request actions

Hand-clap: Subjects slaps own hand/hands on the table on which the target-object is located (eventually repeated)

Using adult's hand as a tool: Subject takes/pulls the adult's hand guiding it towards the target-object (target out of reach)

Request gestures

Arm extension with opening and closing of the hand (eventually repeated)

Arm extension with hand opening, palm up, towards the target-object (eventually repeated)

Arm extension with hand opening, palm down, towards the target-object (eventually repeated)

Referential gestures

Gestures representing specific referents and whose basic semantic content does not change with context:

Conventional gestures such as shaking the head ("No"), waving bye-bye, raising the arms ("all-gone")

Nominal gestures (providing labels for specific objects/actions) such as drinking from an empty cup, opening and closing the mouth ("Fish"), flapping the hands ("Birdie")

For each action/gesture the co-occurrence of one or more of the following behaviors is also indicated:

Other's directed gaze (before, after or concomitant to the execution of the action/gesture)

Accompanying vocalizations (insistent, grizzly, chatty)

Facial expressions (negative, pleasant, smile, laugh)

Mutual attention

The child and the adult look at each other eyes

Joint attention

The child alternates his/her own gaze between the adult's eyes and the object/event

As far as the autistic children's reactions to experimental conditions is concerned, production and comprehension of *imperative* and *declarative* pointing gestures were assessed not in terms of frequencies but using categorical data (see Goodhart & Baron-Cohen, 1993, for a similar choice). It was scored if the subject produced any clear instance of imperative or declarative pointing in each test session. The results on production are quite clear (Table V). No child produced any pointing gesture in the first session (see also Table IV), but two children displayed pointing with an imperative function since the second session and the third child (MA) exhibited this type of pointing in the last two sessions. Two children produced the declarative pointing, one in the third session and the other in the fifth session; both of them were already able to use the imperative pointing earlier.

Table IV. Frequency of Categories of Communicative Actions/Gestures and Gaze Direction for Three Children in the Five Sessions

	Subjects														
	MA					DA					AN				
Variable	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Age (years; months)	2;1	2;7	3;3	3;10	4;3	2;8	3;2	3;6	3;9	4;5	4;6	4;10	5;2	5;5	6;2
Ritualized request actions	2	6	2	1	1	2	3	11	1	0	3	23	6	16	1
Request gestures	0	0	3	1	1	4	0	0	1	8	1	6	2	0	1
Referential gestures	0	0	0	0	1	0	0	0	0	0	0	0	1	1	1
Pointing gestures	0	0	4	12	38	0	1	5	0	0	0	13	7	7	3
Mutual attention	6	7	0	0	2	0	1	2	0	2	1	4	0	0	3
Joint attention	9	8	8	7	5	5	2	4	8	1	7	10	9	6	1
Joint attention + smile/laugh or vocalizations	8	13	8	15	20	3	5	7	4	0	5	8	0	4	9

Table V. Subjects Displaying Production and Comprehension of Imperative and Declarative Pointing (+) in the Five Sessions

		Session				
Variable	Subjects	1	2	3	4	5
Production						
Imperative pointing	MA				+	+
	DA		+	+		
	AN		+	+	+	+
Declarative pointing	MA					+
	DA					
	AN			+	+	
Comprehension						
Imperative pointing	MA	+	+	+	+	+
	DA	+			+	
	AN		+	+	+	+
Declarative pointing	MA			+		+
	DA					
	AN					

Comprehension of the imperative pointing gestures produced by the experimenter was displayed either in the first or in the second session by all subjects, which continued to exhibit the same response in the following sessions (Table V). Only one autistic child was able to understand the declarative pointing at least in two sessions.

DISCUSSION

The three children with autism longitudinally examined in the present study showed heterochrony in the emergence of different communicative functions (Stone & Caro-Martinez, 1990; Wetherby, 1986). Imperative or instrumental functions were easy for these children and emerged earlier in all of them; declarative or experience-sharing functions emerged later in two subjects and were completely absent in one child. This finding confirms the developmental pattern predicted on the basis of a previous experiment (Perucchini & Camaioni, 1993) showing a temporal *décalage* (of about 3 months) between imperative and declarative pointing in normal 1-year-old infants for both production and comprehension. So a certain amount of heterochrony—with earlier emerging and later emerging communicative functions—characterizes also the communicative development of normal infants. Under normal circumstances, however, the developmental rate might be so rapid as to mask a sequential pattern of acquisition.

Only two children with autism reached the ability to use the declarative pointing (at about 5 and 4 years of age, respectively), and only one of them understood the declarative pointing produced by the experimenter. It is important to note, however, that—since the first session—all three children consistently showed joint attention behaviors, an ability deemed to be a precursor of indicating skills for referential purposes. The relative proficiency of our subjects in joint attention eye contact could be explained on the basis of considerable individual differences in this dimension. Previous studies have reported how young autistic children vary in the degree to which they display joint attention skills and have suggested that joint attention deficits may be affected both by mental age and by environmental manipulations (cf. Lewy & Dawson, 1992; Mundy et al., 1994). Mundy et al. reported, for example, that young autistic children with high IQs do not display joint attention deficits that simply involve eye contact, but do display joint attention deficits that involve more sophisticated referential gestures. An alternative explanation takes into account symptom severity as the main source of individual differences in joint attention behaviors in children with autism.

In general, our data show consistent developmental change in the more advanced communicative behaviors displayed by autistic children through a longitudinal assessment over a 2-year interval. These results give further support to the idea that the type or level of communicative impairment that is characteristic of autistic subjects may change over time and development (cf. Mundy et al., 1993). Moreover, it is of considerable clinical interest that we observed and evaluated in the present study not an unassisted course of development but rather a developmental progress possibly affected both by early detection of autism (before 3 years of age) and early intervention efforts (special education program).

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