Autism and symbolic play

Simon Baron-Cohen

Recent work suggests autistic children are impaired in their symbolic (or pretend) play. However, such studies have either used inadequate definitions of 'pretend', or have not examined *spontaneous* play. An experiment is reported which attempts to overcome these difficulties This confirms that autistic children are severely impaired in their ability to produce pretend play, in contrast to non-autistic retarded and normal controls. This is discussed in terms of the symbolic deficit theory (Ricks & Wing, 1975). It is argued that when a 'symbol' is defined as being a 'second-order representation', this theory has the potential to link both the social and pretend impairments in autism. The theory awaits more adequate testing.

Autistic children are frequently reported to be impoverished in their *pretend** play (Wing *et al.*, 1977; Riguet *et al.*, 1981; Ungerer & Sigman, 1981; Gould, 1986). In contrast, they have been shown to be unimpaired in their *reality*† play. It is unfortunate, however, that many of the studies of pretend play in autism have used inadequate definitions of 'pretend'. For example, Gould (1986) uses the Lowe & Costello (1976) definition of pretend: this includes such behaviours as brushing one's own or a doll's hair, or placing toy teacups onto saucers, etc. However, all of these actions are appropriate for the objects, and as such constitute reality (or 'functional') play. There is nothing necessarily pretend about them. The problem in the Lowe & Costello test is that it assumes that play with *miniature* objects (toys) is necessarily pretend, since miniature objects are symbols of real-size objects. This assumption may not be reliable, since for the child the miniature object may be perceived simply as a small but real object. Thus, both this study and that by Wing *et al.* (1977) may overestimate the incidence of pretend play through the use of insufficient criteria.

Riguet *et al.*'s (1981) study used a definition of pretend play which included *object substitution*, and this criteria is widely recognized as valid (Fein, 1975; Watson & Fischer, 1977; Jackowitz & Watson, 1980; Ungerer *et al.*, 1981). However, no other indices of pretend were considered, and this may have underestimated its incidence. In fact, the only study which does use a thorough definition of pretend play is by Ungerer & Sigman (1981), but whilst these authors purported to test 'free play' in an 'unstructured setting', the session 'began with the experimenter modelling four different symbolic acts with the toys' (p. 323). Such a procedure throws some doubt on the 'spontaneity' of the play. This criticism also applies to some other studies (Curcio & Piserchia, 1978; Hammes & Langdell, 1981). The inclusion of modelling makes it difficult to distinguish imitation from genuine pretence. Finally, some other studies have had the additional problem of not including a non-autistic retarded control group (Mundy *et al.*, 1984; Wetherby & Prutting, 1984). Because of these various limitations, we decided to gather fresh evidence of autistic children's ability to produce spontaneous pretend play, using a more thorough definition of 'pretend'.

Defining pretend play

It is notoriously difficult to define 'play', but this question is not of direct relevance here and is discussed elsewhere (Rubin *et al.*, 1983). Our concern is to define 'pretend' play, as

---

*In this paper, 'symbolic play' and 'pretend play' are coterminous.

†Reality play is also sometimes called 'functional play' because it involves using objects in ways appropriate to their conventional function.

distinct from 'reality' play. For a person to be pretending, s/he must *simultaneously know* both what the object actually is, and what the object now is represented as being (Golomb & Cornelius, 1977). This ensures that the person is pretending rather than simply being mistaken or confused (Austin, 1961; Leslie, 1985). Some authors have termed these simultaneous representations 'double knowledge' (Rosenblatt, 1977; McCune-Nicolich, 1981). Pretence also has an *'as if'* quality (e.g. drinking water from a shell as if it was a cup and as if it contained water) (Reynolds, 1976; Fein, 1981). Similarly, the *transformational* quality of pretend play is stressed (Fein, 1975)—real situations or objects are transformed into pretend ones. Most importantly, pretend play (like language) is also a generative, highly productive activity, not limited to one or two topics.

Leslie (1985) had the insight that the *logical properties* of mental states, as described by Brentano in 1874 (namely, 'referential opacity'; 'non-entailment of truth'; and 'non-entailment of existence') are identical to the three logical properties of pretending. He identifies these as:

1. 'Deviant reference', in which objects are substituted for one another (e.g. 'this banana is a telephone');
2. 'Deviant truth', in which 'false' properties are attributed to objects (e.g. 'this doll's face is dirty');
3. 'Deviant existence', in which absent objects are present (e.g. 'this [empty] cup is full of tea').

These properties suggest a definition of pretend play which, with the exception of Ungerer & Sigman's (1981), goes further than that used in previous studies with autistic children. This is the definition used in the experiment reported here, and is operationalized as follows: Pretend play can be said to occur if there is evidence that:

1. The subject is using an object as if it were another object, and/or
2. The subject is attributing properties to an object which it does not have, and/or
3. The subject is referring to absent objects as if they were present.

This is a definition of *observable* pretend play and is used so that it can be independently identified. It is possible that some pretence will be missed, since pretence in principle can be totally 'in one's head' with no outward, visible indices (Austen, 1961). It is also possible that some pretence will be attributed when there is none. For example, a child might look at a wooden brick and say the word 'car', and this would meet the third part of the definition above, even though the child may have no *intention* of referring to the brick as a car. Such errors, however, will be a feature of all definitions of pretend play. The strength of the one above is that it includes more forms of substitution than simply object substitution, and it allows pretend play to be distinguished from other types of play. These are described in the experiment below, which tests the hypothesis that autistic children do not show any spontaneous pretend play.

Method

Subjects

Details of the subjects are shown in Table 1. The clinical groups were drawn from special schools in the London area, and the normal group from a nursery school. The 10 autistic children had been diagnosed according to established criteria (Rutter, 1978). The 10 Down's syndrome children were included to control for the effects of general mental retardation. The autistic group's mean mental age (MA) was matched to the Down's syndrome group on a non-verbal scale (Leiter International Performance Scale), and also on the more conservative measure of a verbal scale (British Picture Vocabulary Test). The latter resulted in six subjects (three Down's and three autistic) being classed as 'non-verbal' in that they produced no score at all on this scale. They were nevertheless included in the experiment because the hypothesis focused on the relationship between diagnostic group and

pretend play, irrespective of language level. Regarding the normal group, we assume that MA would roughly correspond to chronological age (CA). There was an equal sex ratio in the Down's group, but more boys (seven) than girls (three) in the autistic group, reflecting the increased prevalence of autism in males. This ratio was matched in the normal group. Subjects who did not interact with the play materials *at all*, i.e. who could not be described as even minimally 'object-directed', were dropped from the sample. This resulted in one Down's and one autistic child being excluded, leaving 30 subjects who met the inclusion criteria.

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

Diagnostic group	*n*		CA	Non-verbal MA	Verbal MA
Autistic	10	mean	8·1	4·9	2·5
		SD	2·6	2·9	0·9
		range	4·3–12·4	2·3–10·2	1·7–3·4
Down's syndrome	10	mean	7·5	3·8	2·5
		SD	2·9	1·7	0·6
		range	2·5–12·2	1·9–5·8	1·7–3·4
Normal	10	mean	4·1	—	—
		SD	0·7	—	—
		range	3·0–5·1	—	—

Procedure

Each child was filmed for 15 minutes individually, using three different sets of toys (five mins each). The choice of material used was decided on the basis that as wide a variety of toys as possible would increase the likelihood of eliciting pretend play. The three toy sets were:

(*a*) Five different stuffed animals (2–6 inches long), and wooden bricks (of different shapes and sizes).

(*b*) A toy kitchen stove with miniature pots, pans, spoon, two dolls, small pieces of green sponge (10 mm cubes) and a toy telephone. (The pieces of sponge were *the* essential element of this second set of toys, since other studies which have used cooking or domestic-type toys usually only elicit functionally appropriate use of them, whereas if the child incorporated the sponge as food, this would clearly be an example of pretend.)

(*c*) A set of 'play people' (commercially available)—i.e. plastic people (3 inches high), in a playground setting (swings, climbing frame, bench).

The child was seated at a small table, away from other children, and the experimenter presented one set of toys at a time. Another experimenter videotaped the child in each of the three conditions continuously. The order of the presentation of these three sets of toys was randomized, but each child played with all three sets. The experimenter simply said to each child, 'Here are some toys. Would you like to play with them? You can do anything you like with them.' Following these instructions, the experimenter only spoke to the child if the child initiated any interaction (e.g. asked questions, etc.). For long periods, and for most of the time, the focus was on the child's *solitary* spontaneous play. There was no modelling at all.

Video-film coding scheme

The children's toy-directed behaviour was coded into any one of four mutually exclusive play categories: sensorimotor, ordering, functional and pretend (largely derived from Ungerer & Sigman, 1981). These are defined in Table 2. These four categories were found to encompass all toy-directed behaviours and are labelled 1 to 4 because they also represent a developmental sequence, from simple to complex, concrete to abstract, in the first few years of childhood (Fein, 1975; Sigman & Ungerer, 1984). Each behaviour type was also rated using one of three measures of certainty: (1) unambiguous; (2) quite sure; (3) ambiguous. If the behaviour was ambiguous, it was 'relegated' to the simpler, developmentally earlier behaviour category. For example, a child sucking a brick could be taken as an ambiguous example of pretending the brick was food. In our strict coding scheme, however, this would be scored as sensorimotor. Similarly, piling up bricks could be taken as pretending the bricks were a tower, etc., but in the absence of any other supporting evidence for a pretend interpretation, this would be coded as 'ordering'. Since there were five separate toys within the three conditions, and four object-related behaviour categories, this generated $4 \times 5 = 20$ toy × category mutually exclusive combinations. This is clarified in Table 3.

Judges

(i) All the video-films were analysed first by the experimenter, noting down all *different* (i.e. novel) examples which fell into each behaviour category for each type of toy. Each was also scored using the three measures of certainty. Transcriptions of these films are shown elsewhere (Baron-Cohen, 1985). Because of the unreliability of counting 'units of behaviour', most of the later analyses were qualitative (i.e. does the subject show this type of

Table 2. Definitions of different play categories

1. *Sensorimotor*
   Definition: banging, waving, sucking, throwing, rolling, 'twiddling', or sniffing objects, with no attention paid to their 'function'.
2. *Ordering*
   Definition: a more 'intelligent' behaviour involving the child imposing some *pattern* onto the objects, such as lining them up, piling them up, putting one inside another, arranging them in systematic ways, but still with no regard for their 'function'.
3. *Functional play*
   Definition: using the objects 'appropriately', that is, according to their intended function.
4. *Pretend play*
   Definition: child uses an object *as if* it is another object, *or* attributes properties to an object which it does not have, *or* refers to absent objects as if they were present.

Table 3. Toy-type × behaviour category interaction

Toy type	1 Sensorimotor	2 Ordering	3 Functional	4 Pretend
Animals	Sucking, throwing, banging, waving, rolling, 'twiddling' or sniffing the animal	Lining up animals	Naming the animals	Animating animals, e.g. making animal walk, eat, bite, fight, etc.; making animal noises
Bricks	Same actions as above on bricks	Lining up bricks; piling up bricks; arranging them by colour, size, shape, etc.	Naming colour, shape or size of bricks	Name pile of bricks as house, etc.; using a brick as another object, e.g. a knife, or a train, etc.
Telephone	Same actions as above on telephone; making it ring	Lining up telephone with other objects	Naming telephone; dialling; picking up receiver, replacing it, holding it to ear, saying 'Hello'	Adapting telephone conversation as if someone else was at other end
Cooker set	Same actions as above on pans, spoon, sponge, dishes	Putting pans inside one another	Turning dials on cooker; opening cooker doors; assembling parts of cooker; placing empty pan in/on to cooker	Putting sponge into pan; putting pan with sponge inside/on to cooker; stirring sponge from pan to dishes; feeding dolls with sponge from spoon; animating dolls, e.g. making doll cook; attributing heat to cooker
Play people	Same actions as above on play people; pushing swing without people in it	Lining up play people	Sitting people on bench; putting people in swing and pushing it; making people climb up ladder	Giving people roles other than those related to actions appropriate on a climbing frame or swing (i.e. not functional)

behaviour or not) rather than quantitative (i.e. how much of this type of play does the subject show).

(ii) The experimenter then watched all the video-films for a second time and recorded whether each child produced behaviours of each type, as a test of reliability of his judgement about each child's behaviour. This test–retest coefficient will be discussed later.

(iii) An independent judge, blind to each subject's diagnosis and to the hypothesis, then analysed all the films, as a test of reliability both of the first judge, and of the scoring method for each diagnostic group. This was done by using Tables 2 and 3 as operational definitions of each play category, and the films were randomized so that all three groups of children were mixed up together. Whilst this does not entirely prevent knowledge of diagnosis from influencing ratings, it makes it more difficult to guess the diagnosis of each child. This second judge simply scored each child for whether they produced any of the four types of play behaviour, and whether these judgements were unambiguous, quite sure, or ambiguous.

(iv) Finally, 14 independent judges (drawn from psychology postgraduate students) were asked to rate films of three subjects' play (one normal, one Down's and one autistic child) for unambiguous instances of pretend play only, in the animal condition. These judges were also blind to the hypothesis, and to the diagnosis of the children. The animal condition was chosen because initial analysis had revealed that pretend play was more likely to be elicited with this material than with the other materials. The normal and the Down's subjects were selected at random, and the autistic child was then selected on grounds of being closely matched with the latter for non-verbal MA, verbal MA, and CA.

Results

First judge

Table 4 shows the percentage of children in each group showing each behaviour. A subject was rated as showing the behaviour if it occurred with any of the three toy sets. Since the number of children who produced behaviours rated as quite sure and ambiguous did not differ significantly between groups, ratings at these levels are not reported here, but can be found elsewhere (Baron-Cohen, 1985). Table 4 therefore shows just the unambiguous ratings. These results are from all three conditions combined. A Fisher-Yates test of significance for 2×2 matrices was performed on these data, resulting in a significant difference being found only between the autistic and the two control groups in the pretend category ($P < 0.025$). This difference was found when the Down's and normal groups were considered separately and together. All other group differences were non-significant ($P > 0.05$). Furthermore, the difference in the pretend category was unaffected when only non-verbal pretend acts were considered. There was an effect of condition, in that the play-people condition elicited functional and sensorimotor play from all three groups, but no unambiguous pretend play. In contrast, the other two conditions elicited pretend play to an equal extent. There was no effect of sex on pretend play (12/19 males pretended, and 7/11 females pretended [Chi$^2 = 0.599$, d.f. = 1, $P > 0.3$]).

Table 4. First judge's ratings, expressed as percentage of each group showing each play behaviour unambiguously

	Pretend	Functional	Sensorimotor	Ordering
Autistic	20*	80	100	40
Down's	80	90	80	20
Normal	90	100	40	40

* = significant.

A further analysis of the pretend play category considered the *number* of unambiguous pretend actions made, and the number of children making them, for each diagnostic group. Table 5 shows this comparison. This particular analysis was done despite the problems in deciding how to count behaviours in order to determine how much pretend play is

produced by each group, at an approximate level. Crude measures of none, few, and many revealed group differences. Analysis of Table 5 showed that there were significantly more autistic children who produced *no* pretend play at all, when compared to the Down's and normal groups separately or together (Fisher exact probability test, $P < 0.025$). The three groups were not significantly different in terms of the number of children producing a few pretend actions (Fisher exact probability test, $P < 0.05$). There were significantly more normal than autistic children who produced many pretend actions (Fisher exact probability test, $P < 0.01$), but there were not significantly more normal than Down's, or more Down's than autistic children in the many category (Fisher exact probability test, $P > 0.05$, in both).

Table 5. Number of subjects in each group producing different quantities of unambiguous pretend play

	None	Few	Many
Autistic	8*	2	0
Down's	2	5	3
Normal	1	3	6

* = significant.
Note. Few = less than 10 instances;
    Many = more than 10 instances.

Measures of reliability

The experimenter's test–retest reliability for rating each child as either showing each behaviour or not was calculated using Cohen's kappa (Cohen, 1960). Any measure of test–retest reliability of one person's judgements will inevitably be subject to possible memory effects between time 1 and 2. However, the interval between these judgements was eight weeks, which reduces the degree of any such memory effects. In addition, the inter-rater reliability for the two judges for each group × play category was calculated using the same method. All of these reliability measures were within 0.7–1.0, which is considered to be within the range of acceptability. These are shown in Table 6. The two judges showed agreement on 28 out of the 30 subjects on the important category of pretend. The third test of reliability was from the 14 judges rating one of each type of child for pretend play: 14 out of 14 rated the normal child as having unambiguous pretend play (100 per cent), 12 out of 14 rated the Down's child as showing this as well (85.7 per cent), but none of the 14 judges scored the autistic child as showing any unambiguous pretend play at all (0 per cent). This difference was highly significant (Fisher exact probability test, $P < 0.005$). In addition, these 14 judges coded the autistic subject identically to the other two judges.

Table 6. Reliability coefficients of agreement

| | Pretend | Unambiguous play category | | Ordering |
		Functional	Sensory	
First judge[a] (test–retest)	1.0	0.71	0.81	1.0
Inter-rater[a] reliability	0.86	0.71	0.92	0.92

[a]Calculated using Cohen's k, $n = 30$.

Analysis of background variables

The autistic 'pretenders' differed significantly from the autistic 'non-pretenders' in terms of their non-verbal MA (Mann–Whitney [small sample] $U = 1$, $P = 0.044$) and their verbal MA ($U = 1$, $P = 0.044$). The autistic pretenders were not different in CA to the autistic non-pretenders ($U = 6$, $P = 0.356$). The Down's pretenders had a significantly higher non-verbal MA ($U = 0.5$, $P = 0.044$) compared to the Down's non-pretenders, but did not differ in CA ($U' = 6$, $P = 0.356$), or verbal MA ($U = 3$, $P = 0.133$). The autistic non-pretenders did *not* differ significantly from the Down's pretenders in terms of non-verbal MA ($U = 12$, $P = 0.164$), verbal MA ($U = 19.5$, $P = 0.117$) or CA ($U = 33$, $P = 0.48$). Finally, as regards the one normal child who did not show any pretend play, no other background variables apart from CA were available.

Discussion of experiment

Significantly fewer autistic children produced any spontaneous pretend play, relative to non-autistic normal and retarded control groups. The Down's syndrome pretenders were not distinguished from the autistic non-pretenders in any of the background subject variables. This strongly suggests that this must be an autism-specific deficit, and confirms previous work (Riguet *et al.*, 1981; Ungerer & Sigman, 1981; Gould, 1986) and strengthens these earlier findings by examining *spontaneous* pretend play only, and by using a more rigorous definition of pretend play. The experiment also found that pretend play is 'normal' in non-autistic retarded children, relative to their MA, and this replicates other studies (Hulme & Lunzer, 1966; Wing *et al.*, 1977; Hill & McCune-Nicolich, 1981). Furthermore, the operational definitions of different types of play resulted in high levels of agreement between raters, suggesting that these categories can be reliably identified.

Within the Down's group, the pretenders were distinguished from the non-pretenders only in terms of non-verbal MA. This result is not unexpected in that the mean MA of the Down's non-pretenders was 1.8 years and the onset of pretend play in normal children is between 12–24 months. Clearly, the Down's non-pretenders are at the slow end of the normal range, but not outside it.

It is worth noting that, in the second judge's opinion, *no* autistic children produced any unambiguous pretend play, and the first judge's (the experimenter's) scoring of two autistic subjects as pretenders was only possible through more lenient criteria. This disagreement was over one autistic child's questioning ('Are these potatoes? I don't know. They might be peas' [pointing to the sponge]) and another autistic child saying 'Don't touch it. It's hot', referring to the toy cooker. Neither of these utterances were part of any pretend action and, whilst the first judge gave them the benefit of the doubt, the second considered these to be a form of 'word-association' or echolalia, rather than evidence of pretence. Since the expected characteristic of pretend play is for it to be highly generative, it is uncertain whether even these two subjects showed any 'real' pretend play. It is interesting that they had a higher mental age than the autistic non-pretenders. They are discussed in more detail elsewhere (Baron-Cohen, 1985). Certainly, the abundant functional and sensorimotor play found in the autistic group also confirms other studies (Tilton & Ottinger, 1964; Black *et al.*, 1975; Strain & Cooke, 1976). The results also lend weight to the notion of the separation of pretend and functional (reality) play, in that the autistic group showed a deficit in the former but not in the latter. This finding confirms that of Ungerer & Sigman (1981). Sigman & Ungerer (1984) consider the autistic child's pattern of play as an indication that 'representational thought may be manifested in *two systems*, only one of which is impaired in the autistic child' (p. 293). They consider this second system to be the ability to form and manipulate symbols. This theory is considered in more detail in the final part of this paper.

The symbolic deficit theory

Can the deficit in pretend play be seen as evidence that autistic children have an impaired *symbolic* capacity? It is unfortunate that most authors who have proposed this theory (Wing *et al.*, 1977; Richer, 1978; McHale *et al.*, 1980; Hammes & Langdell, 1981; Sigman & Ungerer, 1984; Wulff, 1985) have ignored the problem of how to define 'symbol'. The only proponents of the theory who do define 'symbol' (Ricks & Wing, 1975) use a somewhat loose definition:

> Something that stands for, represents, or denotes something else, not by exact resemblance, but by vague suggestion or by some accidental or conventional relation (p. 192).

If a symbol is simply taken to mean a *representation* of something else, then autistic children can create symbols: The possession of an object concept and their understanding of physical causality are adequate indications that autistic children can represent the physical world (Serafica, 1971; Curcio, 1978; Hammes & Langdell, 1981; Sigman & Ungerer, 1981; Baron-Cohen *et al.*, 1986). Furthermore, there is evidence that autistic children can produce albeit 'concrete' mime-gestures to represent other actions (Hammes & Langdell, 1981; Attwood, 1984). And yet, the results from studies into autistic children's play indicate a lack of symbolic elements, and there are reports that autistic children cannot produce the more 'abstract mime of representing absent objects using "open-hand gestures"' (Hammes & Langdell, 1981; Attwood, 1984). Where does this leave the symbolic deficit theory? It will be argued that, using a different definition of 'symbol', these impairments do implicate a deficit in the autistic child's 'symbolic capacity'.

Defining a 'symbol'

In a short paper it is not possible to do justice to the complexity of defining a symbol. Nevertheless, one basic conceptual distinction must be drawn: that of *'signs'* and *'symbols'* (Langer, 1942; Piaget, 1962; Werner & Kaplan, 1963; Cassirer, 1972). Langer writes:

> A sign indicates the existence—past, present or future—of a thing, event, or condition (p. 57).

In contrast:

> Symbols are not proxy for their objects, but are vehicles for the conception of objects ... it is the conceptions, not the things, that symbols directly 'mean' (p. 60–61).

A symbol, then, is not just a representation of an object, as Ricks & Wing's (1975) initial definition proposed. That is a sign. A symbol, under Langer's definition, is a representation of a concept (which itself refers to an object). In other words, *a symbol is a representation of a representation*, or is a 'second-order' representation.

   How might this apply to autistic children? They appear able to represent the physical world: In this respect they show evidence that *they have the capacity to produce signs*. These are 'first-order' representations. But do autistic children show evidence of being able to use 'second-order' representations? They have been shown to be impaired in the ability to distinguish their own belief from that of another person's *different belief* (Baron-Cohen *et al.*, 1985) and this ability is assumed to require second-order representations (Dennett, 1978; Johnson-Laird, 1983; Wimmer & Perner, 1983; Leslie, 1985). This impairment in their 'theory of mind' may well be linked to the social deficit in autism. Pretend play is also assumed to require second-order representations (Leslie, 1985) in order for an infant simultaneously to know what an object really is, and pretend that it is something completely different. In contrast, a first-order representational capacity is sufficient for reality or functional play—i.e. for representing the world as it actually is. Thus, if a symbol is defined as a second-order representation, then the evidence suggests that autistic children *do not have the capacity to produce symbols*.

The symbolic deficit theory, thus redefined, acquires the potential to link both the pretend and the social impairments in autism. In addition, it generates a wealth of testable predictions: Linguistically, speaking autistic children should be capable of 'denotation' (using a word to refer to/represent a physical object) but not capable of 'connotation' (using it to refer to a concept). Nor should they be capable of producing or understanding figurative language, such as metaphor. Such questions need to be addressed before the symbolic deficit theory can be adequately assessed.

Acknowledgements

References

Attwood, A. J. (1984). Gestures of autistic children. Unpublished PhD thesis, University of London.

Austin, J. L. (1961). Pretending. In J. O. Ourmson & G. J. Warnock (eds), *Philosophical Papers*. Oxford: Clarendon Press.

Baron-Cohen, S. (1985). Social cognition and pretend play in autism. Unpublished PhD thesis, University of London.

Baron-Cohen, S., Leslie, A. M. & Frith, U. (1985). Does the autistic child have a 'theory of mind'? *Cognition*, 21, 37–46.

Baron-Cohen, S., Leslie, A. M. & Frith, U. (1986). Mechanical, behavioural and Intentional understanding of picture stories in autistic children. *British Journal of Developmental Psychology*, 4, 113–125.

Black, M., Freeman, B. J. & Montgomery, J. (1975). Systematic observation of play behaviour in autistic children. *Journal of Autism and Childhood Schizophrenia*, 5, 363–371.

Brentano, F. (1874). Psychologie vom Empirischen Standpunkt. Partial translations in R. M. Chisholm (ed.), (1960) *Realism and the Background of Phenomenology*. Glencoe, IL: Free Press, and in L. L. McAllister (ed.), (1976) *The Philosophy of Brentano*. London: Duckworth.

Cassirer, E. (1972). *An Essay on Man*. New Haven, CT: Yale 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 Childhood Schizophrenia*, 8, 281–292.

Curcio, F. & Piserchia, E. (1978). Pantomimic representation in psychotic children. *Journal of Autism and Childhood Schizophrenia*, 8, 181–189.

Dennett, D. C. (1978). *Brainstorms: Philosophical Essays on Mind and Psychology*. Brighton: Harvester Press.

Fein, G. G. (1975). A transformational analysis of pretending. *Developmental Psychology*, 11, 291–296.

Fein, G. G. (1981). Pretend play in childhood: An integrative review. *Child Development*, 52, 1095–1118.

Golomb, C. & Cornelius, B. B. (1977). Symbolic play and its cognitive significance. *Developmental Psychology*, 13, 246–252.

Gould, J. (1986). The Lowe and Costello Symbolic Play Test in socially-impaired children. *Journal of Autism and Developmental Disorders*, 16, 199–213.

Hammes, J. G. W. & Langdell, T. (1981). Precursors of symbol formation and childhood autism. *Journal of Autism and Developmental Disorders*, 11, 331–345.

Hill, P. M. & McCune-Nicolich, L. (1981). Pretend play and patterns of cognition in Down's Syndrome children. *Child Development*, 52, 611–617.

Hulme, I. & Lunzer, E. A. (1966). Play, language and reasoning in subnormal children. *Journal of Child Psychology and Psychiatry*, 7, 107–123.

Jackowitz, E. R. & Watson, M. W. (1980). Development of object transformations in early pretend play. *Developmental Psychology*, 16, 543–549.

Johnson-Laird, P. N. (1983). *Mental Models*. Cambridge: Cambridge University Press.

Langer, S. K. (1942). *Philosophy in a New Key: A Study in the Symbolism of Reason, Rite and Art*. Cambridge, MA: Harvard University Press.

Leslie, A. M. (1985). Pretence and representation in infancy: A cognitivist approach. Unpublished MS, Medical Research Council, Cognitive Development Unit, London.

Lowe, M. & Costello, A. (1976). *Symbolic Play Test—Experimental Edition.* Windsor: NFER.

McCune-Nicolich, L. (1981). Towards symbolic functioning: Structure of early games and potential parallels with language. *Child Development,* **52,** 785–797.

McHale, S. M., Simeonsson, R. J., Marcus, L. M. & Olley, J. G. (1980). The social and symbolic quality of autistic children's communication. *Journal of Autism and Developmental Disorders,* **10,** 299–310.

Mundy, P., Seibert, J. M. & Hogan, A. E. (1984). Relationship between sensorimotor and early communication abilities in developmentally delayed children. *Merrill-Palmer Quarterly,* **30,** 33–48.

Piaget, J. (1962). *Play, Dreams and Imitation in Childhood.* New York: Norton (originally published as *La formation du symbole chez l'enfant,* 1946).

Reynolds, P. (1976). Play, language and human evolution. In J. Bruner, A. Jolly, & K. Sylva (eds), *Play: Its Role in Development and Evolution.* Harmondsworth: Penguin.

Richer, J. (1978). The partial non-communication of culture to autistic children: An application of human ethology. In M. Rutter & E. Schopler (eds), *Autism: A Reappraisal of Concepts and Treatment.* Plenum: New York.

Ricks, D. N. & Wing, L. (1975). Language, communication and symbols in normal and autistic children. *Journal of Autism and Childhood Schizophrenia,* **5,** 191–222.

Riguet, C. B., Taylor, N. D., Benaroya, S. & Klein, L. S. (1981). Symbolic play in autistic, Down's and normal children of equivalent mental age. *Journal of Autism and Developmental Disorders,* **11,** 439–448.

Rosenblatt, D. (1977). Developmental trends in infant play. In B. Tizard & D. Harvey (eds), *Biology of Play.* London: Heinemann.

Rubin, K. H., Fein, G. G. & Vandenberg, B. (1983). Play. In P. H. Mussen & E. M. Hetherington (eds), *Carmichael's Manual of Child Psychology,* vol. 3, 4th ed. New York: Wiley.

Rutter, M. (1978). Developmental issues and prognosis. In M. Rutter & E. Schopler (eds), *Autism: A Reappraisal of Concepts and Treatment.* Plenum: New York.

Serafica, F. C. (1971). Object concepts in deviant children. *American Journal of Orthopsychiatry,* **41,** 473–482.

Sigman, M. & Ungerer, J. (1981). Sensorimotor skills and language comprehension in autistic children. *Journal of Abnormal Child Psychology,* **9,** 149–165.

Sigman, M. & Ungerer, J. A. (1984). Cognitive and language skills in autistic, mentally retarded and normal children. *Developmental Psychology,* **20,** 293–302.

Strain, P. S. & Cooke, T. P. (1976). An observational investigation of two elementary age autistic children during free play. *Psychology in the Schools,* **13,** 82–91.

Tilton, J. R. & Ottinger, D. R. (1964). Comparison of the toy play behaviour of autistic, retarded and normal children. *Psychological Reports,* **15,** 967–975.

Ungerer, J. A. & Sigman, M. (1981). Symbolic play and language comprehension in autistic children. *Journal of the American Academy of Child Psychiatry,* **20,** 318–337.

Ungerer, J., Zellazo, P., Kearsley, R. & O'Leary, L. (1981). Developmental changes in the representation of objects in symbolic play from 18–34 months of age. *Child Development,* **52,** 186–195.

Watson, M. & Fischer, K. (1977). A developmental study of agent use in late infancy. *Child Development,* **48,** 828–836.

Werner, H. & Kaplan, B. (1963). *Symbol Formation.* New York: Wiley.

Wetherby, A. M. & Prutting, C. A. (1984). Profiles of communicative and cognitive-social abilities in autistic children. *Journal of Speech and Hearing Research,* **27,** 367–377.

Wimmer, H. & Perner, J. (1983). Beliefs about beliefs: Representation and constraining function of wrong beliefs in young children's understanding of deception. *Cognition,* **13,** 103–128.

Wing, L., Gould, J., Yeates, J. R. & Brierly, L. M. (1977). Symbolic play in severely mentally retarded and in autistic children. *Journal of Child Psychology and Psychiatry,* **18,** 167–178.

Wulff, S. B. (1985). The symbolic and object play of children with autism: A review. *Journal of Autism and Developmental Disorders,* **15,** 139–148.