From: THE ACQUISITION OF SYMBOLIC SKILLS
Edited by Don Rogers and John A. Sloboda
(Plenum Publishing Corporation, 1983)

WHAT PRESCHOOLERS KNOW ABOUT ANIMATE AND INANIMATE OBJECTS

Rochel Gelman,
Elizabeth S. Spelke, and
Elizabeth Meck

University of Pennsylvania
United States of America

The world we live in contains animate and inanimate objects, and adults think about these classes of objects in different ways. Consider one clear case from each class: a cat and a chair. We expect a young kitten to grow and change shape over time, but do not expect a newly made chair to do this. If one used instruments to alter the shape of the chair, we might not accept the result as the same object; under the same transformation, the kitten would still be considered the same animal. Additionally, we expect a cat to respond to another animal's actions, to have life-supporting internal organs and external parts, to be governed by an underlying set of psychological functions and states, and above all, to have an endogenous ability to move. We expect a chair to have none of these characteristics.

It has been proposed that young children do not respect these distinctions, and assign animate properties to inanimate objects. In his early work Piaget (1930) interviewed 8 to 10 year old children and found that many maintained that the moon knew where it was going, that clouds had intentions and even that rocks felt the pain from the prick of a pin. According to Piaget, this "animistic" thought disappeared in a four stage sequence. Initially children were said to attribute animate properties to all objects then to all objects having any activity, then to just those objects which moved, and finally to only those objects which moved on their own. It was not until children were 12 years old that they used the criterion of endogenous movement to distinguish animate from inanimate objects. Thus, it was thought that knowledge of the distinctions between animate and inanimate objects develops gradually on the basis of more superficial differences between the moving and the still.

In the main, Piaget's basic findings are replicable (e.g. Carey, 1982; Laurendau and Pinard, 1962). As in many other cases, it is the interpretation of Piaget's findings that is at issue (cf. Gelman and Baillargeon, in press). This is the matter that we address. Indeed, we present evidence that children as young as 3 years know much about the difference between animate and inanimate objects.

We question Piaget's conclusion that young children are truly animistic in their thinking on three grounds. First, consider the objects about which children have been interviewed: the moon, the sun, rivers, the wind. These are not things that are well-known to a child. Moreover, they mimic one important feature of animate objects: they move without an apparent external cause. It is possible that children answer questions about these objects incorrectly out of ignorance or confusion. If asked about more familiar objects, children might respect the animate-inanimate distinction. Second, consider the animate properties that children are asked about: psychological states like volition, thinking, and feeling. The very young child may know little about these states (see Wellman, 1982), and may answer incorrectly because of ignorance. Third, consider the form of Piaget's questions. Most of these are predicate-complement sentences like "Does the sun know where it is going?" On one reading, they have no yes-no answer; they are anomalous, since they presuppose that suns are the kinds of objects that can be knowledgeable or ignorant (Keil, 1979). If children interpret the sentences in this way, they may conclude that the interviewer is playing with them, and that they should answer in a mode of play. Animistic answers thus may reflect a child's capacity for fantasy, not his or her knowledge about objects.

Thus, young children might very well keep separate animate and inanimate objects on the basis of at least some, if not all, criteria; and there are hints in the literature that they do. Keil (1979) reported that 3-year-old children granted feelings to animals and people but not to inanimate objects like plants and doors. Thus they judged sentences like "the lady is sorry" as sensible and "the door is sorry" as not sensible. Carey (1982) reported that 4-year-old children were willing to assign internal organs to animate objects but not to inanimate objects. Children tended to judge, for example, that worms have hearts but twigs do not, despite the superficial similarities between these objects and despite the child's ignorance of hearts. Wellman (1982) showed that 4-year-olds restrict their assignment of brains to animate objects as well.

Our own research was undertaken to explore the child's understanding of the distinction between animate and inanimate objects. Additionally, we wished to probe the sources of animistic

responding in Piaget's tasks. We doubted that we could investigate knowledge of animate and inanimate objects in very young children using an interview, since preschoolers are notoriously bad at answering interview questions and especially at justifying their answers. Nevertheless, we began with an interview format. And we were so impressed with what the preschoolers told us that we never abandoned it. In this chapter, we report on our interviews with 3, 4, and 5 year olds.

In constructing our interview, we decided to ask children about objects they knew well, so that their ignorance about a specific object could not be taken as a general tendency toward animism. Moreover, we decided to ask about clear examples of animate and inanimate objects as well as certain possibly difficult cases. Thus, we could determine if the tendency toward animistic thinking emerges only with a subset of objects. Our difficult cases were objects that mimic the salient parts and actions of animate objects: dolls and puppets.

In considering what questions to ask about these objects, we decided to test a range of distinguishing features to see if some but not others would be applied by the child. The questions were based on our analysis of the differences between animate and inanimate objects (Geiman and Spelke, 1981). In that analysis, these classes of objects are differentiated with respect to: (1) their appearance and physical makeup; (2) their capacity for independent action; (3) their potential for psychological states; and (4) their tendency to engage in reciprocal activities with other animate objects. The interview contained questions in each of these four categories.

EXPERIMENT I : PERSON, DOLL, ROCK

Our first study is best thought of as a pilot project, designed to confirm that preschoolers could be asked questions about the nature of animate and inanimate objects. We selected as target items a person, doll and rock, and we constructed a structured interview which took place over 2 to 3 days, lasting 20 minutes a session.

After a brief introduction during which children were asked "Do you know what a person (doll, rock) is?", the interview began. Children were <u>not</u> shown pictures of the objects in question. We stopped using pictures when we found children confused as to whether we wanted them to answer about the drawing of the object or the object itself, and when we found that the children were ready and able to answer questions about objects in the absence of any pictures.

There were four blocks of questions: action and perception (hereafter action); parts; mental-emotional states (hereafter states); and reciprocal actions. The blocks were presented in this order for all of the children. The target questions within a block were randomized once before the experiment and then presented in a common order across children. Finally, a given question was asked for each of the target items; the order of the items within that frame was randomized across questions and children. The questions within each block were:

1. Action. Can a person (rock, doll) see, run, walk, sit, talk, hear, throw, eat, cry, laugh, breathe?

2. Parts. Does a person (rock, doll) have a head, feet, mouth, eyes, ears, hands, stomach?

3. States. Can a person (rock, doll) feel sad, feel happy, remember, think, make a wish?

4. Reciprocal actions. Can you talk to (listen to, play with, run with, kiss, hug) a person (doll, rock); can a person (doll, rock) talk to you, and so on?

Note that the reciprocal questions for each item were asked one after the other. For example: "Can you play with a doll? - Can a doll play with you?" To get these right then, the child had to catch the change in syntax.

In the case of the questions about parts, the child was also asked what the part was for. In all other question blocks, the child was periodically asked to justify his or her responses to the yes/no questions. We assumed the children would be resistant to providing justifications; hence the decision to seek them haphazardly.

Subjects were eight 3-year-olds (mean = 43.5 mos) and eight 4-year-olds (mean = 53.5 mos). The children came from relatively heterogenous racial and socio-economic backgrounds and attended day care centers or nursery schools in the Greater Philadelphia area. They were well-known to the interviewer (E.M.) who spends a good deal of time at their schools. About 2 to 4 weeks after the basic interview, six 3-year-olds and all 4-year-olds participated in a control condition designed to check the possibility that children adopted a response bias to say "Yes" to questions about a person and "No" to questions about a rock.

Answers were considered correct if: (1) a child answered yes or no as would an adult; (2) a child said the opposite of what was expected but justified the response as would an adult (see protocols below); or (3) a child answered incorrectly to questions

about dolls but, when probed, added a disclaimer that the doll did not "really" have the property or only had it for "pretend". Such probes on the doll questions were infrequent, occurring on only 4% of the trials in each group. When they did occur, the child had to provide evidence that he or she applied the terms differentially to a doll and a person, as in the following example:

C.S. 50 mos: Does a doll see? "Yes". Does a doll see for real or for pretend? "For pretend". Does a person see for real or for pretend? "Real". What is the difference between seeing for real and seeing for pretend? "Cause stuff, they are not real. Dolls - they can't see for real."

In the case of reciprocal action items, the child had to be correct on both forms of the question. Correctness was determined as above.

Table 1: Percent Overall Correct Responses in Experiment I (N = 8)

Category of Question and Age*	PERSON	DOLL	ROCK
ACTIONS			
3 years	100	89	100
4 years	100	95	100
PARTS			
3 years	100	79 (88)**	98
4 years	100	65 (70)	100
STATES			
3 years	100	71	100
4 years	100	86	100

* In an analysis of variance age was not significant; $p<.01$ for target item; $p<.05$ for category of question (including reciprocal questions); $p<.01$ for item x question interaction.

**Percent correct when 'stomach' question was removed are shown in brackets.

Table 2: Percent of Children Passing* Doll Questions in the Different Categories (Experiment I) N = 8

	CATEGORIES					
AGE	Perception	Biological	Movement	Parts	States	Reciprocal
3 years	87.5	100	87.5	87.5	75**	88
4 years	100	100	87.5	62.5	100	100

*Passing criterion was at least 2/3 correct answers for the items within a category. Cell entries reflect correct judgements and/or correct explanations. However, binomial expansions were based only on the yes/no data. Nevertheless, all entries are significant at $p<.05$ (1-tailed test).

**Action items were assigned to 3 subcategories as follows:
perception: see, talk, hear;
biological function and expression: eat, breathe, cry, laugh;
movement: run, walk, sit, throw.

Results

Judgments

Table 1 presents the overall proportion of correct responses for the action, parts, and state questions. Children's answers were invariably correct for the person and rock questions. Thus, they showed no tendency to attribute animate characteristics to rocks. Children did make some errors on the questions about a doll, but not very often. Indeed, as can be seen in Table 2, a significant number of children in each age group succeeded on all categories of questions about dolls.

Note that only 65% of the 4-year-olds' answers to part questions were correct. This reflects the tendency of some children to attribute a stomach to a doll and the tendency of some children to deny dolls feet and mouths. One may question whether this latter response tendency is really incorrect. If "leg" is taken to refer to a part of an animal, then dolls in fact do not have them. Note also that the children were somewhat confused about the happy, sad, and think questions. As Carey (1982) suggests, this fact may reflect a lack of knowledge about these functions and not a fundamental tendency to attribute animate characteristics to inanimate objects.

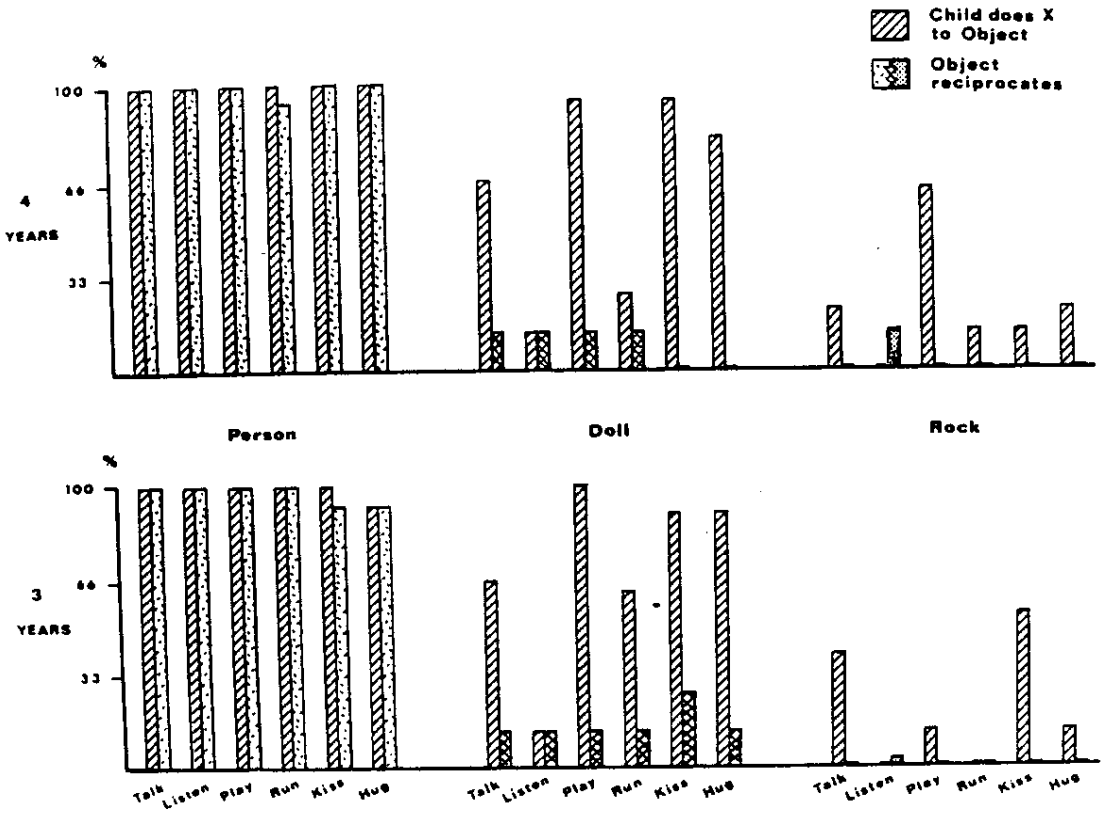

Figure 1: Pattern of children's answers to each part of the pair of reciprocal questions in Experiment I. Note the inclusion of 5-year-old data from another study. These were collected in the final pilot study and are included here for purposes of later comparison.

Further evidence that the children were not responding as animists comes from the reciprocal action results shown in Fig. 1 where the answer to the two forms of the question, e.g. "Can you talk to a person", and "Can a person talk to you?" are plotted side by side. Both ages stated that the various target actions could be performed reciprocally with a person. Wherever children said they could do something with a rock, they also said the rock could not respond in kind. The most interesting data are in the middle panels. Three- and four-year old children alike stated that they could talk to, play with, kiss and hug a doll. Neither group of children thought they could listen to a doll (proportion yes responses <.12). There was some tendency to say they could run with a doll. Still, whatever the children thought they could do with a doll, they knew the doll could not do the same with them. If a child did say a doll could do something to them, say talk, he or she typically went on to say this was because one could pull a

string or push a button and then listen (presumably to a recording). Similarly, a doll could run with them if they carried the doll along.

Explanations

One of the main results of these studies is that we were able to elicit explanations with ease. We planned to ask children what function a given part served and they all answered most queries of this form. No fewer than seven out of eight children in each group could tell us that feet were for walking, mouths for eating, etc. The children had more trouble with the head and stomach questions. Only three of the younger children could give a plausible function for heads.

In addition to the part questions, we asked the children to justify their judgments on an average of 25 and 30 questions in the 3- and 4-year-old groups, respectively. Of these, an average of 22 and 25 justifications were provided. Indeed, all but one 3-year-old gave at least 17 explanations and even this child gave 8 explanations. Excerpts from protocols best illustrate how our subjects explained their yes/no judgments.

C.K. 49 mos: Can a doll run? "No". How do you know? "Because she is just pretend". Can people run? "Yes". How do you know? "Because their legs grow big". Can rocks? "No". How do you know? "Cause they don't have any legs or feet".

Can a doll talk? "No." Why not? "Only if it has a string it can talk". Can people? "Yes". How do you know? "Because they have a mouth". Can rocks? "No" - they don't have a mouth".

Can a rock hear? "Don't have ears". A person? "Yes - they have ears". A doll? "No". They have ears? "Well, they still can't hear - I don't see too many dolls with ears".

D.S. 50 mos: Can a person cry? "Some people when they are sad". A doll? "No". Why not? "Cause it doesn't have any eyes". [Child contradicts what she said on the part question about eyes]. Dolls have eyes. "No they don't". Can a rock see? "No, it doesn't have eyes".

M.E. 51 mos: Can you play with a doll? "I can play with it". Can it play with you? "No". Why not? "Because it's not alive". Can you play with a person? "Yes". Can a person play with you?. "Yes". Can you play with a rock? "Yes". Can a rock play with you? "No". What does it mean to be alive? "It means to move and do things, like take stuff downstairs and stuff like that".

E.W. 39 mos: Can a person throw? "Yes". A rock? "No". A doll? "No". How come a person can but a doll and a rock can't? "A doll can if you put a little tiny ball and then you can move her arm and then the ball will roll". Why can't she do it herself? "Cuz she's not alive".

An explanation code consisting of eight categories was developed after all four of the present studies were completed. Then explanations were coded by two independent coders. Overall agreement for each experiment ranged from 96 to 99 percent.

Explanations were coded as being: (See Appendix 1 for examples)

(1) Classification if the child said the object was alive or not, real or not real (or pretend), human or not human, animal or not animal, of a certain kind, "just stuff" if the object was inanimate, or had parts that were not real. Talk about real or pretend had to be spontaneous for the explanation to count in this analysis;

(2) Movement if the child said the object could or could not move, had parts that did or did not support a given function, could or could not perform a given action, could or could not move on its own, was or was not made to move on its own, was inert (if it was an inanimate object), did or did not need to be moved by an agent;

(3) Parts if the child correctly said an object had or did not have a part;

(4) Mental Acts if the child appealed to a mental activity to justify their saying an object could or could not do something: since such explanations were rare they are combined with "other" in the figures;

(5) Products if the child said an object could or could not perform a target action because the output would take a different form in a nonhuman than it does in a human. Such explanations occur only in experiments which ask about cats. There children say cats cannot talk because they meow, and so on;

(6) Denies Parts if the child claimed that a part which is commonly associated with an object was absent: (see D.S.'s protocol above);

(7) Internal Parts if the child said an object did or did not have a brain, stomach, etc; and

(8) Other when the child talked about things that were true of the objects but not pertinent to the question at hand.

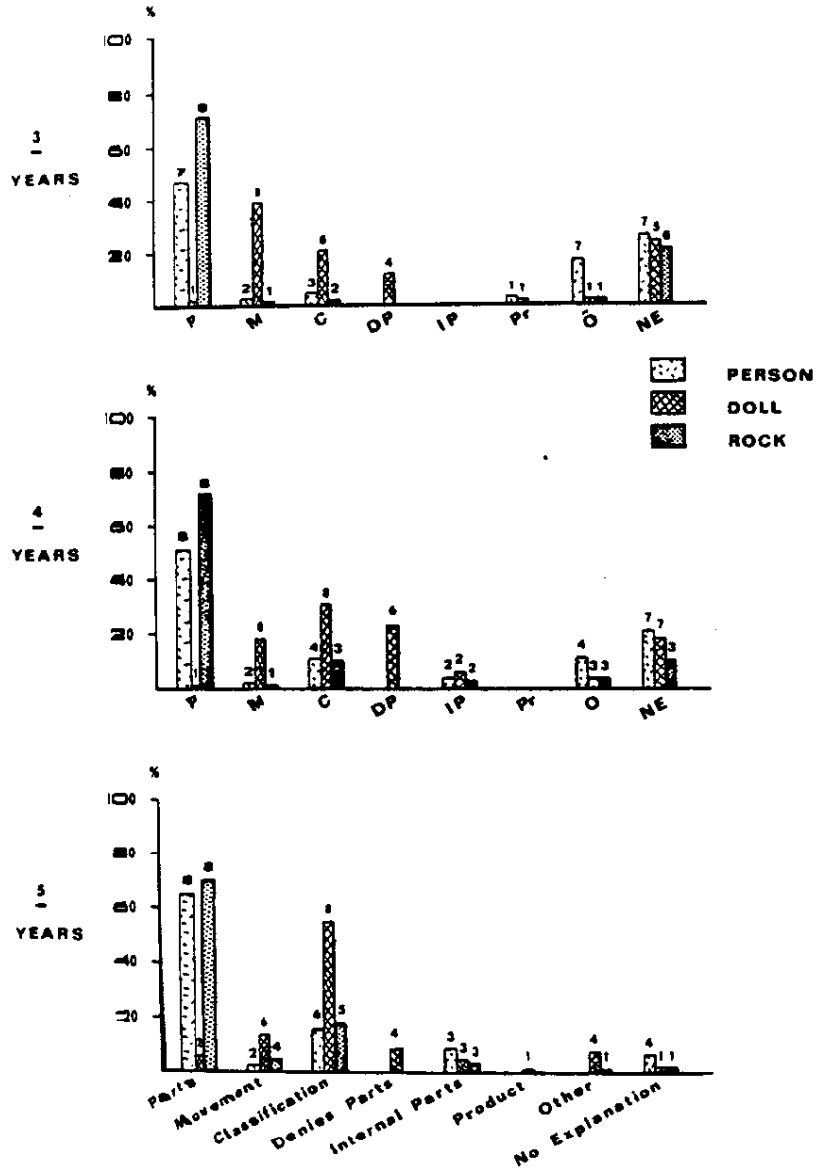

Figure 2: Mean percent of children's explanations in each category of explanation type in Experiment I. Numbers above the bars indicate how many children contributed to the mean.

Note that we do not list here or in the figures the category Incorrect. This is because there were hardly any incorrect responses: only 18 out of more than 3000, for all 4 studies.

Figure 2 shows the mean percent of children's explanations in each category of explanation type and the number of individual children who gave each kind of explanation. By either criterion the findings are the same. When children told us why a rock cannot do something, they focussed on the lack of supporting parts. Similarly, they appealed to part explanations when justifying their explanations about people, stating for example, that a person can eat because it has a mouth. In contrast, they switched to a different kind of explanation when discussing dolls. The 3-year-olds focussed on the fact that dolls cannot move; they also gave classification accounts, volunteering that dolls are not real, not alive, not human, and so on. The main difference between the age groups is that the older children were more inclined to deny that dolls had parts and hence less inclined to talk about movement. Still, it is important to note that 6, 6 and 7 of the 8 4-year-olds gave denial, movement and classification explanations respectively, when talking about dolls.

One might argue that the children did especially well on the rock questions because they simply had to say no. Some features of the results make this an unlikely account. To get the reciprocal action questions correct the children had to move back and forth between a yes and no response and they did. They also gave explanations which made it clear that they knew full well that rocks do not share animate characteristics. A follow-up control interview with the children convincingly rules out this hypothesis. We asked questions we thought a child would say 'yes' to for both a person and a rock, 'yes' to for a rock and 'no' to for a person, and 'no' to for both. These are shown in Table 3, along with the proportion of yes responses. Where the proportions are less than 100% or greater than 0%, explanations were again revealing. For example, C.W. (a 3-year-old) said one could not build with a rock because "You put rocks under things". Children also appealed to physical constraints, e.g. that the rock was too heavy or dirty for them, and moral concerns, e.g. "They might hurt someone if they stood on them".

Discussion

The findings from this study support the hypothesis that, by 3 years of age, children have some understanding of the difference between animate and inanimate objects. This understanding guides not only their judgments about people and rocks but their judgments about what could be a difficult case: dolls. The children in this study had little if any inclination to attribute animate characteristics to dolls. Indeed, they volunteered that dolls did things for pretend and were not real, and thereby provided further evidence that preschoolers can distinguish between appearance and reality (Flavell, Flavell and Green, in press). As regards Piaget's analysis of the stages of animism, we draw attention to

Table 3: Proportion of YES responses to control questions for Experiment I.

QUESTIONS	3-year-olds (N = 6)		4-year-olds (N = 8)	
Can you:	PERSON	ROCK	PERSON	ROCK
1. Drill hole in	17	83	0	63
2. Jump from	40	60	20	80
3. Hammer with	17	100	0	50
4. Build with	17	67	0	88
5. Listen to	100	20	100	0
6. Dance with	100	0	100	0
7. Chase	100	0	100	0
8. Feed	100	0	100	0
9. Look at	100	100	88	88
10. Touch	100	100	100	100
11. Wash	100	100	88	88
12. Cover	83	83	100	100
13. Eat	0	0	0	0
14. Drink	0	0	0	0
15. Pour	0	0	13	50
16. Hide in	17	0	0	50

the fact that every one of our 3-year-old subjects talked about the inability of a doll to move on its own. Apparently, and contrary to Piagetian theory, children are able to classify objects on the basis of endogenous movement at a very early age.

EXPERIMENT II : PERSON, CAT, PUPPET, ROCK

The second experiment was undertaken to replicate the above findings and to pursue several further questions. First, would children show a greater tendency towards animism if we asked them about a puppet instead of a doll or would they treat a puppet as children in Experiment 1 treated a doll? This question is of interest, since children justified their responses to doll questions by noting that dolls do not act on their own. Since puppets are typically seen in motion, one might expect children's answers or justifications to change here. Second, would children apply their knowledge of the difference between animate and inanimate objects to objects other than people? One could argue that children in the first study answered questions on the basis of a person-not person distinction. Should the children treat a cat as they do a person, use of this strategy would be ruled out.

Procedure

This study was conducted in the same way as the first with two exceptions. Children were asked systematically for explanations; and they were asked fewer questions in each category. The items for each category were: Actions - talk, see, run, throw, eat, cry; Parts - feet, mouth, stomach; States - feel sad, dream, remember; and Reciprocal Actions - talk to, play with, kiss and hug. .

Subjects in this experiment were eight 3-, 4-, and 5-year olds. Their respective mean ages were: 42, 54, and 68 mos.

Results

Judgments

It can be seen in Table 4 that the overall tendency of children in each age group to answer the yes/no questions correctly was comparable to those obtained in Experiment I. There are no entries for the state questions about cats simply because it is not obvious as to what constitutes a correct answer (Do cats dream?). Note also the double entries for parts questions about cats and puppets. The figures in brackets represent what happens when we drop the stomach item out of the analysis, an item that was especially hard for the children.

The perfect scores on the reciprocal items are of interest. Although the children said they themselves could act upon the puppet, they denied the puppet the ability to respond in kind. This is hardly the sort of response pattern one would expect on the assumption that preschool children imbue objects which move with animate characteristics.

Table 4: Percent overall correct responses in Experiment II (N = 8)

Category of Question and Age		PERSON	CAT	PUPPET	ROCK
ACTIONS	3 years	98	89	94	98
	4 years	100	94	98	100
	5 years	100	98	100	100
PARTS	3 years	100	88(100)	92(100)*	96
	4 years	100	92(100)	88(100)	100
	5 years	100	96(88)	79(94)	100
STATES	3 years	100	-**	83	91
	4 years	100	-	96	100
	5 years	100	-	100	96
RECIPROCAL	3 years	100	78	97	100
	4 years	100	92	100	100
	5 years	100	88	100	100

*Percent correct with 'stomach' question removed shown in brackets.

**For ANOVA each child was given the average of the other categories.
Significance levels: p=.02 for age; p<.001 for target items; question category not significant; p<.001 for item x question interaction.

Analyses of individual children's success rates on the doll and puppet questions support the above findings and revealed no animistic tendencies. In fact, all 4- and 5-year old children met criterion for all 4 categories of questions; and, respectively, 7, 8, 6 and 8 of the 8 3-year-olds passed the actions, parts, states, and reciprocal action subtests.

The children were again able to tell us the functions for feet and mouths. Only three 3-year olds could approximate an answer for a stomach. Although the older children could do so in this study, other children of the same age had trouble on this item in subsequent experiments.

Explanations

Again, the explanation data make clear how well preschoolers understand the difference between animate and inanimate objects. In all, the 3-, 4-, and 5-year-olds were asked for an average of 36, 44, and 50 explanations. The mean number of respective responses were 23, 40, and 49. The increase in the numbers as a function of age reflects an increasing tendency to give more detailed explanations. Before reviewing the pattern of explanations we present excerpts of answers given for questions about cats and puppets since these are new objects.

A.K. 56 mos: Can a puppet talk? "No". Why not? "You make it talk". Can it talk by itself? "No". A person? "Yes". By itself? "Yes". How come? "Cause they are different than a puppet". How are they different? "Cause you make a puppet and people you don't make". Why not? "Cuz they grow". Can a cat talk? "It could do meow". How come? It can talk because we can talk. A cat is more like us but he does not talk like us. When he wants milk he does meow. When he cries we let him go out".

Can a puppet eat? "No, he doesn't have any mouth. He has a mouth; you can draw him a mouth but you cannot open the mouth". Can a person eat? "Yes - cause he has a mouth but the puppet doesn't have a real mouth". What does it mean to have a real mouth? "A real mouth is like this" [points to own mouth]. How is that different from a puppet's mouth? "Cause you draw a puppet's mouth. You don't know all those things"?

Can a cat dream? "Yes - cause he has a mind". A rock? "No, he doesn't have a mind. He is just a rolling ball". A puppet? "No way! You just make him". What does it mean to dream? "To dream is to sleep and dream about dreams".

J.H. 64 mos: Can a person talk? "Yes". How come? "Because they have questions". How come they can talk? "Because they have a mouth". Can a cat talk? "No". Why not? "Because it an animal and not a person". A puppet? "Of course not". How come? "Because it's not real". A rock? "No. Because it doesn't even have a mouth".

B.W. 58 mos: Can a puppet throw? "If somebody's hand is inside and helps it". How about all by itself? "No - it needs something to help it move".

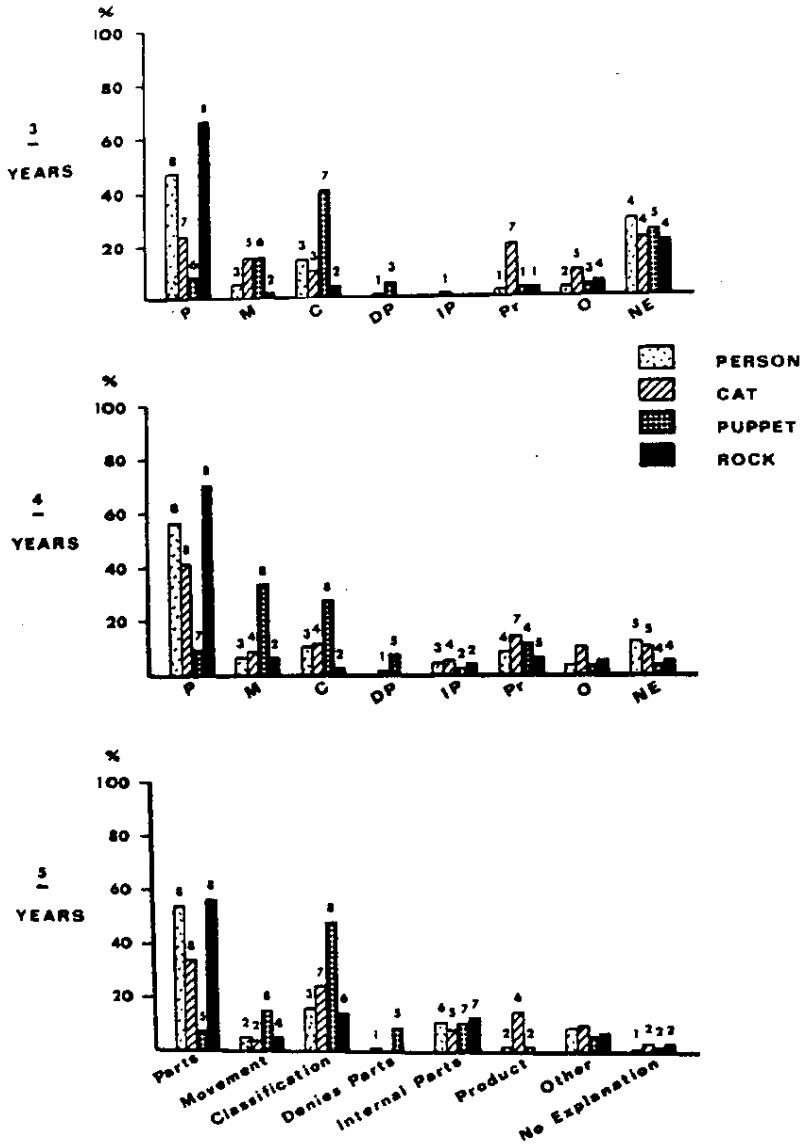

Figure 3: Mean percent of children's explanations in each category of explanation type in Experiment II. Numbers above the bars indicate how many children contributed to the mean.

L.R. 57 mos: Can a puppet see? "No, because their eyes don't move". Can a puppet eat? "No". Why? "Because the mouth is sewed together". Feel sad? "No". Why? "Because it doesn't have a body inside". Remember? "No.". Why not? "Because it doesn't have any stuff in it. It has a hole. You put your hand in it."

What's a person? "A person is the baby a mother has - when you grow up you have hair and stuff and you have a mouth and bones inside". A cat? "An animal". A puppet? "A toy".

As in the first experiment, when children considered animate objects they referred primarily to that object's parts. Likewise, when they considered a rock, they referred mostly to the parts it lacked. When asked, however, to explain their answers for the puppet questions, they focussed on movement and classification arguments. That is, they noted that puppets do not move on their own, are not real, are not alive, are just toys, and so on. The main differences between these patterns and those from Experiment 1 are due to the cat questions. Children often would choose to point out that cats make sounds that are different from the ones that people make. This is reflected in the bar graph labelled products.

Apart from the fact that the 5-year-olds gave more explanations, there are no compelling developmental differences revealed by this analysis. Although the older children were more articulate, their explanations did not differ in kind from that of the younger children.

Discussion

The results of Experiment II replicate and extend those from Experiment I. Children distinguished clearly between animate and inanimate moving objects. They considered a puppet to be inanimate and a cat animate. The pattern of explanations for cat was like that for person in this and the previous study; responses for the puppet were like those for doll in the previous study. These facts add weight to our initial conclusion that preschool children have organized knowledge about animate and inanimate objects and that they can use this knowledge to classify correctly a variety of animate and inanimate objects. The puppet results highlight the fact that very young children can and do consider whether an object has potential for autonomous movement. Despite the clear fact that puppets move, and do so in a manner that is superficially like the movements of animals, children do not mistake this for animate movement.

EXPERIMENT III : NO ROCK

The above findings leave us with a puzzle. Why do children respond animistically to Piaget's questions and not to ours? One possibility concerns our use of a rock in the interview. The presence of a clear example of an inanimate object may lead children to draw on their knowledge of the animate-inanimate distinction when answering all of the questions. To test this possibility, we omitted the rock from Experiment III.

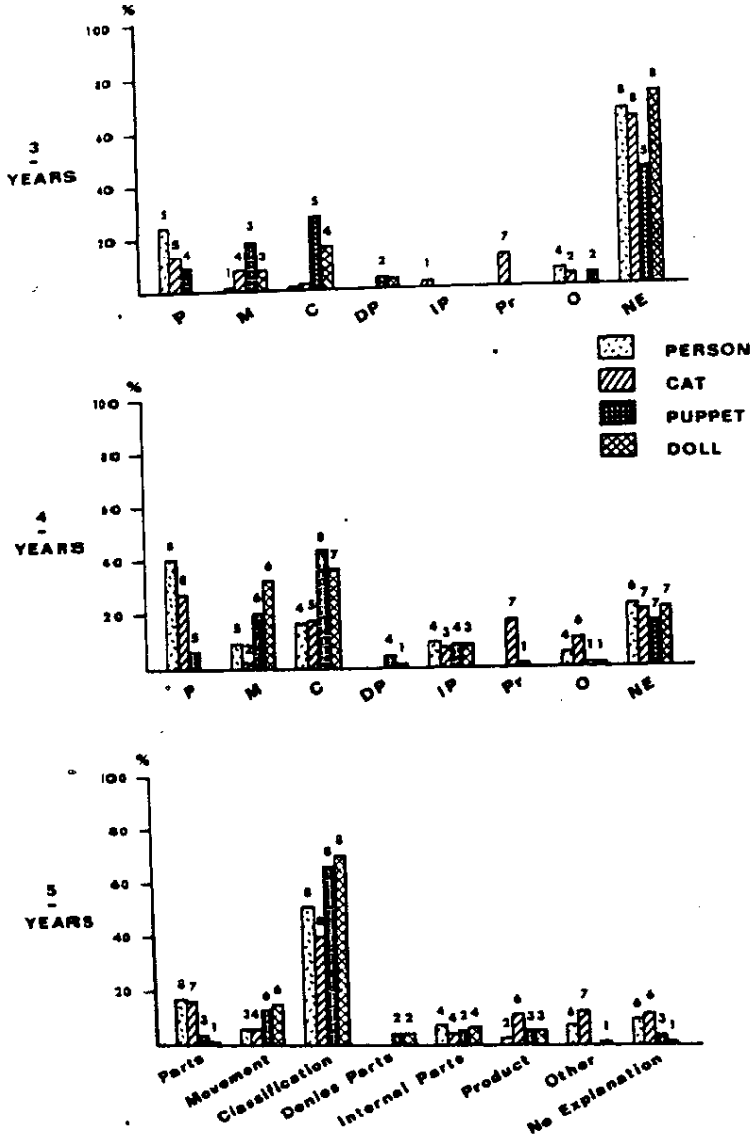

Figure 4: Mean percent of children's explanations in each category of explanation type in Experiment III (No Rock). Numbers above the bars indicate how many children contributed to the mean.

Children were asked about a person, cat, doll and puppet. Since no order effects were obtained in Experiment II, categories of questions were presented in the same order used in Experiment I. Otherwise, the procedure was the same as in Experiment II. So were

Table 5: Percent overall correct responses in Experiment III (NO ROCK). N = 8

Category of Question and Age		PERSON	CAT	PUPPET	DOLL
ACTIONS					
	3 years	98	92	69	75
	4 years	100	96	96	98
	5 years	100	92	96	100
PARTS					
	3 years	100	87(87)*	83(83)	79(100)
	4 years	100	91(100)	87(87)	80(82)
	5 years	100	100(100)	87(94)	75(82)
STATES					
	3 years	100	-**	42	54
	4 years	100	-	87	83
	5 years	100	-	96	100
RECIPROCAL					
	3 years	100	69	44	41
	4 years	100	84	87	87
	5 years	100	88	94	100

*Percent correct with 'stomach' question removed shown in brackets.

**Average of other scores used in ANOVA. $p<.001$ for all effects and interactions.

Table 6: Percent of children passing puppet and doll questions in each category. Experiments III and IV.

	EXPERIMENT III			EXPERIMENT IV		
Age Group	3 years	4 years	5 years	3 years	4 years	5 years
PUPPET						
Actions	75	100	100	100	100	100
Parts	87.5	100	100	75*	87.5	100
States	50*	87.5	100	75*	75*	100
Reciprocal	12.5*	87.5	87.5	100	87.5	100
DOLL						
Actions	75	100	100	100	100	100
Parts	100	100	87.5	75*	87.5	87.5
States	67.5	87.5	100	100	75*	100
Reciprocal	25*	87.5	100	87.5	87.5	100

*Not significantly different from chance on a binomial expansion. All other entries are significant, $p<.05$ (1 tailed)

the questions within a category. Again, eight 3-, 4-, and 5-year-olds served as subjects. Their respective mean ages were 42 mos., 54 mos., and 65 mos. The data from this study were analyzed in the same way as those from the previous ones and are shown in Table 5, Table 6, and Figure 4.

Inspection of Tables 5 and 6 as well as Figure 4 reveals that removal of questions about rocks had some effects on the children's responses but that the effects were rather limited. Considering the correctness of judgments only, the 3-year-olds showed some tendency toward animism; however, when they gave explanations these were good ones. The one salient difference between the pattern of explanations in this study and the first two is the decline in the rate of part explanations at all ages. This makes sense; the children were asked to differentiate between objects which, on the surface at least, have many of the same parts. Hence the objects are not as readily distinguishable on this criterion in this study.

We draw attention to 2 features of the 3-year-old results. First, as shown in Figure 4, these children gave very few explanations. This is because removal of the rock questions had serious motivational consequences for this group. Compared to the same aged children in the previous experiments, these children did not enjoy being in the study, and they resisted requests for explanations. Second, although the explanations that were given by these children make it clear that they knew that dolls and puppets are not animate objects, they said "yes" such objects could respond to them. We believe that this provides a clue as to why our data are so different from Piaget's and will return to why in a later section.

Despite the noted differences, it must be emphasized that the children did treat puppets and dolls in one way and people and cats in another way. Also again, the children told us that the former objects could not move on their own. This tendency, once again, suggests that the source of movement, and not just the existence of movement in an object, is a crucial variable as regards the child's assignment of animacy to an object. In the main, we obtained yet further evidence that preschoolers can classify animate and inanimate objects on the basis of a genuine understanding of the nature of such objects.

EXPERIMENT IV : NO PERSON

Although removal of the rock did not destroy children's abilities to reason about animate and inanimate objects, one recent analysis suggests that removal of a different anchor might indeed have such an effect. Carey (1982) has proposed that person is the prototypical animate object for a young child. When a child is asked to reason about animate properties he or she may do so by comparing the similarity of a given object to a person. Here we deleted questions about a person to determine whether children would still be able to think about animate objects such as cats and the inanimate objects of doll and puppet without the person as an anchor.

The target items were cat, doll, puppet, and rock. The subjects were eight 3-, 4- and 5-year-olds with respective mean ages of 42 mos, 55 mos and 66 mos. Except for the change in the target objects, the study was the same as in Experiment III.

The relevant data from this study are presented in Table 6, Table 7, and Figure 5. As can be seen, the findings from this study roundly replicate those above. And even though the youngest children tended to err on the yes/no parts questions, they could and did appeal to the presence or absence of parts when they themselves talked about the objects. Indeed, they did this as much

Table 7: Percent overall correct responses in Experiment IV (NO PERSON) N = 8

Category of Question and Age		CAT	PUPPET	DOLL	ROCK
ACTIONS	3 years	83	96	90	98
	4 years	88	96	92	100
	5 years	90	96	98	100
PARTS	3 years	71(100)*	63(75)	59(59)	100
	4 years	96(94)	79(88)	58(82)	92
	5 years	96(94)	83(82)	71(82)	100
STATES	3 years	-**	79	91	96
	4 years	-	79	79	100
	5 years	-	100	100	100
RECIPROCAL	3 years	84	94	94	100
	4 years	81	91	87	97
	5 years	91	100	100	100

*Percent correct when 'stomach' question was removed are shown in brackets.

**Average scores used here in ANOVA. Age was not significant; Question, target item and question x item interaction were, with $p<.05$.

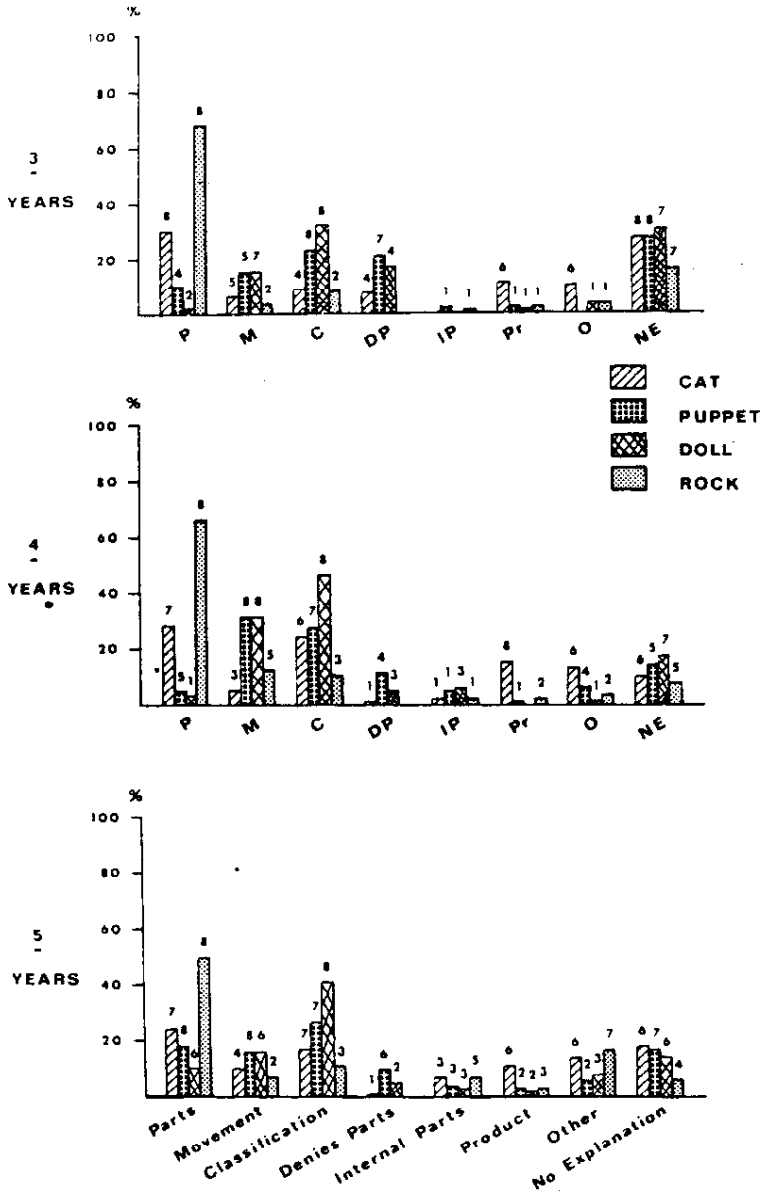

Figure 5: Mean percent of children's explanations in each category of explanation type in Experiment IV (No Person). Numbers above the bars show how may children contributed to the mean.

as did the older children. The relatively high rate at which 3-year-olds said that dolls and puppets do not have human parts suggests that they compared the objects in this experiment to people when reasoning about their nature. Apparently, young

children can access a representation of a person even when no person is asked about. This is another possible reason then why the absence of person questions in this study had almost no effect on the quality of the data.

A SEARCH FOR ANIMISM

The contrast between our findings and those of Piaget is now more striking than ever. Even though we interviewed children as young as three years, even though we asked them about objects such as puppets, and even though some of our questions concerned mental states, our experiments provided no evidence that animism is the predominant mode of thinking of a young child. What is going on in Piaget's experiments? In our last pilot study we explored one further possibility.

We drew attention to the fact that, unlike those in all other experiments, 3-year-olds in Experiment III (No Rock) said dolls and puppets could respond reciprocally. We believe that this is due to the interaction of two factors: the ability of young children to interpret questions about play objects in one of two modes - a play and non-play mode; and the need of the experimenter to make clear which mode the child should apply when answering questions about them.

Rocks are not play things, and there is no ambiguity on how to interpret questions about them. However, dolls and puppets are toys and serve as participants in a child's fantasy play. In a play mode dolls and puppets are given the temporary ability to interact with the child. Hence, one could argue that our questions about dolls are ambiguous and that the effect of the questions about rocks is to disambiguate them (cf Donaldson, 1982). This line of argument could account for the 3-year-olds' ubiquitous tendency in Experiment III to say that dolls and puppets could respond reciprocally. D.A. (45 mos), a subject in Experiment II, says what we mean perhaps better than we do:

Can you play with a rock? "No, because it's not a toy". Can you play with a person? "Yes". A person with you? "Yes". But you are not a toy. "People can play with other people but not the way they treat toys".

Since the Piagetian questions are anomalous on one reading, preschoolers may take them as invitations to pretend that the predicates of the sentences are true. Consider the question "Does the wind know that it moves?" The wind can neither know or not know and hence the question is anomalous. However, the wind does move. If the child takes the mere posing of the question to mean that it is okay to think the wind 'knows' then why not allow that it also knows when it moves?

Given the foregoing, we decided to ask a group of 5-year-olds all the questions we asked 3- and 4-year-olds in the first study and then a sample of questions in the predicate-complement form used by Piaget. The explanation data from our standard interview are plotted in Fig. 2 for purposes of comparison with the 3- and 4-year-olds who were in Experiment I. As expected, all eight of the 5-year-olds gave clear, articulate accounts of the nature of rocks, people and dolls as well as the difference between these objects. In contrast, only two of these very same children held firm when asked the Piagetian questions; another two were full of confusions, and the remaining four turned into prototypical Piagetian animists. We offer excerpts from one protocol to highlight the effect, starting with a piece of our original interview to show how sensible the child was and ending with her switch to nonsense.

C.S. 66 mos: Can a rock talk? "No. Because it's not a person". Puppet? "Only when it's on the show". How about when it's not on the show? "It can't talk". Can a rock feel sad? "No. Because it's not a person". Puppet? "In the show, they could". Well, how about other puppets? "No. Because they are just toys". A doll? "No". Why? "Because she is just to play with". A cat? "Yes, if you bother him he can". Can a doll dream? "No - she's a toy". Puppet? "No. You use puppets". A rock? "No - it stays still everytime. It can't move at all". A cat? "Yes - because a cat is alive".

Do the clouds know that they're moving? "Yes". Does the rain like to water the flowers? "Yes". How come? "It likes flowers". Do the flowers like to be watered by the rain? "No. They don't want to be wet - when they get wet the leaves fall down and they're afraid".

Lest one think it is the items in the latter questions which are responsible for the switch, we note that when this child was asked the simple question "Can flowers be afraid?" She said no. Further, we have some pilot data on what happens when we ask children our questions about rivers and then pose the same content in a predicate-complement construction. Consider what Heath said in these two different contexts:

Can a river talk? "It doesn't have a mouth". Can it move? "No. Well it can move - when you move it around it moves". How do you move it around? "With your hands". Can a river remember? "It doesn't have a remember thing". Can the river grow? "No". Why not? Because it doesn't have any plants". You have to be a plant to grow? "Yes". How about when it rains on the river, does the river get bigger? "When it rains on the river it gets bigger and bigger and it gets fuller and fuller". Does that mean that it grows? "It goes all the way up".

Do you think [illegible] that the river wants to grow?
to but he does" [illegible] How come? "Because he doesn't
coming down". [illegible] the river like something? "H
fish". I thoug[illegible]efore you said that the river
"He does when yo[illegible]ive him mouths".

We find the[illegible] convincing data for the idea
switch from a re[illegible]ty to a non-reality mode. Ou
stimulus for th[illegible]witch is a predicate-compleme
introduced by a [illegible]b of mentation requires detai
our interviews [illegible]ered from Piaget's in many wa
asking direct q[illegible]ions, each question we asked
for all target [illegible]s before a further question w
ordering questi[illegible] in this way, we may have succ
children to swi[illegible] the criteria by which they an
ultimately to s[illegible] on criteria that distinguish
the inanimate. [illegible] our protocols amply demonstra
started with a [illegible]erficial" justification for a
rock can't talk [illegible]ause it doesn't have a mouth"
to a deeper jus[illegible]cation when asked about other
puppet can't ta[illegible]ecause it's not real", or "be
toy", or "becau[illegible]t doesn't have a real mouth")
the central con[illegible]ion is the same. Children ca
animate and ina[illegible]te objects in a sensible fash
alternative mod[illegible] answer as animists.

GENERAL CONCLUS[illegible]

Young chil[illegible]n can think and converse coher
distinction bet[illegible]n animate and inanimate object
have knowledge [illegible]he animate-inanimate distinct
accessible, at [illegible]st in the context of our inter
children were [illegible] to talk about this distincti
questions, and [illegible]justify their answers with exp
both relevant a[illegible]articulate. Our research, lik
evidence for th[illegible]iew (Gelman and Spelke, 1981)
inanimate disti[illegible]on is a most basic and import
children.

From child[illegible]'s answers and justifications,
autonomy of mov[illegible]nt plays a central role in dis
from inanimate [illegible]ects, especially for the youn
Children at all[illegible]s appeal to the automony or l
an object's mov[illegible]nt in justifying their judgmer
object's proper[illegible]s. Moreover, even when childr
answers by refe[illegible]ng to an object's parts or st
autonomous move[illegible]t appears to lie behind their
Thus, children [illegible] deny dolls parts they obvio
legs; when pro[illegible], they often maintain that the

not "real" and do not move on their own. Children do not appear to distinguish animate from inanimate objects by considering their superficial characteristics, such as their visible parts or even their capacity for visible movement. Rather, children distinguish between these objects by considering the causes of their movement. An object is animate if its cause of movement is from within.

Like Piaget, we now believe that the child's understanding of the animate-inanimate distinction is intimately tied to the child's understanding of causality. But it now seems that knowledge in both domains develops very early (Bullock, Gelman, and Baillargeon, 1982). Basic knowledge of objects and the causes of their movements may develop in very early childhood with no explicit instruction and serves as a basis for the acquisition of further knowledge about the physical and the biological world.

ACKNOWLEDGMENTS

Support for the research and preparation of this work came from NSF Grant BNS-8004885 and BNS-8140573 to R.G. and NIHCD Grant HD-13428 to E.S.

REFERENCES

Bullock, M., Gelman, R. and Baillargeon, R., 1982, The development of causal reasoning. in "The Developmental Psychology of Time", W.J. Friedman, ed., Academic Press, New York.

Carey, S. Are children fundamentally different kinds of thinkers and learners than adults?, in press, in: "Thinking and Learning Skills", Vol. 2, S. Chipman, J. Segal and R. Glaser, eds., Erlbaum, Hillsdale, N.J.

Donaldson, M., 1982, Conservation: What is the question? Brit. J. Psychol. 73:199

Flavell, J.H., Flavell, E.R. and Green, F.L., in press, Development of the appearance-reality distinction, Cog. Psychol.

Gelman, R. and Baillargeon, R., in press, A review of some Piagetian concepts, in "Cognitive development", J.H. Flavell and E.M. Markman, eds., Vol.3 of "Carmichael's manual of child psychology", P. Mussen, ed., Wiley, New York.

Gelman, R. and Spelke, E., 1981, The development of thoughts about animate and inanimate objects: implications for research on social cognition. in "Social cognitive development: Frontiers and possible futures", J.H. Flavell and L. Ross, eds., Cambridge Univ. Press, Cambridge, England.

Keil, F.C., 1979, "Semantic and conceptual development", Harvard University Press, Cambridge, Mass.

Laurendau, M. and Pinard, A., 1962, "Causal thinking in the child", International University Presses, New York.

Piaget, J., 1930, "The child's conception of physical causality", Routledge and Kegan Paul, London.

Spelke, E.S., 1982, Perceptual knowledge of objects in infancy, in "On mental representation", J. Mehler, M. Garrett, and E. Walker, eds., Erlbaum, Hillsdale, N.J.

Wellman, H.M., 1982, A child's theory of mind: The development of conceptions of cognition, in "The growth of reflection", S.R. Yussen, ed., Academic Press, New York.

APPENDIX 1

Examples of Explanations in Categories of Code Classification

1. real-pretend:

-Can a cat dream? "Yes, because it's real, all living things can dream real things and not real things cannot dream".

2. Animal-not animal:

-Can a cat talk? "No, because it's an animal and animals can't talk. Only people can".

3. Parts - real or not real:

-Can a doll see? "No, because their eyes are not real eyes".

-Can a cat see? "Yes, because they have eyes that are real".

4. Kind:

-Can a doll eat? "No. It's just a doll". What does that mean? "It can't do anything".

5. Inanimate:

-Can a puppet run? "No - their legs are just sticks and stuff inside".

Movement

-Can a doll walk? " - however its designed it just stays that way".

-Can you hug a rock? "Yes, but a rock can't hug me - it can't move".

-Can you play with a puppet? "No, because it doesn't really move. It's only a toy".

-Can a puppet talk? "People only make them talk and then the puppet talks. The people talk and they pretend that the puppet is talking".

-Can a puppet throw? "No - unless you put something in its hand and throw it".

-Can a doll play with you? "No, because it can't move things because the hands are stiff".

Parts

-Can a rock walk? "It doesn't have feet".

Product

-Can a cat talk? "It doesn't have a voice, it only makes a meow sound".

Internal Parts

-Can a doll dream? "No - because dolls don't have any brains. Just people".

Denies Parts

-Can a puppet dream? "No, because they don't have any eyes and they don't dream".

Mental Acts

-Can a cat dream? "Yes, because it can remember".

Other

-Can a cat dream? "Doesn't sleep in a bed".