Social cognitive development

Frontiers and possible futures

Based on seminars sponsored by the Committee on Social and Affective Development During Childhood of the Social Science Research Council

Edited by

JOHN H. FLAVELL *and* LEE ROSS

(1981)

CAMBRIDGE UNIVERSITY PRESS
Cambridge
London New York New Rochelle
Melbourne Sydney

2 The development of thoughts about animate and inanimate objects: implications for research on social cognition

Rochel Gelman and Elizabeth Spell

> The soul is characterized by two faculties, (a) the faculty of discrimin tion which is the work of thought and sense, and (b) the faculty originating local movement.
>
> From Aristotle's *De Anima*, Book III, Chapter 8, as presente in McKeon, 1941.

This chapter was motivated by a very general question: How is the deve opment of social cognition related to the development of cognition of t nonsocial world? It directly addresses a different but, we believe, pri question: How does a child understand the distinction between anima and inanimate objects? Adults distinguish between the animate and inan mate domains, while recognizing that all objects share certain fundame tal properties. They know that some thoughts and actions can be directe to objects of any kind, but that certain other thoughts and acts should b reserved for the class of animates or inanimates alone. In this chapter w consider the development of knowledge of the animate–inanimate di tinction, especially the distinction between people and manipulable ob jects. We hope to show that this interesting, rarely studied question ca be easily investigated and that it can shed light on the larger question o the relation between social and nonsocial cognition. For a fundament difference between social and nonsocial events is that the former involv animate objects – especially people – whereas the latter do not.

We begin with a preliminary analysis of animate and inanimate objec

We thank all the Penn graduate students who participated in our Spring 19 seminar on the development of social cognition. They gave us the opportunity discuss many of the ideas presented here. We are especially grateful to J Baron, Merry Bullock, Diane Evans, John Flavell, Randy Gallistel, Molly Loga Betty Meck, Al Pepitone, Lee Ross, John Sabini, Prentice Starkey, and Ia Stewart, who read critically one or more of the previous drafts of this pape Preparation of this manuscript was partially supported by Grant NSF BNS-833 and NICH HD-10965 to Rochel Gelman and Grant NICH HD-13428 to Elizabe Spelke. Authors are listed in alphabetical order.

as they appear to be known to adults. Based on this analysis, and on a variety of experimental investigations, we then consider the child's developing understanding of the animate–inanimate distinction, and the child's ability to think appropriately about objects in each domain. We next illustrate how an analysis of the child's concept of animate and inanimate may shed light on the relationship between social and nonsocial cognition. Our discussion focuses on the development of object permanence and the development of causal reasoning. We conjecture that at least part of what develops over infancy and childhood is not a concept of permanence or causation per se but an ability to apply these concepts to a world of animate and inanimate objects that behave in very different ways. We speculate that the child's understanding of objects and of causal principles advances when he or she comes to understand the distinctive properties of animate and inanimate objects. The chapter concludes with some hypotheses about the development of social cognition.

A theme will recur throughout this chapter. Children's understanding of a given domain depends not only on the logical structure of the tasks used to assess competence and the level of development of some general set of cognitive structures. Their competence depends as well on the nature of the objects about which they must reason. Different structures and processes may be used on different objects, depending on the child's conception of those objects. Therefore, we consider the distinctive properties of animate objects and the child's understanding of those properties.

A beginning analysis of the animate–inanimate distinction

We focus on clear examples of animate and inanimate objects. The reader should understand *animate* to refer primarily to people and *inanimate* to refer to such three-dimensional, nonliving things as rocks, machines, books, furniture, clothing, and toys. It is not our goal to attempt to specify the necessary and sufficient conditions for animacy and the proper classification of ambiguous cases. However difficult and philosophically interesting ambiguous cases such as viruses and chess-playing computers may be, we take it for granted that the distinction is central to a good deal of everyday reasoning in adults. By considering how people react to clear instances of animate and inanimate objects we hope to formulate more precise research questions. To this end, we discuss the adult's analysis of animate and inanimate objects as: (1) collections of properties; (2) objects of perception; (3) recipients of action; and (4) domains of systematic knowledge.

Animate and inanimate objects as different natural kinds

Animate and inanimate objects share many properties: They both have physical dimensions, specifiable in terms of size, shape, color, and so forth. They are subject to similar transformations such as displacement in space and occlusion. Despite their similarities, there is a fundamental difference between them that is expressed in several ways. We consider four of its expressions. First, animate objects can act: The source of the transformations in which they engage can be internal as well as external. The same is not true of inanimate objects: They move only when something or someone initiates the transformation.

Second, animate and inanimate objects may both change over time, but they change in different ways. Animate objects grow and reproduce, acting to sustain themselves and their offspring. Inanimate objects may change in size or number if they undergo certain transformations (e.g., ice melts in warm temperatures, and glass may shatter if it is dropped), but they cannot bring these changes on themselves. Nor can they regulate through actions or internal processes the changes that occur in them.

Third, animate objects are entities that know, perceive, emote, learn, and think. In these respects, inanimate objects have no counterpart. A machine may undergo complex transformations of states that are internal and unseen. But it lacks the capacity for any mental representations or processes.[1]

Finally, although most animate and some inanimate objects have internal structures that relate their parts, the structures of animate and inanimate objects differ in certain respects. Animate objects are made up of structures that function to maintain life, foster growth, and allow reproduction. The parts that are common to animate objects are directly related to the kinds of things they can do: Limbs permit movement, digestive and respiratory systems support eating and breathing, reproductive systems create offspring, and brains and nervous systems support sensation, perception, learning, emotion, motivation, and the acquisition of knowledge. Inanimate objects do not eat, grow, reproduce, or think. They lack the life-sustaining, reproductive, and nervous structures that make these functions possible. Nevertheless, they may be comprised of parts that are structurally related. The clearest examples are machines, whose parts serve specific functions and whose organization obeys certain structural constraints. Only in science fiction, however, do machines have structures that permit reproduction, emotion, and intention.

Animate and inanimate objects as objects of perception

Both animate and inanimate objects can be perceived. Objects in both categories have a definite size, shape, substance, and other properties that may be specified to the eye, ear, and hand. Nevertheless, perceivers usually abstract different sorts of information from animate and inanimate objects. When we perceive an inanimate object, we focus on its physical properties. Perception is usually quite determinate (an object usually does or does not look round) and accurate (an object usually is round if it looks so). When we perceive an animate object, we note its physical properties, but are more likely to focus on the object's actions and intentions, motives, and feelings. The appreciation of intentions and feelings is often indeterminate (a person may not look clearly happy or unhappy), even deceptive (a person may look happy without being so).

The process of acquiring information about animate and inanimate objects also differs, because animate objects have the potential to deliver communications. Perceivers evaluate these communications along with all the other information they receive about the object. Perceivers may also communicate with an animate object, requesting information and eliciting certain reactions from the object. Inanimate objects neither communicate with perceivers nor respond to communications from them.

Animate and inanimate objects as recipients of action

Animate and inanimate objects may be acted on in many of the same ways: Both can be pushed, tapped, kissed, and so forth. Actions on animate and on inanimate objects nevertheless differ in certain respects. First, the consequences of such actions are different. Animate objects usually respond to an action by acting in turn, and their reactions are not fully predictable. Inanimate objects cannot respond with independent action. What they do can usually be predicted by a consideration of their physical characteristics and the characteristics of the action on them.

Second, an actor can use a second animate object as an agent; he or she may use an inanimate object as an instrument but never as an agent. One uses an instrument by acting directly on it. It is necessary to coordinate instrument action with goal action. One uses an agent, however, by communicating one's intent to the agent. It often suffices to look at someone in a certain way to get that individual to do something. One could stare at a rock forever, and nothing would happen.

Third, the action of one person can be similar in kind to that of another person. This has several implications. Animate objects have the potential for acting reciprocally and for reversing roles. Reversals occur in communication (A speaks to B after B speaks to A), in action (A may push B after being pushed by B), and in socially organized situations (A may alternately lead and be led by B). Role reversals and reciprocal interactions do not occur between animates and inanimates, although one may mimic such reversals in play.

In addition, an actor and a second animate object can pursue common or conflicting goals. They can cooperate and they can compete. In either case, each actor must take account of the intentions of the other. An inanimate object may at times be a prop or an obstacle for an actor, but it has no goals of its own.

Systems of knowledge about animate and inanimate objects

Thinking about objects, both animate and inanimate, appears to be systematic and principled. We draw on our systematic knowledge to organize our understanding of properties of objects and the dynamics of events. Different systems of knowledge appear to be used, depending on whether the objects and events that we know are animate or inanimate. Knowledge of inanimate objects is organized according to a set of physical laws. To understand what an object is, what states it can enter, and what transformations it can undergo, we must develop some formal or informal understanding of the laws of physics. Knowledge of animate objects is organized as well according to psychological principles and social conventions. To understand the states and predict the actions of a person, we usually appeal to the person's feelings and intentions, to theories about others, and to the conventions of society, as well as to the physical forces that act on him or her.

These different systems of knowledge provide information about what we can and cannot do. They serve to regulate our actions. For example, our knowledge of physical laws keeps us from attempting to move a mountain, part the seas, or lift a building. Our knowledge of social conventions keeps us from undressing in public or driving on the wrong side of the road. Our grasp of moral principles is presumably involved when we help those in distress.

The development of the distinction between people and inanimate objects

When does a child first appreciate that animate and inanimate objects differ in some properties, that they are perceived and acted on in different ways, and that some knowledge about them is organized differently?

Evidence for the development of this distinction comes from a variety of sources. We will review some of the evidence, following the format set forth in our analysis of the adult's distinction between animate and inanimate objects.

The child's understanding of the properties of animate and inanimate objects

To understand the differences between the properties of animate and inanimate objects, children must come to realize that only animate objects act independently, grow, reproduce, possess certain structures, and think. Piaget (1930) suggested that children attribute the capacity for independent action to some inanimate objects – clouds, rivers, the moon – throughout the preschool years. When presented with well-known objects, however, even very young children seem to know that only animate objects act on their own. Golinkoff and Harding (1980) noted that infants of twenty-four months were surprised when a real chair seemed to move on its own; they showed no surprise when the chair was moved by a person. Infants of sixteen months failed to be surprised by any of these events. Thus the understanding that people – but not chairs – are capable of independent movement may develop in the first two years of life.

We know of little work that addresses the question of when children first understand that only animate objects can grow, reproduce, and die. Even seven-month-old infants appear to be responsive to the age of another person: They are more interested in and less fearful of people who are young (Brooks & Lewis, 1976). Likewise, children of four years are sensitive to age differences; they communicate differently with two-year-olds than with peers or adults (Shatz & Gelman, 1973). Work by Piaget (1969) suggests that an understanding of growth develops. By four or five years, children appreciate that they were once as little as an infant; by five or six years, they acknowledge that an adult was once as young as they. These findings raise a critical question: Do young children appreciate that unlike people, rocks and chairs do *not* grow? That a small stone is no younger or less competent than a large one? That a large stone was not once small? In play, young children sometimes appear to treat inanimate objects like animate objects; for example, the smallest-sized block may be called "the baby." We do not know whether this game reflects a metaphorical extension or a genuine failure to appreciate that growth and reproduction are capacities reserved for animate objects.

Children as young as four years appear to appreciate that only animate objects have certain kinds of parts. Carey (1978) taught preschool-aged children that a given animal (for example, a cow or a human) had an omentum. An omentum is a membrane that holds the intestines in place, but surely none of the children were aware of this. Children were then asked whether each of a series of objects – for example, aardvark, fish, or bug – had an omentum. Children's willingness to grant this organ to other animals depended somewhat on the similarity of that animal to a cow or human. In general, however, all children were much more willing to attribute this organ to any animal than to any inanimate object. Children of four years implicitly may understand that animate and inanimate objects are made up of different kinds of parts or substances.

Johnson and Wellman (1979) studied young children's beliefs about the brain. Even the youngest subjects reported that they and the experimenter had brains. Most of the four- and five-year-olds and many of the youngest children further believed that the brain was not visible and was located inside the head. In contrast, most four- and five-year-olds declared that a doll does not have a brain. Here the three-year-olds disagreed. Those who attributed a brain to the experimenter were likely to grant one to the doll as well. The understanding that only animate objects have brains may develop after the third year.

Perhaps the most interesting aspect of the animate–inanimate distinction is the fact that only animate objects have minds. When does a child appreciate that animate objects, and only animate objects, can perceive, think, know, feel, and act in response to motives and/or intents?

Studies of perspective-taking abilities suggest that young children distinguish between animate and inanimate objects as objects that can perceive. Lempers, Flavell, and Flavell (1977) have shown that very young children know that humans have perceptions. There are hints in this research that young children also know that inanimate objects do not have perceptions. Lempers et al. report that one child tried to get an adult to see an object by bringing the object close to the eyes, and that the child did not do this with a doll. Similarly, Flavell, Shipstead, and Croft (1979) reported that some young children say they cannot see a person if his or her eyes are closed; the children did not say this about a doll with closed eyes. These scattered findings are worth pursuing.

When do children know that humans think and dream whereas rocks do not? Johnson and Wellman (1979) provide indirect evidence that such knowledge exists at five years of age. Kindergarten children report that thinking and dreaming are functions of mind, and that they themselves have minds and brains. Because they deny brains to dolls they may further believe that dolls and other inanimate objects lack minds and related mental functions. Other investigations with more demanding tasks sug-

gest that preschool children have no consistent understanding of thinking and dreaming (Broughton, 1978; Piaget, 1929).

Quite early in life children may appreciate that only animate objects have knowledge. Gelman and Shatz (1977) show that four-year-olds attribute different capacities and/or knowledge states to other humans as a function of age. Recent work by Flavell et al. (1979) further suggests that they do not attribute such knowledge to inanimate objects. Children reported that a person can know his or her name, but that a doll cannot. These findings contrast with early work by Piaget (1929) in which young children asserted, for example, that the sun "knows when it sets." These discrepancies invite further studies on the child's treatment of animate and inanimate objects as knowing creatures.

Young children seem to learn quickly that only animate objects have feelings. In an extensive study of semantic and conceptual development, Keil (1979) asked children whether certain statements about objects made sense. Children as young as three years consistently distinguished between animate and inanimate objects when those statements involved feelings. For example, they judged that sentences like "the lady is sorry" are sensible whereas sentences like "the door is sorry" are not.

Finally, by about three years of age, children will grant people intentions and motives (see Keasey, 1978, for a review). Whether they restrict such attributions to people is in dispute. Piaget's subjects sometimes explained the movements of clouds by referring to intentions. Bullock (1979) finds no comparable explanations when three- and four-year-olds reason about the movements of simple, familiar inanimate objects.

There is a clear rift in research on the child's theory of mind. Some investigators find evidence of a coherent, developing theory early in the preschool years, whereas others, notably Piaget, find no consistent and coherent theory before the period of concrete operations. Furthermore, the former group of investigators finds that the child restricts "minds" to animate objects early in life, whereas the latter group finds no such restriction. Piaget (1929) reported that young children grant knowledge, feelings, and intentions to at least some inanimate objects, like the moon. He also reported that preschool children do not grant perception to people and other animate objects exclusively. These discrepancies may reflect in part the nature of the inanimate objects that Piaget asked young children about. The moon and the clouds are not objects that children know well. As Piaget notes, these objects also appear to share one characteristic of animate objects – independent movement – because the wind, the earth's rotations, and interplanetary gravitational forces are not perceptible to humans. Children may distinguish people from familiar inanimate objects

like toys and furniture before they can think appropriately about less well-known and less clear cases of inanimate objects like the moon and machines that mimic human actions.

A second difference between the Piagetian work and the work of Flavell, Wellman, and others concerns the nature of the tasks given to children. In his work on animism, Piaget asked children some questions that an adult would have trouble answering. For example, he asked whether "the sun knows where it is moving." The answer seems to be neither "yes" nor "no." The sun is neither knowledgeable nor ignorant; indeed, as Keil points out, these are anomalous questions. Accordingly, children may have been understandably confused by Piaget's questions.

In summary, the case can be made that, at least by age four, children appear to begin to develop a systematic set of beliefs about the thoughts, feelings, intentions, motives, knowledge, and capacities of other people. In other words, following Premack and Woodruff (1978), they develop a theory of mind. Young children do not seem inclined to attribute mind or its functions to inanimate objects – as long as they are asked to use their theory to guide some action or simple judgment, and not to reflect on it or state it explicitly. The differentiation of many key properties of animate and inanimate objects may begin early in life.

The child's understanding of animate and inanimate objects as objects of perception

As noted, the adult's perception of animate objects differs from his perception of inanimate objects in at least two ways: (1) the focus of perception of a person is in part on the intentions and feelings of the person, and (2) the adult gets information from a person in part by communicating with him or her. Observational studies of young infants give every indication that they, too, perceive animate and inanimate objects in different ways.

Young infants have been reported to be sensitive to the manifestations of emotion in another person. They react in kind to expressions of positive and negative emotion at five months (Kreutzer & Charlesworth, 1973). Infants of two months may also distinguish a person who intends to communicate with them from one who speaks to someone else (Trevarthen, 1977). Finally, infants of eight months are sensitive to the direction of gaze of another person and appear to attempt to look in the same direction (Scaife & Bruner, 1975). Thus we may speculate that infants as well as adults attempt to discover what others are doing or feeling. We do not know whether they investigate inanimate objects in the same ways.

It has been claimed that very young infants attempt to communicate with animate objects and not with inanimate objects. Faced with a graspable ball, a prereaching child may engage in intense activity of the fingers, hands, and arms (Bower, 1972; Bruner & Koslowski, 1972; Dodwell, Muir, & DiFranco, 1976; Trevarthen, 1977). Faced with a responsive person, an infant may be more apt to gesture with its face and make "prespeech" sounds, while its hands are inactive (Trevarthen, 1977). This contrast suggests that infants differentiate between objects in the two classes. Of course, these studies do not demonstrate that infants respond to the animate–inanimate distinction rather than to other distinctions between people and toys, such as differences in size.

More striking evidence that infants expect people to act in a communicative setting comes from studies of responses to the impassive face of a parent or other person. Very young infants are upset if someone faces them without moving or speaking (Trevarthen, 1977; Tronick, Adamson, Wise, Als, & Brazelton, 1975; Bloom, 1977). Although systematic comparisons have not been made, it seems unlikely that a static inanimate object could evoke a comparable response. The infant's distress may reflect in part his expectation that a person will engage in reciprocal acts of communication with him.

Regardless of the weight of these early observations, it seems clear that once children can talk, they talk to people in order to exchange information, and they do not do this with inanimate objects. Young children sometimes speak when they are alone at play with toys, and they may even "converse" with a doll or other toy. It seems very unlikely, however, that they expect the toy to answer and engage in reciprocal conversation. A child who addresses an adult and is not answered will persist with greater and greater insistence. A child who also talks to a doll appears to accept the doll's nonresponse as a matter of course. These observations suggest a clear differentiation between animate and inanimate objects for purposes of communication. Nevertheless, this differentiation needs to be documented experimentally.

The child's understanding of animate and inanimate objects as recipients of action

Animate objects behave differently from inanimate objects in three major ways: (1) only animate objects respond to an action with an act of their own; (2) only animate objects can serve as agents; and (3) only animate objects can act reciprocally, reverse roles, cooperate, and compete.

Even young infants are sensitive to contingencies between their actions and movements of an inanimate object (Papoušek, 1969; Watson, 1972), or an animate object (e.g., Trevarthen, 1977; Weisberg, 1963). We know of no research, however, on the infant's ability to distinguish between contingent responses of animate and inanimate objects. We also do not know if infants expect the contingent responses of animate objects to be more variable and less predictable than those of inanimate objects. Other than the work on infancy, there is no research on these questions.

When do children appreciate that a person can be used either as an agent or an instrument whereas an inanimate object can be used only as an instrument? Piaget observes that infants of eight months or more will use one inanimate object in order to move or attain another. For example, they may use a blanket to pull nearer a toy that lies on it. Bates (1976) finds that infants of the same age treat people differently. People are appealed to; they are used implicitly as agents in the attainment of the child's goals. Young infants soon become adept at communicating their needs to a person who then satisfies them; no one has suggested that they systematically communicate their needs to inanimate objects. None of these findings are based on systematic comparisons of actions on animate and inanimate objects: Such comparisons are needed.

Once the child can talk, he or she can use knowledge of agent–instrument object relationships in various ways. For example, preschoolers can be shown the initial and final states of a transformed object and select the instrument that brought about the transformation (Gelman, Bullock, & Meck, 1980). We do not know whether they can do such a task with transformations that are brought about by a human agent and (most interestingly) whether they reason about agents and instruments in different ways. When do children first know, for example, that use of an instrument to achieve a goal implies some agent, but that the use of an agent need imply no separate instrument? When do they first understand that two separate agents can cooperate or compete, but that two instruments (or an agent and an instrument) can do neither? Once again, a study that pitted animate against inanimate objects in tasks such as this would greatly enhance our understanding of the developing agent–instrument distinction.

Concerning the reciprocal nature of actions on animate objects, Piaget (1952) grants that a rudimentary understanding of reciprocity is achieved by the end of infancy. Recent studies lead to the suggestion that this understanding develops even earlier. Very young infants have been reported to imitate some of the facial and manual gestures of an adult (Church, 1970; Meltzoff & Moore, 1977). If these findings are substantiated–two attempted replications have failed (Hanun, Russell, &

Koepke, 1979; Hayes & Watson, 1979) – they will suggest that a baby implicitly "knows" that he and another person can act in kind. They do not reveal whether babies also know that inanimate objects cannot do what they do. Infants have been observed to "imitate" with tongue protrusion the movements of a pencil as well as those of the mouth (Jacobson & Kagan, 1978). One of us has observed four-month-old infants to "imitate" with hand movements the movements of toy animals and blocks. The tendency to imitate may thus reflect no consistent differentiation of animate and inanimate events.

Finally, observations of children's play suggest a developing understanding of turn taking, role reversals, cooperation, and competition (Garvey, 1977). As children grow, their social network becomes increasingly complex. However, even young children appear to distinguish in their play between animate and inanimate objects. A young child who wishes to play may approach another person, perhaps with toys and social overtures; children are rarely seen to approach inanimate objects in these ways.

When we consider all the evidence on the understanding of the different principles of action that apply to the animate and inanimate domains, we are impressed with how early in life this distinction may be worked out.

The child's developing systems of knowledge

When do children first distinguish physical laws from psychological laws and social conventions? Lockhart, Abrahams, and Osherson (1977) questioned children about the possibility of changing physical laws, social conventions, and moral principles. Apparently children do not distinguish among these domains until eight or nine years of age (cf. Piaget, 1932). Preschoolers claimed that the laws of all domains were immutable. Surprisingly, older children were willing to indicate that physical laws as well as social conventions could be changed. Thus, if everybody in the state of California were to agree, we could not only decide to drive on the left and eat with our hands but could also decide that rocks can float in water! By contrast, work by Turiel (this volume) suggests that children begin very early to distinguish at least between social conventions and moral principles. In Turiel's study, children of all ages state that it is "all right" for a school or society to change its rules to permit public nudity (a presumed violation of conventions of the children's own society), but that it would never be all right for a school or society to permit hitting (a presumed violation of a moral principle).

Turiel's studies suggest an earlier distinction among systems of

knowledge than do the studies by Piaget and Lockhart et al. One difference between the studies is in the questions that children were asked. Lockhart asked whether it is *possible* for society to decide that we can drive on the left and hit each other, whereas Turiel asked whether it is *right* for society to make such decisions. Turiel's questions are thus moral questions, and they test the child's understanding of the various sets of principles that constrain his actions. A comparison of Turiel's and Lockhart's work suggests that children may develop an ability to think about what is right before they can think about what is possible. To our knowledge, however, there have been no studies that focus on the distinction between the possible, the permissible, and the ethical. The following anecdote suggests that children may think in terms of the permissibility or the morality of actions at an early age. This conversation with a young child illustrates the way one can contrast animate and inanimate objects in questions that are ambiguous as regards the possible and permissible:

R.G.: Can you kick a table?
Adam: (3 years, 7 months) Shakes head yes.
R.G.: Can you hit a table?
Adam: Yes.
R.G.: Can a table cry?
Adam: No, hasn't got a mouth.
R.G.: Can you kick me?
Adam: No. Can't kick people.
R.G. Can you kick a kitten?
Adam: No!
R.G.: A wall?
Adam: Yes.

We draw attention to the fact that Adam is a three-year-old; at least a rudimentary understanding of what are permissible acts on people appears to develop early in life. Do very young children distinguish between actions on animate versus inanimate objects with regard to judgments of permissibility?

We have asked friends and colleagues whether they believe infants show anything resembling moral restraint in their actions on animate objects. Will an infant who, at some stage, attempts to play with all his toys by hitting them with a stick also hit a person with a stick? The intuitions of our informants widely differed. Some took the view of Hobbes, maintaining that infants will hit, scratch, and pinch people indiscriminately, in blissful freedom from moral inhibitions. Others were more Rousseauian and strongly felt that infants are much gentler with other people, perhaps especially other infants. Those in the former group pointed to the "terrible two's" as incontrovertible support for the hy-

pothesis of an amoral infant. Those of the latter group saw the two's as an age when infants begin to feel out implicit rules that have always constrained their actions – such as the ban on hitting animate objects – by systematically violating these principles and observing the consequences. In view of these sharply divergent and heated opinions there would seem to be a special need for research on this question.

Summary

This review of research supports three conclusions about the child's developing understanding of the animate–inanimate distinction. First, the beginnings of this distinction seem to appear very early in life: Even one-month-old infants appear to treat animate and inanimate objects as different in some respects and for some purposes. Second, an understanding of the differences between animate and inanimate objects appears not to develop in a unitary fashion. A child of three may understand some aspects of this distinction – for example, that only animate objects can communicate – and yet fail to comprehend other aspects of the distinction – for example, that only animate objects have brains. Third, it seems possible that children come to understand that only animate objects can act in certain ways before they understand that only animate objects have certain static properties and organs. Children may also understand that different systems of knowledge constrain their own actions on objects before they understand that different systems of knowledge are used to predict the behavior of another object. In general, children may draw distinctions between animate and inanimate objects for purposes of action and communication before they draw these distinctions for other ends.

These conclusions are offered tentatively, because the development of the animate–inanimate distinction has received little systematic study. The most productive experimental approach, we believe, is one in which animate and inanimate objects are pitted against each other in a single experimental paradigm. A child may be asked the same questions about a person and a doll (e.g., "What made it move?" "Does it breathe?"). A child may also be asked to perform the same action or bring about the same result with a person and a chair (e.g., "bring it to me."). An infant may be systematically observed with a person and a toy under comparable conditions (e.g., conditions in which neither – or both – responds contingently to any action by the infant). In any of these cases, we may observe whether the child treats the animate and the inanimate object differently. By varying the tasks that a child is given, experiments may

reveal the child's understanding of the ramifications of the animate–inanimate distinction. By varying the objects to which each task is applied, experiments may elucidate the child's categories of animate and inanimate, their definition and their organization.

The development of social and nonsocial cognition

As we reviewed evidence concerning the child's differentiation of the animate from the inanimate, one investigator towered over all others in his contribution. Piaget has addressed this question time and again in his studies of animism, causality, moral judgment, perspective taking, and communication. Many of Piaget's analyses in these domains turn on the distinction between animate and inanimate objects. Yet Piaget believed that animate and inanimate objects alike come to be known through the development of a unitary set of abstract cognitive structures and processes.

We believe that this assumption needs to be scrutinized. There is reason to think that the child's developing cognitive structures are far less general, and more task specific, than Piaget holds. For example, the child's concept of number may be mediated by structures that differ from those that underlie perspective taking (Gelman, 1978). Such observations point to the possibility that social and nonsocial cognitions also derive, at least in part, from separate cognitive systems (cf. Glick, 1978). We explore this possibility by looking at the development of concepts of object permanence and causality.

The development of object permanence and attachment

During the first years of life, striking changes are observed in infants responses to hidden objects. If a toy is moved out of view, five-month-old infants act as if it is no longer there (cf. Harris, 1975; Piaget, 1954) unless perhaps one observes them under special and restricted conditions (Bower, 1967). Their attention is likely to turn immediately to something else and they make no effort to remove the toy's cover – an action that need not be beyond their motor capacities. A few months later, however infants continue to orient to the hidden object and search for it under or behind the cover. Their ability to search consistently and effectively for variously displaced objects continues to grow throughout infancy and indeed, childhood (Wellman, Somerville, & Haake, 1979). The development of search in infancy is thought to reflect the achievement of an ability to represent objects as independent entities in an objective spatial layout: the development of the "object concept" (Piaget, 1954).

During the first year, dramatic changes also occur in the child's emotional response to others. Young infants generally respond positively to all people, and they react with equanimity to separations from any of them. Infants in the second six months come to respond most positively to a small number of people, to monitor their movements with care, and sometimes to protest their departures. This developmental change appears to reflect the development of specific attachments (cf., Bowlby, 1969, 1973; Ainsworth, 1973). That development in turn has been thought to depend in part on the child's growing ability to appreciate the persisting existence of an absent person: the development of "person permanence" (Bell, 1970).

What is the relationship between the development of attachment behavior and the development of systematic search for inanimate objects? Many have felt that the two developments are closely linked. People, like toys, can move from the child's view. Surely children will not attempt to prevent a person's departure or hasten his or her return until they can represent that person as an independent, enduring object. Attachment behavior and object search therefore might both depend on the same underlying capacity. This view has received little experimental support (cf. Flavell, 1977). Does it make sense in principle, in light of the similarities and differences between animate and inanimate objects? To address this question, we compare the two classes of objects as things that can disappear and be recovered.

Animate and inanimate objects occupy definite locations in space. Both exist in the world, not just in the experience of some perceiver, and they continue to exist when they are out of perceptual contact. Neither is basically dependent for its existence on any action by the child. These are the properties that Piaget emphasized in discussing the development of the object concept. He did not discuss three differences between animate and inanimate objects.

First, an animate object that is out of visual contact appears to be "gone" in ways that an inanimate object is not, even if the animate and inanimate objects are equally near or far. As ethologists and social psychologists remind us, perceptual acts directed at an animate object can have enormous social consequences. A given action may mean different things if it is acompanied by eye contact than if it is not (Ekman, Friesen, & Ellsworth, 1972; Smith, 1977). A person to whom the child is not looking, and who is not looking to the child, is not as "talkable-to" or as "playable-with" as one who faces the child with full attention. In his discussion of the object concept, Piaget proposed that the child must learn that out-of-sight transformations do not affect the status of an object as a recipient for action: Objects are unaffected by the child's acts o

perception. It is clear that this general rule does not hold if the object i
animate and the perceptual action functions as a communication.

Second, different kinds of transformations alter the position of out-o
sight animate and inanimate objects. An inanimate object, because
does not move from within, will remain in a hiding place unless it
displaced by some external force. An infant can keep track of it b
representing and interpreting the effect of external actions on it. A
animate object can move at will. Once the mother has disappeared be
hind the front door, she is not likely to remain there. An ability to tak
account of unseen, external actions on an object will rarely help an infa
to keep track of a person who leaves his view. The unseen displacemen
of animate objects will usually be better predicted by taking account
the object's habits and customs (e.g., mother usually returns after a
hour when she leaves at nap time) than by attempting to keep track
every unseen displacement.

A third difference concerns the actions by which an out-of-sight obje
is recovered. To recover any object that moves from view, one must a
in some way to reverse the transformation that takes it from sight. If th
object is inanimate, the transformation that made it disappear was exte
nal to the object: A person placed a barrier in front of the object,
knocked the object over so that it fell behind a pillow. Thus, the chi
must detour to avoid the obstruction, or act on the obstructor, or act
the person that manipulated it, in order to recover the object. He cann
act on the object directly until he has done something else. Recoveri
inanimate objects thus requires a coordination of means with ends,
ability that Piaget believes is attained rather late in infancy, at Piaget
fourth stage of sensorimotor development. If the object is animate, ho
ever, the transformation that took it from view probably came fro
within that object: The person walked out of the child's room. The be
way – and often the only way – to reverse such a transformation is to a
on the motivational system of the person. The child can do this by callin
cajoling, or crying. These are immediate emotional responses to the d
appearance of the desired object. Thus, a child may become accor
plished at activities that bring back the mother without representing h
as an independent object at all. In terms of Piaget's stage theory
development in infancy, protest on separation bears a closer semblance
stage two functioning (attained at about 1 month of age) than to sta
four (attained at about 8 months). Indeed, Piaget cites just this activity
an example of stage-two behavior (1954, p. 12).

Let us return to the question of how searching for objects and attac

ment to people develop. Do both developments depend on the achievement of a general understanding of the objectivity of all things? Although Piaget's theory remains tenable, we offer an alternative hypothesis. Infants may come to search adaptively for animate and inanimate objects as they learn to sort out their commonalities and differences. The development of object search and attachment may reflect not a general decline of egocentrism but (in part) the acquisition of knowledge of objects – and of the crucial distinctions among them.

Early in life, the disappearances of a person might very well be of greater consequence to a child than the disappearances of an inanimate object. Infants may begin to first develop abilities to perceive the disappearance of people, to anticipate their reappearance and to recover them by calling and crying. When faced with similar disappearances of inanimate objects, infants may do nothing – if they have not yet developed any comparable understanding of inanimate objects – or they may generalize what they have learned about animate to inanimate objects. Some such generalizations will be appropriate; for example, if the child learns to attend to the point of departure of a parent, such a strategy will apply well to the point of departure of a toy. Other generalizations may be inappropriate. For example, a child who learns that a parent out of visible contact cannot be played with easily may fail to play with unseen toys as well. And a child who learns that a parent can move independently from one near place to another may come to expect falsely that a toy will do this as well, and hence he may not attempt to deduce where such a toy is. Many of Piaget's examples of bizarre searching for inanimate objects, such as persistent tracking and searching in habitual hiding places, could derive from inappropriate generalizations from the animate to the inanimate. Such generalizations might be expected if the child fails to appreciate some of the properties of inanimate objects and some of the ramifications of the animate–inanimate distinction. The child who generalizes inappropriately across these domains may appear to be guided by false and bizarre beliefs about the world, and thus may be branded "egocentric." In fact, the child may simply be reasoning about objects whose properties are insufficiently understood.

We are speculating, in brief, that young infants do not fail an object permanence task because of a generalized "egocentrism" or because they lack any understanding of the objectivity of things in the world. They fail in part because they do not understand that different kinds of objects are transformed and returned to view in different ways. These are only speculations and have not been thoroughly evaluated. They may be addressed, however, by investigations of the infant's understanding of the animate–inanimate distinction.

The development of causal reasoning: physical mechanisms and social attributions

Beginning in infancy and continuing into the school years, children appear to develop an increasingly elaborated and adaptive understanding of causal relationships. This development may be observed in two domains. First, children come to interpret physical events by appeal to increasingly sophisticated causal principles and mechanisms. They invoke such mechanisms in their explanations of why a particular event came about and in their efforts to bring about an event themselves. Second, children come to analyze social events – in particular, the actions of other people – by appealing to social and psychological principles and mechanisms. These causal principles are involved when children explain why people do what they do and when they anticipate what people will do next. Are the child's developing understandings of physical and social causality related? Again, we approach this question by comparing the causal properties of animate and inanimate objects.

There appear to be two overriding similarities between the causal properties of the animate and the inanimate, as they are conceived by human adults. First, both animate and inanimate events are believed to have causes of some kind. Second, for both types of events, the cause is believed to precede the effect or occur simultaneously with it; cause cannot follow effect. The causes of animate events otherwise differ greatly from the causes of inanimate events. The largest difference, we believe, concerns the nature of a causal mechanism.

Inanimate events are usually brought about by mechanisms that can be taken apart and analyzed. The puppet's movements are really controlled by strings that can be pulled, cut, or replaced to discover how they work. Animate events are brought about by mechanisms of a different kind. A person's actions are caused by intentions, habits, or dispositions. These cannot be seen or taken apart. In the case of animate events, we make attributions regarding intent and motive. In the case of inanimate we perceive or infer physical mechanisms. Because different mechanisms underlie animate and inanimate events, different information will be used in judging the causes of these events. For example, the cue of spatial contiguity is probably only used in the inanimate domain. This follows from the fact that psychological states have no spatial properties. Thus, children must develop some causal principles that apply both to the animate and to the inanimate, and some that are restricted to one of these domains.

Early research by Piaget (1930) suggests that the preschool child's concept of physical causality is sketchy at best. The child begins with a

diffuse sense that events are caused, but he may attribute all causes to things inside himself; he may endow inanimate objects with intentions, and he may think "magically" about the sources of events. In contrast, more recent reports show that children as young as four years have a concept of causality for inanimate events that goes considerably beyond what Piaget described. Bullock (1979; Bullock & Gelman, 1977) found that four-year-olds appear to understand that inanimate events have causes, that causes precede their effects, and that causes are spatially and temporally contiguous with their effects. They also infer unseen, intervening mechanisms when none are visible. Moreover, children expect certain kinds of events to have causes of certain types: The impact of a ball is considered a reasonable cause for the popping of a jack-in-the-box, while an intention to jump is not. Four-year-olds will also analyze systematically a simple causal mechanism that has broken down. If one object, attached to another by a partly hidden string, initially moves when the second object is pulled, and then fails to do so, four-year-olds will look for a break in the string (Bullock, 1979).

Four-year-olds seem, then, to reason appropriately about the causes of inanimate events and do not appear to grant inanimate objects animate-like causal mechanisms. Although we know of no direct studies, we suspect that young children know that people can move without being pulled, pushed, or propelled by another, although toys cannot. It is known that children as young as three ascribe intents and motives to explain acts of people (Keasey, 1978). It appears likely that the four-year-old reasons differently about the causes of animate and inanimate events.

Bullock has also studied three-year-olds, and their reasoning appears somewhat different. Although they appear to understand that events have causes and that causes precede their effects, they do little apparent analysis of causal mechanisms. A three-year-old who confronts the display with two objects and a string will not infer that the string is broken once the two objects no longer move in tandem. Asked "what happened?" the three-year-old might say "won't work," and no probing can bring a further illumination.

What are we to make of these findings? Are three-year-olds the "pre-causal" creatures that Piaget described all preschoolers to be? We doubt it, because they do not appeal to intentions or other psychological attributes when asked to explain why a mechanical device no longer works. We offer an alternative possibility. Three-year-olds may well appreciate the causal principles that apply to all objects: principles such as "events have causes" and "causes precede their effects." Indeed Kun (1978), working within the framework of attribution theory, has demonstrated that children this

young honor the principle of temporal ordering when deciding about socia events. Young children may also understand that animate and inanimat events have causes of different kinds. They may even know that peopl have intents and motives (cf. Keasey, 1978; Guttentag & Longfellow 1978). But they may be ignorant of the principles that are restricted to a inanimate event: principles like spatial contiguity and analyzability of mechanism. They may treat a causal mechanism as an underlying propert of the whole object itself – as the mechanism may be if the object is ani mate. In brief, what may develop over childhood is a clear understandin of the distinction between the psychological and physical mechanisms tha govern animate and inanimate events respectively.

Conclusions

In developmental psychology, the study of social cognition, like the stud of cognition in general, has been dominated by the view that all cognitiv development derives from the growth of a unitary system of cognitiv structures. These structures are thought to apply to all objects and a tasks. Students of social cognition have asked how the structures an processes that underlie cognition of the physical world are applied to th social world. Our considerations of the nature of thoughts about th animate and inanimate worlds lead us to conclude that this a priori vie may be unwarranted. The relation of thinking about animate objects t thinking about inanimate objects is likely not to be simple, and no simpl assumptions about it seem justified. Rather than making such assump tions, psychologists should make the relationship between thinking abou animate objects and thinking about inanimate objects itself a primar area of investigation.

We have suggested one focus for research: studies of children's abilit to distinguish between animate and inanimate objects, and studies c their understanding of the implications of this distinction for perceptior action, and thought. Experimental tasks need to be designed that p reactions to the animate and the inanimate domains against each othe Similarities and differences in the child's thinking about the two kinds c objects can be noted. Then students of social cognition may begin to ma the child's understanding of the animate–inanimate distinction onto h conceptions of the social world.

Our review of the development of the animate–inanimate distinctio provides more questions than answers. However, it appears that humans c all ages – even newborns – make this distinction to some degree and fo certain purposes. But the distinction is by no means fully formed at a

early age; the child's understanding of animate and inanimate objects appears to grow and deepen with development. There appears to be much that a young child has to learn about the animate–inanimate distinction.

We now need to understand this developmental progression. As psychologists come to learn more about the child's developing understanding of the animate–inanimate distinction, we should be able to make better sense of the development of social cognition, the development of cognition of the physical world, and of the relation of social cognition to the larger enterprise of cognitive psychology.

We end with a speculation about what such a study of social cognition may find. We suggest that for many purposes, an understanding of animate objects and their properties will develop before any comparable understanding of inanimate objects is achieved. Suggestions that cognitions about animate objects develop first have come from many quarters. Children have been seen to be sometimes remarkably sophisticated in their approach to problems that are clearly social. The young infant who searches ineptly, even bizarrely, for a hidden toy may be much more adept at bringing back a departing parent. The communication and perspective-taking abilities of children improve immensely when they are tested in a truly interpersonal situation. Even the perceptual capacities of infants may be best revealed when they must perceive animate events.

If these speculations have any truth, then an investigation of cognition about animate and inanimate objects should be of interest to all students of cognitive development. The animate world will provide a rich domain in which to study not only the child's developing social understanding, but also some of the most advanced aspects of his innate and early developing cognitive capacities.

Note

1 Here, as elsewhere in the text, the reader will surely ponder the status of a computer. For purposes of exposition, we disregard or set aside modern man-made machines that mimic in one or more ways the characteristics of man.

References

Ainsworth, M. D. S. The development of infant–mother attachment. In B. M. Caldwell & H. N. Ricciuti (Eds.), *Review of child development research* (Vol. III). Chicago: University of Chicago Press, 1973.

Bates, E. *Language and context: The acquisition of pragmatics*. New York: Academic Press, 1976.

Bell, S. M. The development of the concept of object as related to infant–mother attachment. *Child Development*, 1970, *41*, 291–311.

Bloom, K. Operant baseline procedures suppress infant social behavior. *Journal of Experimental Child Psychology*, 1977, *23*, 128–32.

Bower, T. G. R. The development of object permanence: Some studies of existence constancy. *Perception and Psychophysics*, 1967, *2*, 411–18.

Object perception in infants. *Perception*, 1972, *1*, 15–30.

Bowlby, J. *Attachment*. New York: Basic Books, 1969.

Separation. New York: Basic Books, 1973.

Brooks, J., & Lewis, M. Infants' responses to strangers: Midget, adult, and child. *Child Development*, 1976, *47*, 323–32.

Broughton, J. Development of concepts of self, mind, reality, and knowledge. In W. Dam (Ed.), *New directions for child development* (Vol. 1). San Francisco: Jossey-Bass, 197

Bruner, H. S., & Koslowski, B. Visually preadapted constituents of manipulatory actio *Perception*, 1972, *1*, 3–14.

Bullock, M. *Aspects of the young child's theory of causation*. Unpublished doctoral thes University of Pennsylvania, 1979.

Bullock, M., & Gelman, R. Preschool children's assumptions about cause and effect: Te poral ordering. *Child Development*, 1979, *50*, 89–96.

Carey, S. *The child's concept of animal*. Paper presented at the annual meeting of t Psychonomic Society, San Antonio, Texas, 1978.

Church, J. Techniques for the differential study of cognition in early childhood. In Hellmuth (Ed.), *Cognitive Studies I*. New York: Brunner-Mazel, Inc., 1970.

Dodwell, P. C., Muir, D., & DiFranco, D. Responses of infants to visually present objects. *Science*, 1976, *194*, 209–11.

Ekman, P., Friesen, W. V., & Ellsworth, P. *Emotion in the human face*. Elmsford, N.Y Pergamon Press, 1972.

Flavell, J. H. *Cognitive development*. Englewood Cliffs, N.J.: Prentice-Hall, 1977.

Flavell, J. H., Shipstead, S. G., & Croft, K. *What young children think you see when th eyes are closed*. Unpublished manuscript, Stanford University, 1979.

Garvey, C. *Play*. Cambridge, Mass.: Harvard University Press, 1977.

Gelman, R. Cognitive development. *Annual Review of Psychology*, 1978, *29*, 297–332.

Gelman, R., Bullock, M., & Meck, E. Preschoolers' understanding of simple object tra formations. *Child Development*, 1980, *51*, 691–9.

Gelman, R., & Shatz, M. Appropriate speech adjustments: The operation of conversation constraints on talk to two-year-olds. In M. Lewis & L. Rosenblum (Eds.), *Interactio conversation, and the development of language*. New York: Wiley, 1977.

Glick, J. Cognition and social cognition: An introduction. In J. Glick and K. A. Clarke-Ste art, *The development of social understanding*. New York: Gardner Press, Inc., 197

Golinkoff, R. M., & Harding, C. G. *The development of causality: The distinction betwe animates and inanimates*. Paper presented at the International Conference on Infa Studies, New Haven, April 1980.

Guttentag, M., & Longfellow, C. Children's social attributions: Development and chan In C. B. Keasey (Ed.), *Nebraska symposium on motivation* (Vol. 25). Lincoln, Ne University of Nebraska Press, 1978.

Hamm, M., Russell, M., & Koepke, J. *Neonatal imitation?* Paper presented at the Soci for Research in Child Development, San Francisco, March 1979.

Harris, P. L. Development of search and object permanence during infancy. *Psychologi Bulletin*, 1975, *82*, 332–44.

Hayes, L. A., & Watson, J. S. *Neonatal imitation: Fact or artifact?* Paper presented at t Society for Research in Child Development, San Francisco, March 1979.

Jacobson, S. W., & Kagan, J. *Released responses in early infancy: Evidence contradicting selective imitation.* Paper presented at the International Conference on Infant Studies, Providence, March 1978.

Johnson, C. N., & Wellman, H. M. *Children's conception of the brain: A developmental study of knowledge about cognitive processes.* Unpublished manuscript, 1979.

Keasey, C. B. Children's developing awareness and usage of intentionality and motives. In C. B. Keasey (Ed.), *Nebraska symposium on motivation* (Vol. 25). Lincoln, Neb.: University of Nebraska Press, 1978.

Keil, F. *Semantic and conceptual development.* Cambridge, Mass.: Harvard University Press, 1979.

Kreutzer, M. A., & Charlesworth, W. R. *Infants' reactions to different expressions of emotion.* Paper presented at the Society for Research in Child Development, Philadelphia, March 1973.

Kun, A. Evidence for preschooler's understanding of causal direction in extended causal sequences. *Child Development,* 1978, *49,* 218–22.

Lempers, J. D., Flavell, E. R., & Flavell, J. H. The development in very young children of tacit knowledge concerning visual perception. *Genetic Psychology Monographs,* 1977, *95,* 3–53.

Lockart, K. L., Abrahams, B., & Osherson, D. N. Children's understanding of uniformity in the environment. *Child Development,* 1977, *48,* 1521–31.

McKeon, R. (Ed.). *The basic works of Aristotle.* New York: Random House, 1941.

Meltzoff, A. N., & Moore, M. K. Imitation of facial and manual gestures by human neonates. *Science,* 1977, *198,* 75–8.

Papoušek, H. Individual variability in learned responses in human infants. In R. J. Robinson (Ed.), *Brain and early behavior.* New York: Academic Press, 1969.

Piaget, J. *The child's conception of the world.* London: Routledge & Kegan Paul, 1929.
The child's conception of physical causality. London: Routledge & Kegan Paul, 1930.
The moral judgment of the child. London: Routledge & Kegan Paul, 1932.
The origins of intelligence in children. New York: International Universities Press, 1952.
The construction of reality in the child. New York: Basic Books, 1954.
Epistémologie et psychologie de l'identité. Volume XXIV des études d'épistemologie génétique. Paris: Presses Universitaires de France, 1969.

Premack, D. & Woodruff, G. Does the chimpanzee have a theory of mind? *The Behavioral and Brain Sciences,* 1978, *4,* 515–26.

Scaife, M., & Bruner, J. S. The capacity for joint visual attention in the infant. *Nature,* 1975, *253,* 265–6.

Shatz, M., & Gelman, R. The development of communication skills: Modifications in the speech of young children as a function of listener. *Monographs of the Society for Research in Child Development,* 1973, *38* (2, Serial No. 152), 1–37.

Smith, W. J. *Behavior of communicating.* Cambridge, Mass.: Harvard University Press, 1977.

Trevarthen, C. Descriptive analyses of infant communicative behavior. In H. R. Schaffer (Ed.), *Studies in mother-infant interaction.* London: Academic Press, 1977.

Tronick, E., Adamson, L., Wise, S., Als, H., & Brazelton, T. B. *The infant's response to entrapment between contradictory messages in face-to-face interaction.* Paper presented at the Society for Research in Child Development, Denver, April 1975.

Watson, J. S. Smiling, cooing, and "the game." *Merrill-Palmer Quarterly,* 1972, *18,* 323–39.

Weisberg, P. Social and nonsocial conditioning of infant vocalizations. *Child Development,* 1963, *34,* 377–88.

Wellman, H. M., Somerville, S. C., & Haake, R. C. Development of search procedures in real-life spatial environments. *Developmental Psychology,* 1979, *15,* 530–42.