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Perceptual role taking and protodeclarative pointing in autism

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In previous studies we have found that autistic children were severely impaired in conceptual role taking, that is, in their theory of mind. In this study we consider two possible precursors to this impairment, both of which are early interpersonal abilities. The first is perceptual role taking. A test of this revealed no impairment, ruling it out as related to the impairment in theory of mind. The second is pointing. This was shown to be abnormal, both in comprehension and production, relative to non-autistic controls. In particular, protodeclarative pointing was impaired whilst protoimperative pointing was not. The possibility that impaired protodeclarative pointing may be a precursor to autistic children's impaired theory of mind is discussed.

Autism is a neurodevelopmental disorder (Schopler & Mesibov, 1987), characterized by severe impairments in the ability to relate socially and in communication (Kanner, 1943). In this article we consider the developmental psychology of the social impairment in autism, which many authors now argue is a primary symptom in the syndrome (Fein, Pennington, Markowitz, Braverman & Waterhouse, 1986; Volkmar, 1987). A review of the social deficit is available elsewhere (Baron-Cohen, 1988*a*) but we can summarize this deficit in the following way: although assuming a number of different forms, in all cases social behaviour in autism lacks 'reciprocity' (Rutter, 1983).

Autistic children also possess specific cognitive deficits (Hermelin & O'Connor, 1970; Sigman, Ungerer, Mundy & Sherman, 1987) and this has led to the hypothesis that the social impairment may be due to deficits in their *social cognition* (Frith, 1982). In previous studies we identified one aspect of social cognition which was impaired in autism: the ability to attribute mental states, such as beliefs, to others (Baron-Cohen, Leslie & Frith, 1985, 1986). This finding has subsequently been replicated (Baron-Cohen, 1988*b*; Dawson & Fernald, 1987; Harris & Muncer, 1988; Leslie & Frith, 1988; Perner, Frith, Leslie & Leekam, 1989). By itself, this would render a child unable to make sense of much of the social world (Humphreys, 1983; Wellman, 1985) and disrupt communication (Grice, 1967).

In normal children, the ability to attribute mental states to others has become a subject of considerable interest to developmental psychologists. The experimental studies relevant to this field have recently been brought together in an excellent book

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(Astington, Harris & Olson, 1988). This body of evidence suggests that the ability to attribute a false (and therefore different) *belief* to others is well within the competence of normal 3–4-year-old children (Wimmer & Perner, 1983), as is the ability to attribute *intentions and desires* to others (Yuill, 1984). The ability to understand *pretence* in others is present even earlier, by 2 years of age (Leslie, 1987, 1988). The ability to understand other people's mental states has been described as a 'theory of mind' (Premack & Woodruff, 1978). This phrase succinctly reminds us that mental states are not observable but must be postulated or inferred from behaviour, that is, the child must develop a theory of their existence. Once in possession of such a theory the child can use it not only to make sense of action but to predict it (Dennett, 1978). And it seems that it is precisely in the normal development of a theory of mind that autistic children have immense problems.

The question arises as to the developmental origins of this deficit in autism. In which simpler and developmentally earlier behaviours might this deficit be manifested? In this paper we consider two possible *precursors* of the deficit: (*a*) perceptual role taking and (*b*) joint-attentional gestures, specifically pointing. These two abilities are selected because, like a theory of mind, they both involve the child coordinating his or her attention with that of another person but, unlike a theory of mind, both are demonstrably present in normal children in the second year of life. We use the term 'precursor' to imply not only that one ability temporally precedes the other, but that the earlier one stands in a developmentally necessary or causal relationship to the later ability.

Perceptual role taking has been shown to be unimpaired in autism (Hobson, 1984). In contrast, joint-attentional behaviours have been found to be impaired in autism (Sigman *et al.*, 1986). We retested these abilities, not only to establish the reliability of these findings, but also to explore pointing in more detail than previous studies had done.

Perceptual role taking

Perceptual role taking ability has been shown to be present in normal children as young as 30 months of age (Flavell, Shipstead & Croft, 1978; Lempers, Flavell & Flavell, 1977). Hobson (1984) investigated perceptual role taking in autism. He found that most autistic children could position a doll so that it could either see the experimenter or the child. They were also able to hide model people so that the experimenter was unable to see them, and to state a doll's visual perspective of a cube (each face of which was a different colour). When errors occurred, these were more frequent among children of lower mental ages. In other words, performance on these tasks was found to be influenced by mental age rather than by autism-specific factors.

Hobson's results suggest autistic children understand what Lempers *et al.* (1977) call the 'facts of vision' – knowing, for example, that normally at least one open unobstructed eye is necessary for vision, that eye-orientation indicates which objects are being viewed, that objects which are not occluded by any other and which stand along an imaginary straight line from a person's open eye(s) (that is, along their 'line-of-sight') will be visible, and that what one person sees or does not see has absolutely no effect on what another person sees, etc.

In Expt 1 we aimed to replicate Hobson's finding, using a different paradigm. A task used by Lempers *et al.* was given to three groups of children – autistic, Down's syndrome and normal. The rationale for including these non-autistic groups was to control for the effects of low mental age (MA). Our task assessed the subject's ability to infer what the experimenter was attending to from the orientation of his eyes alone.

Lempers *et al.* found when eye-orientation alone was available as a cue, 3-year-olds were successful whilst 2½-year-olds required head-orientation prompts as well. Since our subjects all had an MA of about 3 years (minimum), we chose the eye-orientation condition for our test. We predicted that if this ability depended solely on a minimum MA of 3 years, this task would be equally straightforward for all three groups, given their developmental level. In this respect, we predicted that perceptual role taking in autism would not be related to the deficit in their theory of mind.

Experiment 1: Perceptual role taking

Method

Subjects. Details of the subjects are shown in Table 1. The 20 autistic children had been diagnosed according to currently used criteria (DSM III–R, 1987). In addition, there were 14 Down's syndrome and 27 clinically normal preschool children. Non-verbal MA of the clinical groups was established using the Leiter International Performance Scale (Arthur, 1952). The autistic group's mean non-verbal MA was significantly higher than that of the Down's syndrome group, and this was also true of their verbal MA, assessed using the British Picture Vocabulary Scale (Dunn, Dunn, Whetton & Pintilie, 1982). For both clinical groups, verbal MA was significantly delayed, relative to non-verbal MA. We assumed that for the normal group MA would roughly correspond to chronological age (CA). The clinical groups

Table 1. Means, SDs and ranges of chronological age (CA) and mental age (MA) of subjects in Expts 1 and 2

Diagnostic groups	CA	Non-verbal MA[a]	Verbal MA[b]
Autistic (*n* = 20)			
Mean	11:11	9:3	5:5
SD	3:0	2:2	1:6
Range	6:1–16:6	5:4–15:9	2:8–7:5
Down's syndrome (*n* = 14)			
Mean	10:11	5:11	2:11
SD	4:11	0:11	0:7
Range	6:3–17:0	4:9–8:6	1:8–4:0
Normal (*n* = 27)			
Mean	4:5		
SD	0:7	—	—
Range	3:5–5:9		

[a]Leiter.
[b]BPVS.

were selected because they had a verbal MA of about 36 months, by which age normal children succeed on this task.

Procedure. Subjects were tested individually, with only the experimenter present. Six small toys were placed around the seated subject: three on a shelf above the child and approximately 4 ft behind him or her; one below (on the floor near the child's feet); and one placed on tables approximately 2 ft to either side of the subject. This arrangement is shown in Fig. 1. The child was first asked to name each toy in order to check that these items were within his or her vocabulary, which in all cases they were. (The toys comprised a miniature train, a toy cat, a female doll, a teddy, a plastic telephone and a model house.)

The experimenter, facing the subject, closed his eyes, moved them under closed lids to face one of the toys, and only then opened his eyes, continuing to face straight ahead. The subject was then asked:

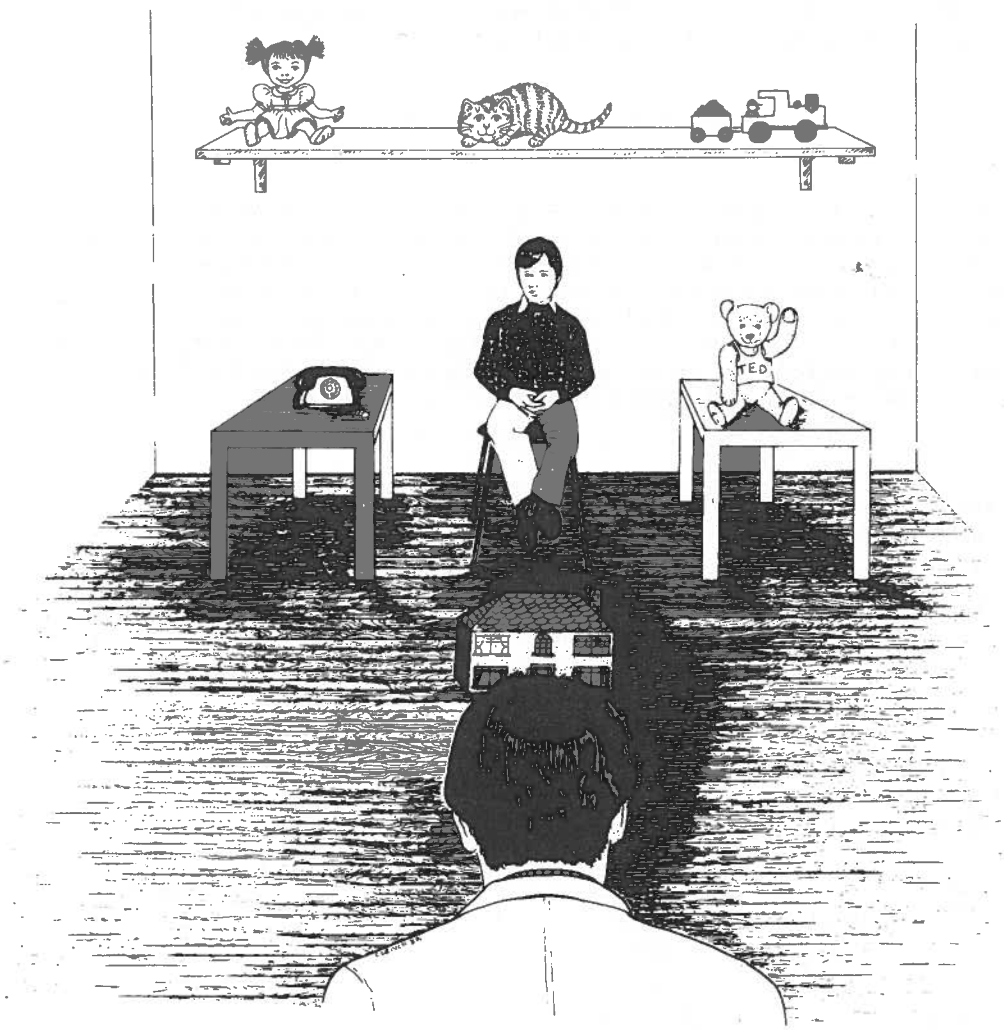

Figure 1. Arrangement of subject, apparatus and experimenter in the test of perceptual role taking (Expt 1).

'Which toy am I looking at?'. Thus, only the experimenter's eye-orientation (and not head-orientation) was available as a cue. The order in which the toys were looked at was randomized. The child's verbal and non-verbal responses to the test questions were noted. The positioning of three of the toys behind the subject allowed us to investigate if perceptual role taking was more difficult when the target object was not immediately in the subject's visual field.

Results and discussion

Table 2 shows the percentage of subjects in each group passing the test, averaged across the six objects. Passing was defined as correctly naming the object being looked at. There were no significant differences within or between groups across the six objects. Subjects in all three groups performed virtually at ceiling, so no further analysis was performed on these results.

Table 2. Average number of children (and percentages in each group) passing perceptual role taking test

Groups	*n*	Pass	%
Autistic	20	18.5	92.5
Down's syndrome	14	12.5	89.3
Normal	27	25.5	94.4

It is clear that the autistic children were unimpaired in this test of perceptual role taking. In this sense, they demonstrated that they understand the role of another person's eyes in seeing, and appreciate that other people stand in a particular relationship to a perceived environment. This replicates Hobson's (1984) study using a different paradigm, and rules out perceptual role taking as a developmental precursor to the autistic child's impaired theory of mind.* Our results also replicate those of Lempers *et al.* (1977) with normal subjects, and demonstrate that this ability is normal in Down's syndrome subjects. In our second experiment, we tested the same subjects' ability to understand pointing gestures, to investigate if this might be a precursor to the autistic child's impaired theory of mind.

Pointing

Normal children produce the pointing gesture by 9–14 months (Bruner, 1983; Murphy, 1978) and use it for at least two different functions. In Bates, Camaioni & Volterra's (1975) terms, these are:

(1) *Protoimperative function.* The infant points in order to use another person to *obtain* an object. The gesture might thus be said to correspond to the utterance 'Give me that' or 'I want that'. This corresponds to the lowest level of communication – sometimes referred to as 'perlocutionary' (Austin, 1962) – in which the infant intends to 'create some effect' in the other person. However, there is no evidence here that the infant is trying to influence the mental state of the other person. The infant's goal is limited to obtaining some state of affairs in the *physical* world. It can be thought of as an 'instrumental behaviour' (Zinober & Martlew, 1985).

* Leslie & Frith's (1988) article has appeared since this paper was submitted and includes some further data in support of intact perceptual role taking in autism.

(2) *Protodeclarative function.* The infant points in order to *comment* or *remark* on the world to another person. This gesture might be said to correspond to the utterance 'Look! There's an *x*' or 'Look! Over there'. It has been suggested that this operates at a higher level of communication – sometimes referred to as 'illocutionary' (Austin, 1962) – in which the infant intends to influence the other person's *mental* state (Bates, 1976). That is, the infant's goal is to make another person recognize, attend to or understand what s/he is thinking about.

Pointing has been reported to be abnormal in autism (Ricks & Wing, 1975; Sigman *et al.*, 1986), while this is not true of either mentally handicapped children (Coggins, Carpenter & Owings, 1983) or language-delayed children (Caparulo & Cohen, 1977). Fine-grain analyses of gestures in autism suggest that those gestures used for requesting objects, actions or social routines may be present in autism (Attwood, Frith & Hermelin, 1988; Loveland & Landry, 1986), whilst gestures sharing an awareness of an object's existence or properties are absent (Curcio, 1978; Mundy, Sigman, Ungerer & Sherman, 1986, 1987; Wetherby, 1986).

The aim of the following experiments was to explore this in more detail. We tested if comprehension (Expt 2) and production (Expt 3) of protoimperative pointing were normal in autism, whilst comprehension and production of protodeclarative pointing were not – a comparison that previous studies had not examined.

Experiment 2: Comprehension of pointing

Method

Subjects. The subjects in this experiment were the same as those in the first experiment. The comprehension test was given to this relatively older sample of clinical subjects because pilot studies showed that a minimum language level of about 3 years old was necessary to understand the experimental instructions.

Procedure. The comprehension tests were carried out in a quiet room with each child individually. Each child was tested for comprehension of the two types of pointing, in random order.

(i) *Understanding protoimperative pointing.* The act of labelling a pointing gesture as a protoimperative depends on the viewer interpreting it as such. We therefore recorded how the subject *interpreted* a pointing gesture. The experimenter said 'I am going to use my finger to say something. What am I saying?'. He then faced the subject and pointed to one of four toys in turn (drawn from the toys used in Expt 1), positioned in a semicircle close to the subject but at some distance from the experimenter. The experimenter then waited to see how the subject responded. The toys were positioned in this way because pilot studies showed that these conditions (of *shared* visual fields and with the target object being out of reach of the pointer but not of the other person) applied most often in spontaneous instances of protoimperative pointing.

Scoring. Four response categories (two pass and two fail) were expected, and indeed these turned out to cover all responses obtained:

(*a*) If the child picked up the object and handed it to the experimenter, this was rated as a pass, the subject interpreting the gesture as a protoimperative (request for object).

(*b*) If the subject said 'You want me to give you that toy', or some such phrase, this was rated as a pass, the subject articulating the meaning of the gesture as a protoimperative.

(*c*) If the subject did nothing, or made some inappropriate response (e.g. touching the index finger or imitating the gesture), this was rated as a fail.

(*d*) If the subject named or commented on the toy, this was rated as the child interpreting the gesture as a protodeclarative, in which case the experimenter repeated the gesture insistently, in order to emphasize that a different response was expected. If the child did not then produce a response described in (*a*) or (*b*) above, this was scored as a fail, although understanding protodeclarative pointing was noted.

(ii) *Understanding protodeclarative pointing.* The experimenter said 'Now I am going to use my finger to say something else. What am I saying?' He then walked over to the window, looked up to the sky and pointed, and then looked across to the subject, whilst still pointing up at the sky. The experimenter then waited to see how the subject would respond. He then repeated this with three other locations: through the open door, into his briefcase and into his jacket pocket. Each of these locations was selected because the experimenter could see an object which the subject could *not* see (e.g. a plane or bird in the sky, a person in the corridor or a toy in the briefcase or the pocket). This feature (of *unshared* visual fields) was used because pilot studies had indicated that these conditions applied most often during spontaneous instances of protodeclarative pointing by normal children. On each trial, if the subject did not respond immediately, the experimenter then looked up again in the direction of his point, and again back at the subject, and repeated this up to twice more, waiting again for the subject to respond.

Scoring. Five response categories (three pass and two fail) were expected, and again these were sufficient to code all the data obtained:

(*a*) If the child looked in the direction of his point (often involving the child moving nearer to the experimenter), this was rated as a pass, the subject interpreting the gesture as a protodeclarative.

(*b*) If the child said 'What is it?' or 'What are you looking at?' or named the object, etc. (i.e. expressed interest in the experimenter's aim), this was also rated as a pass, the subject interpreting the gesture as a protodeclarative.

(*c*) If the child said 'You want me to look at something you can see', or an equivalent phrase (e.g. 'You're saying "There's a plane in the sky"'), this was scored as a pass, the subject articulating the meaning of the gesture as a protodeclarative.

(*d*) If, however, the subject attempted to pick something up and give it to the experimenter, this was rated as a fail, the subject (inappropriately) interpreting the gesture as a protoimperative. Understanding protoimperative pointing was, however, noted.

(*e*) Finally, if the subject made no response, or an inappropriate response (such as touching the index finger, etc.), this was rated as a fail.

Results and discussion

The results of the test of comprehension of protoimperative and protodeclarative pointing are given in Table 3. As the four different locations did not significantly affect performance for most subjects, Table 3 shows the number of children in each group who passed this test, averaged across all four locations. Chi square tests revealed that the three groups did not differ from each other on comprehension of protoimperatives (Down's × autism, $\chi^2 = 0.027$, d.f. = 1; normals × Down's, $\chi^2 = 0.866$, d.f. = 1; normal × autistic, $\chi^2 = 3.07$, d.f. = 1; all $P > 0.05$), but that the autistic group was significantly worse than either the Down's syndrome ($\chi^2 = 16.49$, d.f. = 1) or the normals ($\chi^2 = 32.03$, d.f. = 1) on comprehension of protodeclaratives (both $P < 0.001$). In contrast, the Down's and normals did not differ on this ($\chi^2 = 0.576$, d.f. = 1, $P > 0.05$).

To test for an autism-specific dissociation between comprehension of protoimperative and protodeclarative pointing we compared the average number of children in each group who passed on one type of pointing but failed on the other. This is also shown in Table 3, and analysis of this comparison showed evidence of an autism-specific dissociation (autistic × Down's, $\chi^2 = 7.63$, d.f. = 1; autistic × normal, $\chi^2 = 16.25$, d.f. = 1, both $P < 0.05$; Down's × normal, $\chi^2 = 0.03$, d.f. = 1, $P > 0.05$).

Table 3. Average number of children (and percentages in each group) passing comprehension test of protoimperative and protodeclarative pointing

		Protoimp		Protodec		Dissociation	
Groups	*n*	Pass	%	Pass	%	Rate[a]	%
Autistic	20	14	70.0	2*	10.0	12**	60
Down's syndrome	14	11	78.5	12	85.7	1	7.2
Normal	27	25.25	93.5	26	96.2	0.75	2.3

*$P < 0.001$; **$P < 0.05$.
[a]Dissociation rate = average number of children passing one and failing other.

Of those who passed the test of comprehension of protoimperative pointing, most interpreted the point as a request for object, and this was true in all three groups. On the test of comprehension of protodeclarative pointing, subjects who passed tended to produce the first two pass response types (i.e. looking along the line of point, or asking 'What is it?'), although some normal children produced pass response type (*c*) (i.e. articulating the meaning of the gesture). Of the autistic subjects (18 out of 20 of whom failed this test), 14 did nothing at all, whilst four attempted to pick up an object (i.e. interpreting the gesture as a protoimperative) on at least two trials. The two autistic children who passed the protodeclarative pointing comprehension test were not significantly different from the 18 who failed on either MA or CA, and both of these subjects produced response type (a) (looking along the line of point).

These results suggest that whilst autistic children may be unimpaired in their comprehension of protoimperative pointing, their comprehension of protodeclarative pointing seems severely impaired. This confirms the earlier prediction, and raises the possibility that this may indeed be a developmental precursor to the deficit in their theory of mind. In the final experiment, we investigated if this same pattern of results would also appear in their production of these gestures.

Experiment 3: Production of pointing

Method

Subjects. In Expt 3 there were also three groups of 10 subjects: autistic, mentally handicapped and normal children. Unlike the previous experiments, these subjects all had a verbal MA of 18–36 months (again assessed using the BPVS). These subjects were selected because it is normal to find abundant spontaneous production of pointing at this verbal MA and indeed our pilot studies had shown that, in normal and mentally handicapped children, pointing is spontaneously produced only when the child has very little language. Indeed, the desire to communicate in the absence of language abilities may be the driving force behind the production of pointing. The two clinical groups were assessed for non-verbal MA using four performance items from the Merrill–Palmer Infant Ability Test (namely, the Wallin Peg-Boards, the little pink tower, the Seguin Form Board, and the 16 cubes). Details of the subjects are shown in Table 4.

Table 4. Means, SDs and ranges of chronological age (CA) and mental age (MA) of subjects in Expt 3

Diagnostic groups	CA	Non-verbal MA[a]	Verbal MA[b]
Autistic (*n* = 10)			
Mean	3.9	3.0	1.9
SD	0.8	1.8	0.6
Range	2.6–5.2	1.5–5.5	1.5–3.0
Mentally handicapped (*n* = 10)			
Mean	4.2	2.0	1.6
SD	0.9	0.6	0.6
Range	3.0–6.1	1.5–3.0	1.5–2.0
Normal (*n* = 10)			
Mean	2.1		
SD	0.3	—	—
Range	1.8–2.4		

[a]Merrill–Palmer (four performance items).
[b]BPVS.

A heterogeneous mentally handicapped group was used here because of the unavailability of a Down's syndrome sample of the appropriate mental age. However, despite being less homogeneous diagnostically, this group was quite suitable as a way of controlling for general developmental delay.

Each group of subjects was videofilmed for 45 min during play. The camera was positioned such that at least eight out of the 10 children were visible at the same time, whilst one or two children occasionally wandered out of the camera's range, and then back into it. This loss of data was the same for all three groups, and was methodologically unavoidable. The room was unremarkable in terms of equipment (tables, chairs, sandpit, toys, etc.), and in each case there were two female crêche workers (adults) playing with the children.

In the case of the autistic group, the playgroup adjoined a training centre for parents with an autistic child less than 5 years old, and in the case of the mentally handicapped subjects were in a school for children with mild to moderate learning difficulties. The normal children were in a crêche attached to University College London.

Scoring. The videotapes were rated by two independent judges, using the following criteria:

(*a*) Pointing was scored as protoimperative if it was rated as unmistakably part of an attempt to *obtain* an object [e.g. (i) Sam points at a toy held by Anna, and repeats the point until Anna hands the toy over; or (ii) Sam points at a toy held by Anna, and then abandons the gesture through Anna's lack of response, and finally takes the toy himself].

(*b*) Pointing was scored as protodeclarative if it was rated as unmistakably part of an attempt to *comment* on an object or event, that is, to draw another person's *attention* to the object or event, as an end in itself [e.g. (i) Sam points at a boy who is crying, then looks over to an adult, and continues pointing until the adult turns around and looks; or (ii) Sam points at an object or event which could not be an object of possession, such as an airplane out of the window, or a car across the road, and then looks over to Anna, and waits until she also looks at the same event].

Pointing rated as ambiguous by both judges was ignored. In each type of pointing, the way in which the subject monitored its effect on another child was the critical distinguishing variable. Reliability of these two types of pointing was established by calculating Cohen's kappa (reliability coefficient) for each type of pointing. This is reported in the Results section below.

Results and discussion

Each child was rated as either showing or not showing each of the two types of pointing. The results for each group are shown in Table 5. Reliability ratings showed that protodeclarative and protoimperative pointing could be distinguished (Cohen's $\kappa = 0.81$ and 0.86, respectively). Whilst the mentally handicapped and normal groups did not differ on either type of pointing, significantly fewer autistic children produced protodeclarative pointing than the other two groups (autistic × mentally handicapped, $\chi^2 = 7.91$, d.f. = 1; autistic × normal, $\chi^2 = 12.93$, d.f. = 1, both $P < 0.005$). The three groups did not differ on protoimperative pointing (autistic × normal, $\chi^2 = 0.81$, d.f. = 1; autistic × mental handicap, $\chi^2 = 1.87$, d.f. = 1, both $P > 0.05$).

Table 5. Average number of children (and percentages in each group) producing protoimperative and protodeclarative pointing[a]

		Protoimp		Protodec		Dissociation	
Group	n	Pass	%	Pass	%	Rate[b]	%
Autistic	10	4	40	0*	0	4	40
Mental handicap	10	8	80	7	70	1	10
Normal	10	7	70	9	90	2	20

*$P < 0.005$.
[a]First judge only.
[b]Dissociation rate = the number of children passing one and failing the other.

These results support the prediction that autistic children are severely impaired in their production of protodeclarative pointing, whilst their production of protoimperative pointing is not significantly different from that of normal and mentally handicapped children. This pattern mirrors that found in the earlier test of comprehension of pointing.

Concerning the test of an autism-specific dissociation between production of protoimperative and protodeclarative pointing, the number of children in each group who produced one type of pointing but not the other was not significantly different (autistic × normal, $\chi^2 = 0.24$, d.f. = 1; autistic × Down's, $\chi^2 = 1.07$; $P > 0.05$ for both). The lack of an autism-specific dissociation in this task may be due to the fact that the autistic children interacted less in general. However, by itself this factor does not account for why almost half of them produced protoimperative pointing, whilst *none* produced any protodeclarative pointing.

Final discussion

The studies reported here investigated two social-cognitive abilities in autism, perceptual role-taking and pointing – abilities which are normally present in the second year of life. Our rationale was to ascertain if either of these might be developmental precursors to the impairment in autistic children's theory of mind, a deficit revealed in our earlier studies.

Experiment 1 confirmed the finding that perceptual role taking is unimpaired in autism (Hobson, 1984), ruling it out as a possible precursor to the impaired theory of mind in autism. In contrast, Expts 2 and 3 found a dissociation: protoimperative pointing was both understood and produced in autism, whilst protodeclarative pointing was not. In Expt 2 this produced a statistically significant autism-specific dissociation. The results from Expts 2 and 3 confirm findings from Mundy *et al.* (1986, 1987) that requesting gestures are present in autism whilst indicative gestures are impaired. Our results are compatible with the idea that protodeclarative pointing may be an early developmental precursor of the social impairment in autism. At this stage we need to remain cautious in interpreting the *combined* results from Expts 2 and 3, as the subjects in each of these experiments were of different ages. Nevertheless, the trend in these experiments was the same: that protodeclarative pointing was impaired whilst protoimperative pointing was relatively spared.

Accounting for the presence of perceptual role taking in autism may be possible in terms of their intact representational capacity, evident in their possession of the concept of object permanence (Sigman *et al.*, 1987). Perceptual role taking may simply involve 'mental rotation' of representations, and applying the 'facts of vision' (described earlier) from themselves to other people. Accounting for the presence of protoimperative pointing in autism may also be relatively unproblematic. In normal development, the concept of physical causality appears to be necessary for the production of protoimperatives (Harding & Golinkoff, 1979), and the concept of physical causality appears to be intact in these children (Baron-Cohen *et al.*, 1986; Curcio, 1978). Accounting for the absence of protodeclarative pointing in autism may be considerably more difficult. We turn to this question in the final section of this paper.

Implications of the absence of protodeclarative pointing

Before thinking about its relevance to autism, it is worth noting the considerable significance with which protodeclarative pointing has been credited in normal developmental psychology. It has been seen as an early form of at least seven psychological abilities:

(i) *joint-attention* (reciprocal) behaviours (Bruner, 1975, 1976);
(ii) a prerequisite for the acquisition of the concept of *dialogue* (Bruner, 1975, 1976);
(iii) *reference* (Bruner, 1983; Macnamara, 1982);
(iv) *deixis* (Clark, 1978);
(v) Production of *speech acts* with illocutionary force (Dore, 1975), where this term refers to any communicative act (verbal or non-verbal) which contains a

'complex intention', i.e. in which the sender's intention is coordinated with the receiver's intention (Grice, 1967; Searle, 1983);

(vi) the ability to attribute mental states to another person (Bates, 1976; Churcher & Scaife, 1981), that is, a *theory of mind*;

(vii) *Symbol use* (Bates, Benigni, Bretherton, Camaioni & Volterra, 1979; Lock, 1978), insofar as the infant uses it to stand for or represent his/her intention.

It is a matter of ongoing debate whether protodeclarative pointing is within the ability of non-human species (Premack & Premack, 1983; Savage-Rumbaugh, 1986). The various claims regarding its status are summarized in Fig. 2.

Figure 2. The developmental status accorded to protodeclarative pointing.

Protodeclarative pointing has been postulated to be one of the earliest gestural forms of:

(i) Joint-attention (reciprocal) behaviours
(ii) Dialogue
(iii) Reference
(iv) Deixis
(v) A Speech Act with illocutionary force
(vi) Theory of mind
(vii) Symbol use

The idea that all of these abilities are linked to protodeclarative pointing gathers strength from the surprising fact that, with the possible exception of reference, *all* of these psychological abilities have been reported to be impaired in autism (joint-attention: Mundy *et al.*, 1986; dialogue: Baltaxe, 1977; deixis: Bartolucci & Albers, 1974; speech acts: Baron-Cohen, 1988*a*; theory of mind: Baron-Cohen *et al.*, 1985, 1986; symbol use: Baron-Cohen, 1987; Ricks & Wing, 1975). One tempting possibility is, therefore, that the absence of protodeclarative pointing in autism is a critical precursor to all of these later deficits.

But what does it mean to say that protodeclarative pointing is a precursor? Let us consider this notion in relation to just one of these abilities – a theory of mind, the focus of this article. On the one hand we might mean that, as a precursor to a theory of mind, protodeclarative pointing is an earlier but *essentially similar* ability, that is, that protodeclarative pointing itself requires a theory of mind (as Bates *et al.*, 1979, suggest).

This notion is somewhat controversial, since this would lower the earliest age at which a theory of mind has been postulated to 9–14 months. Nevertheless, the idea that protodeclarative pointing requires a theory of mind seems plausible, since it may involve the child representing the mental state of *thinking*. For example, in production of protodeclarative pointing, the child may need to represent 'I want you to attend to what I am thinking about'; and, in comprehension, the child may need to represent 'You want me to attend to what you are thinking about'.

On the other hand, a less controversial meaning of the claim that protodeclarative pointing is a precursor to a theory of mind might be that protodeclarative pointing is an earlier but *simpler* ability, that is, that protodeclarative pointing does not itself require a theory of mind. It may be that all the child needs to represent is 'I want you to attend to what I am attending to' – with no reference to a mental state such as 'thinking'. Representing the goal of shared and differing *attention* between people may be an important but simpler step along the road to representing shared and differing thoughts and beliefs.

Both of these theories of protodeclarative pointing require further consideration, but the evidence of intact perceptual role taking in autism (in Expt 1) suggests that shared attention may not be the critical aspect of protodeclarative pointing that autistic children fail to understand. This leaves open the possibility that attribution of mental states is involved in this.

This brief discussion of what might be entailed in viewing protodeclarative pointing as a precursor to a theory of mind highlights the considerable theoretical importance of this small gesture. In addition, protodeclarative pointing may have equally important practical implications. We are currently investigating one such possibility: the significance of protodeclarative pointing to the early diagnosis of autism.

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Figure 1 was produced by Cathy Clench, of the Medical Illustration Services, St Bartholomew's Hospital, London.

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