

How many ways can the point be made? Evidence from children with and without autism*

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ABSTRACT

Previous studies have found a dissociation between two forms of pointing gesture in autism: protoimperative pointing is present, while protodeclarative pointing is absent or impoverished. The latter appears to be part of a joint-attention deficit. In the present study, we searched for a third form, referential pointing, in autism. We predicted that since referential pointing can occur for non-social reasons, and without joint-attention, it might be intact in autism. This prediction was borne out. This new dissociation, intact referential pointing with impaired protodeclarative pointing, suggests that our assessment of this important gesture is becoming more refined, and may hold potential for early diagnosis.

One of the most robust findings about the early development of children with autism is that the *pointing* gesture that normally develops during early preverbal communication is abnormal in these toddlers. On this point, if readers will excuse the pun, there is total agreement in the literature. This observation can, for example, be found in Frank Curcio's (1978) important paper, and runs with extraordinary consistency through many studies since then (Baron-Cohen 1989, Frith 1989, Loveland & Landry 1986, Ricks & Wing 1975, Rutter 1978, Sigman *et al.* 1986, Wetherby 1986).

Two functionally distinct forms of pointing have been identified: *protoimperative* and *protodeclarative* pointing (Bates, Camaioni & Volterra

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1975). Protoimperative pointing is defined as pointing in order to use another person to obtain an object, or obtain some state of affairs, in the physical world. Protodeclarative pointing is defined as pointing in order to comment or remark on the world to another person, to share interest or attention about an object, as an end in itself. Both forms of pointing appear in normal development between 9–14 months (Bruner 1983).

Until recently, the claims about lack of pointing in autism had not distinguished these two functional types. Baron-Cohen (1989) tested both comprehension and production of these forms of pointing in children with autism, and found a clear dissociation between the two. Whilst they understood and produced protoimperative pointing (to some extent), they showed severe impairments in comprehension and production of protodeclarative pointing. This dissociation has also been found by Mundy & Sigman's group (Mundy, Sigman & Kasari 1993). The dissociation is important for at least three reasons. First, protodeclarative (but not protoimperative) pointing has been conceptualized as being an early, preverbal indicator to several key psychological abilities: joint-attention, dialogue, theory of mind, and symbol-use (Bruner 1975, 1983, Bates, Benigni, Bretherton, Camaioni & Volterra 1979, Lock 1978). Since these are the very areas in which impairments are found later in autism (Baron-Cohen 1988, Frith 1989), this suggests that protodeclarative pointing may be a *necessary precursor*¹ for the development of these later abilities (Baron-Cohen 1989).

Secondly, most non-human primates lack protodeclarative pointing but possess something similar to protoimperative pointing (Gomez *et al.* 1993).² This dissociation thus seems to have important evolutionary implications. Finally, given that among human populations the specific dissociation between these two forms of pointing has only been found in children with autism, one possibility is that the absence of protodeclarative pointing in toddlers might serve as a useful diagnostic indicator of early cases of autism. In our recent prospective study, four 18-month-olds who lacked protodeclarative pointing³ who were later followed up at 30

[1] Note that: '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' (Baron-Cohen 1989: 114). Gomez, Sarria & Tamarit (1993) use a similar definition.

[2] A case has been made for pigmy chimpanzees possessing protodeclarative pointing (Savage-Rumbaugh, McDonald, Sevcik, Hopkins & Rubert 1986), and if this is substantiated then they appear unique among the monkeys and apes.

[3] These four cases also lacked pretend play. By itself, absence of protodeclarative pointing did not predict autism at 30 months, but in conjunction with absence of pretend play, it did.

months, were indeed all found to have a clear diagnosis of autism (Baron-Cohen, Allen & Gillberg 1992).

In the present study we sought to investigate pointing in autism in more detail. Specifically, we asked: What about a third form, *referential pointing*? By this, we mean pointing to name or identify one object as distinct from another. Referential pointing can occur for both social or private reasons. If it is social, it serves to inform someone else of the identity of an object, to pick it out. As such, of course, it also directs their attention to the object, and thus is indistinguishable from a protodeclarative point. However, referential pointing can also serve to identify objects purely *for oneself*. Imagine a child sitting *alone* with a picture book. He or she might touch-point each object in the picture in turn, possibly saying the object's name aloud as each point is made. In such solitary use, it is as if the index finger is being used as the external and visible equivalent of selective attention – like one's personal searchlight. Mandler (1988) has described such pointing in 18-month-olds in their developing ability to categorize, and it is likely that in normal development it appears long before this (Blake, McConnell & Benson 1991).

We predicted that such referential pointing, in its non-social form, would be intact in children with autism. This prediction was made not only because referential pointing can be non-social, but more particularly because in its non-social form it entails no *joint-attention* skills (gaze monitoring, showing behaviours, etc.) Joint-attention skills are clearly impaired in autism (Sigman *et al.* 1986, Mundy *et al.* 1993). Protodeclarative pointing, in contrast, necessarily involves joint-attentional skills. In the study reported below, we therefore sought to test for a further dissociation: intact (non-social) referential pointing and impaired protodeclarative pointing, in subjects with autism.

THE EXPERIMENT

Subjects

We tested 20 subjects with autism (6 females, 14 males) diagnosed according to established criteria (Rutter 1978, DSM-III-R 1987). They were all attending a school for children with autism in London. They were selected not by chronological age (CA), but on the basis that they had *some* language (i.e. a verbal mental age above 1 year, with at least single word vocabulary), since referential pointing can also be thought of as a non-verbal 'naming' activity. Their details are shown in Table 1. Their language level (comprehension and expression) was measured using the Reynell Developmental Language Scale (Reynell 1967).

In addition, we tested 20 normal children (8 females, 12 males). Those

TABLE 1. *Background variables of subjects in the Experiment*

		CA in years	Language comprehension	Language expression
Autism	x	13;7	3;1	2;10
	sd	3;5	1;5	1;7
	range	7;5 - 18;10	1;0 - 7;0	1;0 - 7;0
Normal	x	3;3		
	sd	1;1		
	range	1;3 - 7;6		

over 2 years and 6 months were attending a mainstream nursery school in the London area, whilst those under this age were recruited from local parents with infants. They were selected in order that their chronological age (the mean and range) matched the verbal mental age of the group with autism. Again, the only inclusion criterion for this group was the presence of at least single word vocabulary. Their ages are also shown in Table 1. Since they were all free of any clinical diagnosis, it was assumed that their chronological age was a reasonable estimation of their mental age.

Procedure

Subjects were tested individually in a quiet room of their school. The subject and the experimenter sat at a small table, facing each other. The experimenter told the subject that she had a book for him or her to look at. The subject was handed the book and the experimenter watched for 2 minutes for any instances of the pointing gesture. If the subject produced any pointing in the 2 minutes, the experiment was ended. If, however, after two minutes the subject had not displayed any *spontaneous* pointing, the experimenter then provided a prompt by asking 'What's in the book?' The subject was given a further two minutes to look at the book before being asked to give it back to the experimenter. During the task, the experimenter deliberately did not look at the book, or engage in any spontaneous conversation with the subject. Instead, she watched the subject's hands and face for any points or eye-contact,⁴ and kept a record of the different forms of pointing displayed by each subject. She used the following criteria, developed by Bates *et al.* (1975) and used by Baron-Cohen (1989), for differentiating the various forms of pointing:

[4] It occurred to us that to ensure that referential pointing was being produced for genuinely non-social reasons, the experimenter should have left the subject alone, and observed if pointing occurred when under solitary conditions, via a one-way mirror. However, for practical reasons, this was not possible in this particular school setting, though it would be interesting for future studies to consider including this manipulation.

Criteria

Referential pointing (non-social): Pointing at or touch-pointing a picture or object either to name it, or indicate its position, or distinguish it from the other pictures or objects, without any attempt to make *eye contact* with the experimenter.

Protodeclarative pointing: Pointing at or touch-pointing a picture or object to show it to the experimenter, in combination with eye contact alternating between the object and the experimenter. Subjects with expressive language may also accompany this point with a command to the experimenter, such as ‘Look at this’.

Protoimperative pointing: This form of pointing was not expected to be displayed by subjects during a picture book task, since its function is defined in terms of pointing to *obtain* an object or to request something. However, if it occurred, it could be differentiated from protodeclarative pointing by noting whether the subject was satisfied by the experimenter simply *looking* towards the object being pointed at, or whether the subject required a more active response from the experimenter (giving it, etc). Subjects with expressive language might also accompany a protoimperative point with a verbal demand or question, such as ‘Give me the x’, ‘Do x for me’.

Scoring

Frequency of different types of pointing was not assessed, because our pilot studies showed low inter-rater reliability for this. Instead, categorical data were collected, where good reliability was obtained (Cohen’s (1960) Kappa Coefficients between 0.61 – 0.93: see below). The experimenter scored if the subject had produced *any* unambiguous instances of protodeclarative or referential pointing, and whether this was in the first 2 minutes (i.e. spontaneously) or in the 2 minutes after the prompt.

RESULTS

As shown in Table 2, 90% of the subjects with autism produced referential pointing and 25% of them also produced protodeclarative pointing. All of the normal subjects produced referential pointing, and 90% of them also produced protodeclarative pointing. This group difference was highly significant (Fisher’s Exact Probability Test, $p < 0.001$). No subjects displayed any protoimperative pointing, and whilst this was not expected towards pictorial stimuli, neither was any displayed towards other objects in the room.

Ten normal subjects and 6 subjects with autism produced their pointing

within the first two minutes. They were therefore not given the prompt and the additional two minutes. Of these 6 subjects with autism, two produced referential and protodeclarative pointing, whilst the other four only produced referential pointing. It could be objected that these latter four subjects might have produced some protodeclarative pointing if they had been given the extra 2 minutes that the rest of the group received. We therefore re-analysed the data for the group with autism without these four subjects. This is shown in Table 3. Even with this conservative comparison, the number of subjects producing referential pointing (87.5%) was significantly higher than the number producing protodeclarative pointing (31.3%) (Sign test, $p < 0.002$).

TABLE 2. *Number of subjects displaying referential and proro declarative pointing*

	Autism	Normal
Referential pointing	18 (90%)	20 (100%)
Protodeclarative pointing	5* (25%)	18 (90%)

* Autism \times Normal, Fisher's Test, $p < 0.001$.

TABLE 3. *Revised results from the subjects with autism (see text)*

	Displayed	Not Displayed
Referential pointing	14 (87.5%)*	2
Protodeclarative pointing	5 (31.3%)	11

* Sign test, $p < 0.002$

Reliability

The test of the subjects with autism was repeated on a later visit with a random selection of 11 out of the 20 subjects. On this occasion, a video recording was made, so as to test the reliability of the experimenter's judgements in classifying types of points. Two independent judges, both clinical psychologists and blind to the hypothesis of the study, were asked to rate all these videotapes using the criteria above, to differentiate between the three forms of pointing. In addition, the experimenter demonstrated the three types of pointing. The Kappa Coefficient between the experimenter and Judge A on the classification of points was 0.61, whilst between the experimenter and Judge B it was 0.93. Both of these Kappa Coefficients are traditionally in the range of substantial to almost perfect strength of agreement.

DISCUSSION

The results from this study during a picture book task⁵ demonstrate a strong dissociation in subjects with autism between the production of referential pointing and the absence of protodeclarative pointing, in comparison to a group of normal children who showed both types of pointing. This dissociation was predicted on the basis of the necessary role of joint attention in the latter, and its non-involvement in (non-social) referential pointing – joint attention itself being impaired in autism (Mundy *et al.* 1993, Baron-Cohen 1989, Mundy *et al.* 1986). The dissociation between referential and protodeclarative pointing must be seen in the light of the previous dissociation between protoimperative and protodeclarative pointing, and has several implications.

First, the lack of protodeclarative pointing cannot be due to motoric or motivational factors – an inability or unwillingness to form the outstretched index finger configuration of the hand – but is likely to be due to cognitive factors related to the child's comprehension of the function of the gesture. Secondly, insofar as protoimperative and referential pointing are present in autism, these cannot be related to later impaired abilities in autism, whereas the absence of protodeclarative pointing may indeed be related to later impairments in autism. For example, an absence of protodeclarative pointing may be related to the abnormalities in theory of mind development in this group (Baron-Cohen 1989, 1991, 1993). Longitudinal studies are needed to test such causal hypotheses about the different developmental pathways these forms of pointing inhabit. Thirdly, if our earlier claims about the diagnostic value of the absence of protodeclarative pointing (Baron-Cohen 1989, Baron-Cohen *et al.* 1992) have any substance, it is clear that diagnostic systems will need to distinguish the absence of protodeclarative from the presence of protoimperative and referential forms of pointing.

Finally, we do not rule out that there are yet further forms of pointing (beyond the three studied here) to be examined in development. One possibility is *problem-solving pointing*; that occurs when one is running through a hypothetical series of steps, in one's mind. For example, we have observed chess-players who, while thinking of the next 3 or 4 moves that might be made in a game, trace a series of moves in the air with their index finger. Another possibility is *directional pointing*; that occurs when one is 'reading off' a mental map of how to get from A to B⁶. Again, both

[5] Goodhart (1991) reports a similar (but less strong) effect on a Toys Task.

[6] We thank Juan-Carlos Gomez for suggesting this form of pointing. Whether problem-solving pointing is different to directional pointing is unclear.

of these could occur for non-social reasons, and would therefore be expected to be intact in autism. Such an idea needs testing.

REFERENCES

- Baron-Cohen, S. (1988). Social and pragmatic deficits in autism: cognitive or affective? *Journal of Autism and Developmental Disorders*, **18**, 379–402.
- (1989). Perceptual role-taking and protodeclarative pointing in autism. *British Journal of Developmental Psychology*, **7**, 113–127.
- (1991). Precursors to a theory of mind: understanding attention in others. In A. Whiten (ed.), *Natural Theories of Mind* (Oxford: Basil Blackwell).
- (1993). From attention-goal psychology to belief-desire psychology: the development of a theory of mind and its dysfunction. In S. Baron-Cohen, H. Tager-Flusberg & D. J. Cohen (eds), *Understanding Other Minds: Perspectives from Autism* (Oxford: Oxford University Press).
- Baron-Cohen, S., Allen, J. & Gillberg, C. (1982). Can autism be detected at 18 months? The needle, the haystack, and the CHAT. *British Journal of Psychiatry*, **161**, 839–843.
- Bates, E., Benigni, L., Bretherton, I., Camaioni, L. & Volterra, V. (1979). Cognition and communication from 9–13 months: correlational findings. In E. Bates (ed.), *The Emergence of Symbols: Cognition and Communication in Infancy* (New York: Academic Press).
- Bates, E., Camaioni, L. & Volterra, V. (1975). The acquisition of performatives prior to speech. *Merrill-Palmer Quarterly*, **21**, 205–226.
- Blake, J., McConnell, S. & Benson, N. (1991). The evolution of communicative gestures during the second year. Paper presented at the Society for Research in Child Development Conference, Seattle, April.
- Bruner, J. (1975). The ontogenesis of speech acts. *Journal of Child Language*, **2**, 1–19.
- (1976). From communication to language: a psychological perspective. *Cognition*, **3**, 255–287.
- (1983). *Child's Talk: Learning to Use Language* (Oxford: Oxford University Press).
- Cohen, J. (1960). A coefficient of agreement for nominal scales. *Educational and Psychological Measurement*, **20**, 37–46.
- Curcio, F. (1978). Sensorimotor functioning and communication in mute autistic children. *Journal of Autism and Developmental Disorders*, **8**, 218–292.
- DSM III-R (1987) *Diagnostic and Statistical Manual of Mental Disorders*, rev. 3rd edn (Washington, D.C.: American Psychiatric Association).
- Frith, U. (1989). *Autism: Explaining the Enigma* (Basil Blackwell: Oxford).
- Gomez, J.-C., Sarria, E. & Tamarit, J. (1993). The comparative study of early communication and theories of mind: ontogeny, phylogeny, and pathology. In S. Baron-Cohen, H. Tager-Flusberg & D. J. Cohen (eds), *Understanding Other Minds: Perspectives from Autism* (Oxford: Oxford University Press).
- Goodhart, F. (1991). An investigation of the use of referential pointing by children with autism. Unpublished MSc Thesis, Institute of Psychiatry, University of London.
- Lock, A. (ed: 1978). *Action, Gesture, and Symbol: The Emergence of Language* (London: Academic Press).
- Loveland, K. & Landry, S. (1986). Joint attention and language in autism and developmental language delay. *Journal of Autism and Developmental Disorders*, **16**, 335–349.
- Mandler, J. (1988). Differentiating global categories. Paper presented at the Psychonomic Society Meeting, November 1988, Chicago.
- Mundy, P., Sigman, M. & Kasari, C. (1993). Theory of mind and joint attention deficits in autism. In S. Baron-Cohen & D. J. Cohen (eds), *Understanding Other Minds: Perspectives from Autism* (Oxford: Oxford University Press).
- Reynell, J. (1967). *Reynell Developmental Language Scales* (Windsor: NFER).
- Ricks, D. & Wing, L. (1975). Language, communication, and symbols in normal and autistic children. *Journal of Autism and Childhood Schizophrenia*, **5**, 191–222.

- Rutter, M. (1978). Language disorder and infantile autism. In M. Rutter & E. Schopler (eds), *Autism: a Reappraisal of Concepts and Treatment* (New York: Plenum).
- Savage-Rumbaugh, S., McDonald, K., Sevcik, R., Hopkins, W. & Rubert, E. (1986). Spontaneous symbol acquisition and communicative use by Pygmy Chimpanzees (*Pan paniscus*). *Journal of Experimental Psychology: General*, **115**, 211–235.
- Sigman, M., Mundy, P., Ungerer, J. & Sherman, T. (1986). Social interactions of autistic, mentally retarded, and normal children and their caregivers. *Journal of Child Psychology and Psychiatry*, **27**, 647–656.
- Wetherby, A. (1986). Ontogeny of communicative functions in autism. *Journal of Autism and Developmental Disorders*, **16**, 295–316.

