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Precursors of Symbol Formation and Childhood Autism[1]

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The salience of various precursory requirements for the formation of symbols is discussed. The conclusion is drawn that several necessary precursors could be assumed, and two experiments are described that were designed to test for the presence of these precursors in autistic children compared to matched retarded children. First, there was a study of the children's ability to imitate and form internal images, and then there was a study of their development of a concept of object permanence and ability to anticipate. These studies led to the conclusion that the autistic children could form internal images but seemed to lack the ability to manipulate them in a purposeful and meaningful manner, as reflected in their inability to show symbolic imitations and their lack of tendency to use elements of their perceptions that might allow prediction of future events. The findings are discussed in terms of cognitive and social development.

INTRODUCTION

It has been suggested that one fundamental aspect of the syndrome of childhood autism may be a gross impairment in the ability to comprehend and use symbols (Ricks & Wing, 1976). However, the topic of the formation

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of symbols has as yet been but lightly touched upon in the literature. Hermelin (1978) posits the idea that a deficit in the formation of images might be central to the condition and that this, in Piagetian terms, is a precursory stage in the development of symbols, and consequently of language proper. Certainly when one considers the fundamental aspects of the syndrome (Rutter, 1974), a study of the precursors of symbol formation would seem to be in order; by definition, the onset of autism is usually at birth or within the 1st year of life, and thus at a *pre*linguistic stage in infant development.

Theories of the precursors of symbol formation differ somewhat as to the nature of the most salient elements. However, Piaget is in little doubt that the formation of the image is an important step along the road toward symbolization (Piaget & Inhelder, 1969). He makes a distinction between the "signifier" (the internal representation) and the "signified" (the schemes with their content, that is, the action). For him, representation begins when there is simultaneous differentiation and coordination between signifiers and the signified. The first of these differentiations is provided by imitation and the mental image (which Piaget views as being derived from imitation, as an internalization of it), both of which extend the process of accommodation to external objects. The meaning of symbols, on the other hand, comes by way of assimilation, which is the dominant factor in play and holds an equivalent position to accommodation in adaptive representation. Clearly, in Piagetian terms, the development of symbols is dependent upon full completion of all the stages of sensorimotor development. Suffice it to say at this juncture that part of this early period is the attainment of an "object concept," which may also be seen to be strongly intertwined with the above-mentioned formation of internal representations of external objects and events (Piaget & Inhelder, 1969).

Other theorists, such as Werner and Kaplan (1963) and Bruner (1975), place a much greater emphasis on the interaction of the child with an adult. Thus, they would argue the act of reference (being concomitant with the ability to represent), and consequently symbolism, emerges not as an individual act but as a social one (Werner & Kaplan, 1963, p. 43).

As in Piaget's theory, Werner and Kaplan hold that objects that are to enter into symbolic activity must first become "objects of contemplation" in that they are regarded as "out there" and entities in their own right. To them, the sharing of these objects with the mother is of prime importance, for the mother invites the child to regard the object from her point of view. They also emphasize the importance of denotation of an object that is seen in the earliest stages by the gesture of pointing and vocal utterances such as "da" and "ta." As Murphy and Messer (1977) have shown, however, pointing is not necessarily a spontaneous activity on the part of the infant but rather seems to have its origins in the reaching behavior of the child,

which the mother interprets and shapes into a gesture of pointing. The final elemental constituent in Werner and Kaplan's view is "depiction," and this is concerned with the child's ability to imitate. Like Piaget, they regard the onset of delayed imitation as an important indication that the child has formed some kind of internal "model" or "image."

Bruner (1975) delineates four main precursors to the development of language: communicative intent, joint activity, reference, and predication. For him, the very earliest phase of development carries with it the features of what he terms a "demand mode" in which the infant exercises essentially innate communicative routines to express discomfort, pleasure, and so on. In practice these are usually responded to with the effect of establishing an expectancy of response. When such expectancies are developed, Bruner claims, changes take place that mark the beginning of what he terms the "request mode." At this stage the child is beginning to use certain aspects of his behavioral repertoire to refer to elements in his environment, although as yet these are inextricably bound up with the elements they refer to. Without these formative phases the child is seen to be unable to go on to a stage where taking turns can occur (Bruner's "exchange mode"). This last stage forms the basis for what one might term "true" human communication, for now the recipient/agent roles are alternately reversed and the essentially egocentric demanding of the infant is transcended.

On the basis of the above-mentioned theories, it would seem valid to assume several necessary precursors to the formation of symbols (however, no claim is made as to the sufficiency of these precursors): the ability of the child to form internal images, the ability to imitate, and the ability to manipulate images and form expectancies by linking stored images with present and projected perception. The work to be reported in this paper is centered upon these topics and includes one study of autistic children's imitative abilities and another of their ability to anticipate events in the context of an object permanence experiment.

METHOD

Subjects

In both studies to be reported, the same eight autistic children acted as subjects. Six were nonspeaking, two had a few echoic phrases, and all had been diagnosed as autistic by experienced psychiatrists. Symptoms, in each case, had an onset within the 1st year of life and conformed to those regarded as typical of autism (see Rutter, 1978). They included stereotyped behaviors, impaired social relationships and lack of contact with others, severe language and communication difficulties, and a desire for sameness.

In addition to the autistic children, a comparison group of eight retarded children was chosen. These were matched on sex, chronological age, and mental age by use of the Snijders-Oomen test (Snijders & Snijders-Oomen, 1975). These children were all free of autistic symptoms. The mean mental ages of the autistic and retarded subjects were, respectively, 4 years 6 months and 4 years 5 months. The mean chronological ages were 9 years 10 months and 9 years 9 months. There were five boys and three girls in each group.

Experiment 1

Imitative Abilities. From the theories of Piaget and of Werner and Kaplan it is possible to extract four general levels in the development of motoric imitative abilities: At first the child can only imitate ongoing behaviors (or ones that he has just perceived) and can only reproduce these behaviors in a fairly concrete manner. In time he is able to progress to a stage where he can reproduce behaviors long after the model is absent (deferred imitation). These early imitative displays are not only concrete (in that they are reproduced exactly as seen) but also lack an "as if" quality (for example, imitations of holding things not actually present give rise to closed grasps that leave no space for an "imagined" object). Gradually the referential aspect of imitative gestures begins to emerge when the child uses body parts as objects (such as the use of a finger to copy brushing teeth). However, only in the final stages of development can true symbolic behavior be said to emerge: Here the child is able to pretend, and the "as if" quality suffuses his imitations. He is now able to use an object to represent another, and in his imitative gestures, for instance, he leaves space in his hand for the imaginary comb he is holding (Werner & Kaplan, 1963; Curcio & Piserchia, 1978).

The study of imitative ability was designed to investigate at which of these levels of development the autistic subjects would function. They were required to view a video recording of a boy who demonstrated a variety of actions to be copied. Each action of a sequence was presented separately, with the instruction to the child to "watch the boy, and do as he does." Each child was initially shown a group of five actions, once each, all of which were concerned with the pouring and drinking of tea. The first action involved the model pretending to give a doll a drink. The child was given both a doll and a cup to imitate this action with. Next, he saw the model pretend to pour from an empty teapot into an imaginary cup. The child was given a teapot when required to copy this action. The next action was more symbolic in that the model again pretended to pour tea but neither teapot nor cup was present. The child has to copy purely pantomimically too. The fourth and fifth actions were like the second one in that the model

pretended to pour tea with one real object and one imaginary one (first with a teapot but no cup, then with a cup but no teapot). However, the child was given the "wrong" object to copy with, that is, the opposite one to that which he had just seen the model use.

In response to these last two actions, the child could behave in one of four ways: (1) Not having received the object he saw being used, the child might fail to respond. (2) He might drink from the cup or pour with the pot, and thus not strictly comply with the model (this will be referred to as "proper" object use). (3) He could respond on a more representational and symbolic level by pretending to pour from the cup or drink from the pot. (4) He could use a body part as an object or an empty gesture to imitate the pouring activity (these last two will be referred to collectively as "symbolic" use).

The next group was a series of five tooth-brushing actions. Once again the same five types of action were shown to the child; they were presented in the same order as the tea-pouring/drinking ones. The two objects involved in this group were a toothbrush and a tube of toothpaste.

Next, the child had to copy three actions that involved drinking soup from a bowl and stirring it with a spoon. In the first of these actions both the bowl and the spoon were present, and the model was seen to pretend to feed soup to a doll. In the second action the model used the spoon to make the motions of stirring but with no bowl present. In the final action the model showed purely pantomimic stirring.

The final group of actions involved the use of various objects. With the objects in question being present, the child had to copy the following actions performed by the model: combing a doll's hair, drawing a line on some paper, hammering a nail into wood, screwing a screw into wood, sawing wood, putting tobacco into a pipe, and smoking a cigarette. Two of these also had to be copied more symbolically: sawing wood when only the wood was present, and screwing a screw when only the screw was given (partly embedded in a piece of wood).

Each group of actions started with object-use with a doll, which was considered to be easy to imitate. Here the child has a constant point of reference that did not leave his field of vision. DeMyer, Alpern, Barton, DeMyer, Churchill, Hingtgen, Bryson, Pontius, and Kimberlin, (1972) found that autistic children imitate well in such tasks. It was supposed that if a child could respond well to this task, then he understood the basic requirement to copy what was seen on the videomonitor.

When the children's responses were recorded on videotape, a mirror was positioned behind the children to enable the viewer to see both the subject and the model. The recordings thus obtained were viewed by two independent observers, who agreed in all but two cases on the scoring of the responses. In the two cases of disagreement, the observers discussed the cases and came to an agreement. It should be noted that for the purposes of analysis there had to be 100% rater agreement.

Results

It was decided to categorize the subjects' responses according to the type of response they most frequently made. For instance, in order to be scored as a child who copied the actions with the doll, a child needed to show the behavior on at least three of the possible four occasions. By this criterion it was found that all but one autistic child copied the actions with the doll. It may be noted that this child imitated all of the actions in the following type of task. Thus, if a child failed to copy a more symbolic action it could be assumed that this was not due to his failing to understand what was required of him.

When the children had to imitate the use of objects (hammering a nail, for example), it was found that all of the children used the objects in a real rather than a pretend manner (the criterion taken for "real" object use was that the child should use the object in the appropriate manner on five of the six occasions). However, in the more symbolic task of copying the pretend use of an imaginary object in conjunction with a real one (for instance, pouring tea from an empty pot into an imaginary cup), all of the retarded children copied the actions, whereas six of the eight autistic children tended not to copy at all ($p < .0003$, Fisher exact test; for criterion each child needed to copy on at least two of the three possible occasions).

This difference between groups was again apparent in the fourth type of action, in which the children had to copy purely pantomimic behaviors ($p < .02$, Fisher exact test; each child had to show empty gestures on at least three of the possible five occasions, and whereas seven of the retarded children did, six of the autistic children did not). In the last type of action, when the children had to copy the model's activity but were given the "wrong" object with which to do so, the retarded children virtually always gave some response, but five of the autistic children failed to respond on at least half of the occasions ($p < .013$, Fisher exact test). When the children did respond, the two groups tended to give different types of reponse. All but one of the retarded children gave symbolic responses on at least half of the possible occasions, whereas five of the autistic children responded with "proper" uses of the objects ($p < .001$, Fisher exact test). The remaining four children failed to reach either criterion. It is noted that only one autistic child failed to give any "proper" responses, which in the context of the present experiment (where the use of each object had been demonstrated before) implies that the autistic children were generally able to show deferred imitation.

Looking at these results in the light of the aforementioned developmental stages of imitation, it is possible to say that the autistic children were able to imitate at least at the basic level. At the next developmental step, it would seem that the majority of the autistic children were capable of deferred

imitation (in that they produced a behavior not displayed by another at the time but shown to them some time earlier). Because this task requires the storage of mental images, one may infer that the autistic children were capable of forming then (which is in agreement with the studies reported by Hermelin, 1978). Most important, though, was the absence of symbolic gestures in the autistic children's responses; they showed very few imitations of pretend object use, especially pantomimic actions, and failed to respond at a symbolic/representational level in the final type of action in the study.

Experiment 2

Anticipation. In order to study the ability of the children to anticipate events, the paradigm utilized by Bower, Broughton, and Moore (1971) to study object permanence in infancy was used. In this, Piaget's "tunnel effect" (Piaget & Inhelder, 1969) was created by the apparatus shown schematically in Figure 1.

Briefly, on a "normal" unviolated trial the subject saw an object appear at A, travel to B, reappear on the other side of the screen at C when one would expect it to from its trajectory, and finally disappear again at D. In fact, two identical objects were used with two conveyor belt systems that were electronically timed to give the illusion of a single object traveling with uniform velocity from A to D. This basic condition could be violated in three ways: (1) A different object could reemerge at C than had disappeared at B and in the same trajectory as the first—thus giving the illusion of an object that maintained a constant velocity but changed its physical appearance while behind the screen; (2) the instant the first object disappeared at B, the new object could be made to appear at C; or (3) the "same" object could seem to undergo this instantaneous reappearance at C, having just disappeared at B.

The subjects had to watch sequences of trials that were unviolated and that used a different pair of identical objects for each run. The objects were chosen to be as attractive as possible, being mainly small, brightly colored toy animals. Interspersed among these trials at a rate of 6 in any 20, were violated runs randomly chosen from the above three possibilities. The subject's eye movements were recorded on videotape. This was done using a camera positioned behind the apparatus in such a way that, by use of a mirror, one could see not only the child's eyes but also what he was looking at.

Following the Bower et al (1971) paradigm, it was decided that the above data should provide the main source of information regarding the abilities of the children. However, it was also decided that the children's heart rates (HRs) should be measured too, in order to gain further evidence

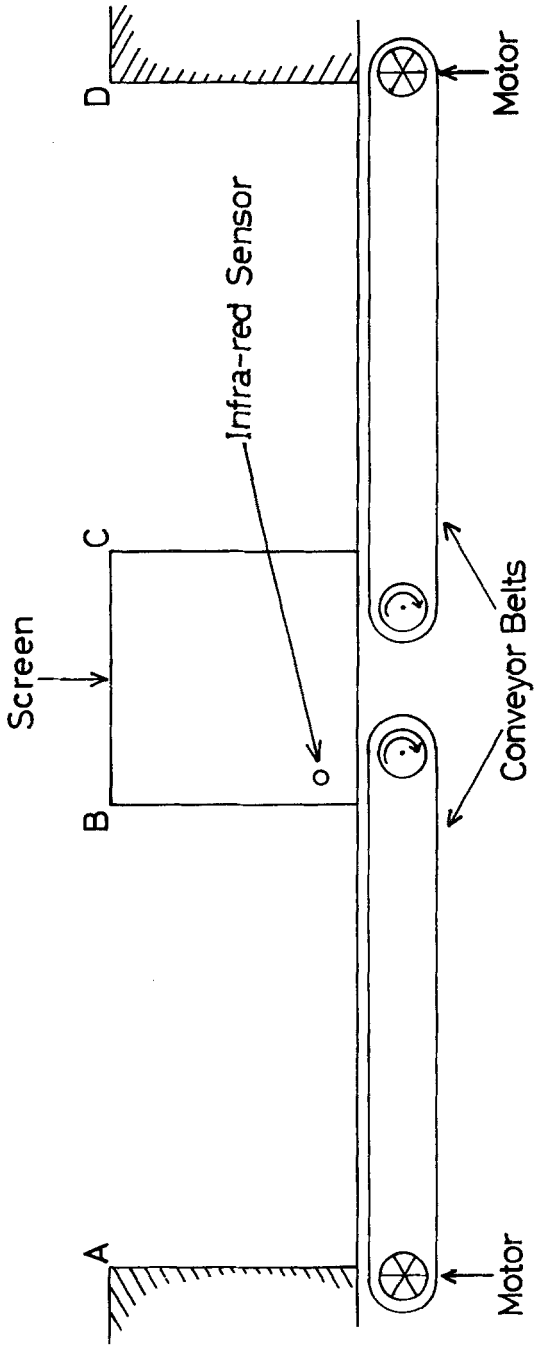

Fig. 1. Schematic representation of apparatus used in the study of anticipation. The infrared sensor detected the first object's arrival behind the screen and triggered an electronic timing device, which thus provided precise control of the conveyor belt movements.

regarding their covert responses. This was done by using a telemetric recording device that provided a pulse-by-pulse readout of their HRs on graph paper. The interbeat intervals could thus be measured directly (in millimeters) from the graphs (cf. Graham & Jackson, 1970). Although there has been some controversy as to the meaning of accelerations and decelerations of HR (see Coles & Duncan-Johnson, 1975, for example), it has been suggested that HR deceleration is linked to attention to visual stimuli (Lacey, Kagan, Lacey, & Moss, 1963; Kagan & Rosman, 1964; Kagan & Lewis, 1965) and to the initial period of the OR response (Graham & Clifton, 1966). It has also been suggested that HR acceleration is connected with response to arousing stimuli, and may indicate internal processing of the event or stimulus just perceived. Additionally, HR deceleration would appear to be an indicator of preparedness for or expectancy of a forthcoming event (Lacey & Lacey, 1970). Thus, the study of such HR changes just prior to or at the time of appearance or reappearance of an object, within the context of the present study, can provide some measure of the subjects's responses to the experimental situation.

However, as Graham and Jackson (1970) point out, a HR "response" is not a discrete event that can easily be identified but is "a transient change in a continuous activity" (page 69). They go on to note that "the transient must be distinguished from a noisy background which may include spontaneous fluctuations, sinus arrhythmia, and movement artifacts, and may affect response differently at different base levels." A thorough investigation of HR would thus require one to make extensive studies of baseline HR prior to the experiment's beginning, HR change for some period prior to the events in question (the appearances of objects), and HR changes for some period after the stimulus (pre and post periods of about 10 to 15 seconds have been usual). Obviously as the present study was not designed primarily with the measurement HR in mind, data from this source will be treated tentatively.

Anticipatory behavior could therefore be scored in a number of ways. One measure was simply to observe whether the subject tended to look back to A in anticipation of the beginning of the next trial following the end of the last. Then the eye movements of the subject while the object was around the screen could be noted: If, when the object disappeared at B, the subject immediately looked to C, then one could infer anticipatory behavior. Equally, if something "went wrong" (in the violated trials), then one would expect the child to react in a puzzled manner or to indicate in some other way that all had not gone according to his expectations. Finally, as described above, the HR data could be analyzed for arousal responses to the violations or attentional decelerations in preparation of an anticipated event.

Results

The results revealed that, throughout, the autistic children showed less anticipatory behavior than did the retarded children, when measured by the children's eye movements (Table I).

The autistic children showed significantly less anticipatory looking to side A at the beginning of each trial ($t = 2.90$, $df = 7$, $p < .05$). They also did not tend to shift their gaze from B to C in anticipation of the object's reappearance ($t = 3.39$, $df = 7$, $p < .05$). Instead, they tended to continue to track the object only after it appeared again at C, which the retarded children did not show ($t = 2.94$, $df = 7$, $p < .05$). They tracked the object's travel less consistently from A to B than did the control subjects ($t = 4.11$, $df = 7$, $p < .01$). From C to D the tendency once again existed for the autistic children to track less, although the difference between the group means just failed to reach significance.

Behavior (such as active visual search, puzzled expressions) failed to differentiate the groups on the violated runs. However, more informative evidence may be gleaned from the HR data. It was decided that the data of one of the autistic children were too variable to be used in the analysis, so those of her and her match control were ignored for the purposes of the following analyses. It was further decided that the direction of HR change should only be taken into account if the video record showed that the child was looking at the apparatus when the violation occurred. For this reason there were a few discounted scores. It should also be pointed out that the groups did not differ as to their average HR levels in the period prior to the beginning of the experiment ($t = .78$, $df = 6$, $p > .1$). Thus, one need not refer to the "law of initial values" (see Graham & Jackson, 1970) when discussing group differences in HR change in response to the experimental situation.

The average HR between A and B was compared with that of the 1 second following the object's reemergence at C, both for the violated runs

Table I. Average Number of Trials ($N = 20$) in Which Each Type of Child Showed the Various Measures of Eye Movements

Group	1 New trial	2 Track A to B	3 Track B to C	4 Jump anticipate	5 Jump emerge	6 Look back	7 Track C to D
Retarded	12.00	14.63	1.63	12.50	3.88	.13	13.00
Autistic	7.00	9.75	.88	6.68	8.88	.00	8.88
t ($p <$)	2.90	4.11	n.s.	3.39	2.94	n.s.	n.s.
	(.05)	(.01)		(.01)	(.05)		(just)
$df = 7$							

and for the predictable ones. A 2 × 2 analysis of variance was computed and revealed a significant groups effect ($F = 15.53$, $df = 1, 12$, $p > .002$), which reflected the fact that there was a general tendency for the autistic children's HR to fall and for the retarded children's to rise. There was also a trend for a groups by conditions interaction ($F = 2.99$, $df = 1, 12$, $p < .11$), which was indicative of a trend for the retarded children to have a greater rise in HR when viewing a violation than when they saw a predictable trial, whereas the autistic children tended to have an equally slight drop in their HR whenever an object emerged at C. These results may be taken to indicate that whereas the retarded children were tending to process what they saw (especially when something went "wrong," when their response might be described as one of "covert surprise"), the autistic children tended to be consistent in their response to seeing an object with attention—although there was reason to believe that this was poorly maintained.

Unlike the behavior of an object around the screen area, that at point A was quite predictable and thus provided a final opportunity to search for evidence of anticipation. The interbeat interval just prior to an object's emergence at A was compared to that immediately preceding it, and was summed across trials. A deceleration between these two could be taken to indicate that the child was anticipating; this was found to be the case for the retarded children but not for the autistic children ($t = 3.58$, $df = 6$, $p < .02$). Instead, the HR of the autistic children tended to remain constant over the intertrial period.

It might be argued that the autistic children were simply slow to learn about the predictive nature of the experiment. If this were so, one would expect more of the above-mentioned decelerations to occur in the second half of the autistic children's trials. However, this was not found to be the case; statistically there was no greater tendency for decelerations of HR prior to emergence at A to occur in the second half for either group. However, the trend was for both groups to have less of such lowering of HR in the second half, which was indicative of the presence of habituation.

Thus, although the results of the analysis of the HR data must be interpreted tentatively, they would seem to support those of the analysis of the children's gaze behavior, and they suggest that the autistic children were not tending to anticipate the objects' movements, whereas the retarded children were. It might also be suggested that while the retarded children's usual response to events was an increase in HR (indicative of processing what they had seen?), the usual response of the autistic children was one of slight HR deceleration—which might be indicative of attention rather than processing, and thus maladaptive to the task of anticipating events by the cognitive processing of past and present perceptions. This topic would merit further study using a purpose-designed HR paradigm.

Naturally, as the paradigm was originally intended to investigate the development of an object concept, something may be said in that regard here. To the extent that the anticipatory gaze shifts implied a knowledge of the object's continued existence when it was no longer in sight, then, because all the autistic children showed some such behavior, it may be inferred that they each possessed an internal image of the object. Although tentative, the inference to be drawn from this work is that while the autistic children possessed an internal image of the objects, they generally failed to use knowledge about it to anticipate the future behavior of the objects.

DISCUSSION

In the introduction, several seemingly necessary precursors to the formation of symbols were partialed out. In light of the above, what may now be said concerning the autistic child's symbolic abilities? They would certainly seem to be capable of imitating at a basic level; this is a finding that gains support from clinical observations that autistic children echo what is said to them, and often do so in a tone of voice that mimics the model. It would also appear, from both this and the work reported by Hermelin (1978), that autistic children are capable of forming internal images of external objects and events, but that they tend to remain "stimulus bound." In the study of imitation, most of the autistic children showed themselves able to produce deferred imitations, which is indicative of the storage of some sort of "image." Equally, in the object constancy study, they were generally capable of forming an image (in that they all showed some anticipatory gaze shifts). However, it must be concluded from the present results that the major deficit shown by the autistic children in these studies was that of manipulating the stored images: to form "symbolic gestures," or to interpret and reproduce the more abstract behaviors such as those represented by the pantomimic actions, or to utilize perceptions in a projective manner in order to anticipate the future state of an object. It was thus the rigidity shown by these autistic children in the same situations in which the retarded children showed flexibility in maniplating internalized images, both across modalities and across time, that stood out as a prime factor.

Within the Piagetian framework one is led to infer that the autistic children may well have been arrested at a fairly early level of development in which the internal "signifier" is either still inextricably bound up with the thing or action it signifies (the "signified") or that at best the differentiation and coordination between these two has only progressed to a basic stage in which the signifier is a "sign" (having a learned correspondence, and not a self-generated one, to the signified). Problems with forming the

"signified" are linked to the development of referential behavior, which itself is involved in the symbolic/representational level of imitation.

Insofar as a child must attain an "object concept" in order to enter into symbolic activity, we may question whether or not the autistic children had in fact attained this concept. Because of the complex nature of the above object constancy study, it is difficult to draw any definite conclusions concerning this point. However, it is of interest that the accepted method for testing whether or not a child has attained the concept is by violating predictions that would be fulfilled if and only if the object were "real." In other words, what defines an object qua object are such factors as continuity of size, color, shape, and such "truths" as that an object cannot be in two places at the same time. All such information allows the infant or child to predict the behavior of something if it is to fulfill the designation of "object."

As noted above, the autistic children did not show as many anticipatory eye movements as the retarded children (a point that was supported by the heart-rate data). The data on anticipatory eye movements may be confounded by the fact that they tended to track the objects' movements far less. As Piaget has pointed out (1955), though, the tracking of objects may be seen as a continuous checking of the state of the object in that prediction about its future position is used in order to maintain efficient tracking. Thus, the tentative suggestion may be proffered that the autistic children were not predisposed to (or possibly, not capable of) accurate anticipation of future events. Consequently, they may not have attained a stable concept of object permanency, which is a suggestion that is in line with the clinical observation that autistic children are known to cling to objects, rather as if they are unaware that they continue to exist when they cannot be seen. However, the work of Piaget may be criticized (Donaldson, 1978) particularly in that it neglects the influence of social interaction upon the development of precursors of symbol formation. Werner and Kaplan (1963) and Bruner (1975) place great emphasis on such influences, especially where they come to bear upon the development of anticipatory and referential behavior.

According to Bruner (1975), the lack of ability to anticipate would certainly be a great handicap in the development of normal interpersonal relationships. The mother's responses, no matter how predictable, to her child's behavior in the "demand mode" may not be predicted by the autistic child. Hence, the "expectancy of response" that Bruner refers to fails to evolve normally, and, in consequence, the "request mode" either is not entered or, if entered, is done so with a rigidity and idiosyncracy quite untypical of the normal child (cf. Ricks & Wing, 1976). Clearly, with only a partial development through these various "modes," the child might well be unable to come to the "exchange mode," which may be seen as the basis of true human communication.

It is also in the nature of such communications between mother and child not only that the child is able to anticipate the mother's behavior but also that the child's behavior is to a large extent predictable too. In this regard one may cite Schaffer (1971), who reported that the autistic infants that he studied did not posses the basic signaling abilities (of crying when hungry, etc.—i.e., Bruner's demand mode characteristics) and thus they were very difficult babies to understand. Wing (1976) confirms this finding and reports that autistic children often show erratic patterns of sleeping and feeding, and, whereas some are extremely placid, others are at the opposite extreme and cannot be comforted. This view of the unpredictability of the autistic child is further supported by the work of Ricks (1972), in which he found that the babble and cries of normal infants are generally understandable to other mothers, whereas that of the young preverbal autistic child may be so idiosyncratic as to be unintelligible to all save the child's own mother.

That an infant's behavior should be predictable is an essential aspect of more recent theories of infant development (Newson, 1974; Schaffer, 1977). Mothers initially form hypotheses about their infant's behavior and impute meaning to it (Bruner, 1975; Newson, 1974). Moreover, this seems possible only because the infant's behaviors are highly organized and precisely timed (Trevarthan, 1974, 1975), such that the mother can make her actions "phase in" with those of her infant's. If the autistic infant's behavior is poorly organized and less precisely timed, then it may be very much more difficult for his mother to impute meaning to his behaviors or to phase her actions and vocalizations in with his (cf. Newson, 1977). Indeed, Newson (1977) suggests that a poor ability to time behaviors might be pathognomonic to the syndrome of autism. Ricks and Wing' (1976) clinical observation that mothers of autistic children often say that they had trouble understanding the sounds made by their child as a baby is no doubt of relevance here, too, as is Newson's (inter alia) observation that such mothers may also have noted difficulties in having a "conversation without words" when the baby was very young.

In conclusion, the pattern that emerged from our research indicates that (1) the autistic child would seem to possess one basic requisite of symbolic behavior, namely, the ability to form internal images, but seems to lack the ability to manipulate these images in a purposeful and meaningful manner; (2) he is able to exhibit good imitation of relatively concrete actions produced by a model but is seemingly unable to produce imitations that possess the symbolic "as if" quality that the retarded child is quite able to do; (3) he seems quite able to distinguish an object from its ground but fails to attend to and utilize those elements of his perceptions that lead him to be able to predict and check on the states of that object; and (4) the ability to form internal images and to be able to predict and be predictable seem to be

essential to the linguistic, cognitive, and social development of the child. While these conclusions may best apply to the nonverbal autistic child, similar factors may lead the more able and verbal children to lack flexibility in their formation and use of symbols. It is suggested that this topic be investigated further.

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