

A Review of the Animate–Inanimate Distinction in Infancy: Implications for Models of Social and Cognitive Knowing

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The ability to distinguish people from things sheds light on an important theoretical question: how is the development of social cognition related to the development of physical cognition? According to Piaget (1954), cognition is unitary and the processes used in dealing with the physical world are the same as those employed in the social world. This statement should be questioned. Although people and objects share certain fundamental properties (size, shape, etc.), only people can communicate, act independently and have feelings and intentions. Thus, people seem much more complex to deal with than things. If all cognitive development derives from the growth of a unitary system, then knowledge about animate objects should lag behind that of inanimate objects. The present paper explores this idea by examining what infants know about the attributes that distinguish people from things. It is concluded that the onset of this distinction begins early in life. Even 2-month-old infants treat people and objects differently when confounding variables of the stimuli are controlled. Rather than lagging behind, the infants' understanding of people appears precocious. The infants' recognition of the crucial distinction between the two classes suggests that a conceptual system is beginning to be formed soon after birth. This conceptual system appears different for social and non-social objects and serves as a foundation from which infants might come to understand the distinctive properties of animate and inanimate objects.

Key words: Social cognition, perceptual differentiation, conceptual representation.

INTRODUCTION

A question frequently addressed by Piaget (1954) in his studies on communication, animism and causality concerned the developing understanding

of the animate–inanimate distinction. As adults we distinguish between the animate and inanimate domains while recognizing that all objects share certain fundamental properties. Both animate and inanimate objects have physical properties (size and shape), but only people can communicate, act independently, have feelings and mental representations, grow and reproduce. Not only do the two

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classes have different properties but they are perceived differently as well. One usually focuses on the physical dimensions of objects, but on communication, feelings and intentions of people. Furthermore, we acquire knowledge differently about the two classes; we communicate with people and act on objects (Bretherton *et al.*, 1981; Gelman and Spelke, 1981; Glick, 1978; Hoffman, 1981).

This paper addresses how infants come to understand the animate-inanimate distinction, in particular the distinction between people and graspable objects. According to the cognitive developmental theory of Piaget, infants are at birth neither social nor cognitive creatures. They do not distinguish between self, other people and things. They come equipped with a set of reflexes, which become circular reactions that for the first 10–12 months of life only allow the infant to relate objects to their own actions rather than to other objects in space. During the second year of life there is a gradual shift from subjective understanding to objective understanding. The infant's circular reactions become internalized, allowing the infant to represent the world in a conceptual manner. Piaget called these first 2 years in the infant's life the sensorimotor period. The only knowledge infants have during this period is perceptual knowledge. During perceptual differentiation infants are merely reacting to immediate sensory stimulation that distinguishes people from things. With conceptual knowledge children can represent objects mentally rather than perceptually. They can think about people and things and recall them when they are absent. It is only when infants understand that people and things continue to exist when not perceptually discriminable that infants are beginning to separate the world from self, and to place themselves within a common space with other objects (Bremner, 1988). The end of the sensorimotor period, then, marks the beginning of thought. According to Piaget, infants at this stage are becoming social and their responses intentional. Objects and people are now differentiated on their social dimensions rather than physical ones.

THE ANIMATE-INANIMATE DISTINCTION: THEORETICAL IMPLICATIONS

Not only does knowing how the animate-inanimate distinction develops in children shed light on the sociability of the infant but it addresses the larger theoretical question of how social and non-social

cognition are related (Gelman and Spelke, 1981; Glick, 1978). According to Piaget (1954), cognition is unitary and people and objects come to be known through the same cognitive processes. However, researchers who have begun to study social cognition using people do not regard the social domain of knowing as similar to the classical developmental models of cognitive knowing (e.g. Glick and Clarke-Stewart, 1978). Cognitive developmental theories in general focus on the cognitive structures people use and the mental schemes they develop when interacting with physical objects. As Glick (1978, p. 2) succinctly points out:

'The application of this developmental scheme to the social world may be difficult since it remains a distinct possibility that people do not behave as objects do'.

On the most elementary level, the rules for dealing with the social world differ from those applied to the non-social world. For example, whereas the movement of things is predictable from a knowledge of the physical forces acting upon them, people can move themselves (Glick, 1978; Hoffman, 1981). In addition, people seem far more complex to deal with than things. As indicated earlier, people know, emote, learn and think (Gelman and Spelke, 1981). Objects do none of these things. Thus, whereas physical events can be specified because they present stable and predictable reactions, social events remain subtle and rich in information. In fact, the unpredictability of social events is often beyond complete specification (Gelman and Spelke, 1981; Glick, 1978; Hoffman, 1981). Given the differences between the physical and social domains, we might expect knowledge about people to be processed in different ways than knowledge about the physical domain.

THE DEVELOPMENT OF DIFFERENTIAL RESPONSIVENESS WHEN FACING VISIBLE SOUNDING AND SILENT PEOPLE AND OBJECTS

One way to determine whether infants perceive people and objects as distinct would be to examine whether their responses to persons are different from their responses to objects, and whether their responses to people are social in nature (Legerstee, 1986; Lock and Brown, 1981).

According to the nativists (Bower, 1979; Bower and Wishart, 1979) infants are born sociable. They have an innate ability to distinguish what Buber

(1958) calls I–thou and I–it relations. Prior to the mid-1980s, evidence for such a claim came from various studies suggesting that infants attempted to communicate with animate objects and not with inanimate objects. For instance, in a study conducted by Richards (1974) and Trevarthen (1974) and discussed by Brazelton *et al.* (1974) (albeit without statistical analyses), it was found that when 2-month-old babies were facing responsive people they would produce expressive facial movements and make prespeech sounds. Faced with graspable objects, the infants made reach-and-grasp movements with neutral facial expressions.

As noted, cognitive developmental, but also social learning theorists, would view such data merely as preferential responding to some type of stimulation originating from people but not from objects. Young babies are known to be sensitive to familiarity (Jackson *et al.*, 1978), movement (Frye *et al.*, 1983; Rheingold, 1961), and contingent responsiveness (Watson, 1972) of people as well as things. In the Brazelton *et al.* and Trevarthen studies, differential responding was found when a familiar, contingently responsive social object (the mother) was compared to a non-familiar, non-contingent, non-social object (a toy monkey). In contrast, Watson (1972) found that when the non-social object moved contingently upon the babies' actions, they would respond with similar social responses (they smiled and cooed) as when they were engaged in natural interactions with their caretaker. Rheingold (1961) also discovered that 3-month-old infants gave social-like responses to a person and a shaken rattle. However, in the studies cited, familiarity, contingent responsiveness, size and movement of the social and non-social objects were not always controlled, neither was presentation of the stimuli. For social stimuli, infants were often placed in an upright position, whereas for inanimate stimuli they had typically been placed in a supine position, a posture less conducive to alerting (Field, 1985). Thus, in the studies cited, it was not clear whether the presence of differential responsiveness was related to some other important, partially confounding stimulus dimension, such as familiarity or contingency, or whether the absence was due to methodological shortcomings.

A clear differentiation of animate and inanimate objects, one inherently linked to sociality, depends on detecting the presence of intention (Frye, 1981; Gelman and Spelke, 1981). Because cognitive developmental theorists (Decarie, 1985; Frye, 1981; Piaget, 1954; Sylvester-Bradley, 1985) do not predict that infants recognize intentional behaviour in

people until much later, they suggest that differential responsiveness to social and non-social stimuli also may be delayed. Several studies (Decarie and Ricard, 1982; Frye *et al.*, 1983) supported such reasoning. They showed that the distinctions between social and non-social objects when the two were responding contingently was firmly established in 10-month-old infants. These babies exhibited differential exploratory behaviour when put into contact with a novel social and a non-social object that responded contingently upon their actions. They smiled and vocalized at a female stranger, although they remained at a distance. However, they hurried toward the non-social object—a large toy turtle—whose eyes lit and that made sounds when touched (in both situations the mother was present) (Decarie and Ricard, 1982). Similarly, observers who coded the babies' responses from video did note differential responding in 10-month-olds, but not in 3-month-old babies, facing their responsive mother and a familiar interactive toy (Frye *et al.*, 1983). Together, these studies seemed to suggest that for very young babies, familiarity and contingent movement of the stimuli influenced their social responsiveness, whereas for the oldest, the social characteristics of the stimuli were determinant.

However in the Frye *et al.* (1983) study the infants were presented with the stimuli at a 100 cm distance. The required distance to elicit interactive responses in young infants is 50 cm or less (Brazelton *et al.*, 1974; Papousek and Papousek, 1984; Tronick, 1981) and it is possible that the experimental situation was not adequate to show differential responding in 3-month-olds. It further appeared that, in the studies examined so far, only two groups of infants had been studied, 3- and 10-month-olds. Thus little solid evidence was provided on how the responses to people and objects would develop during the first year of life, when social and non-social stimuli were pitted against each other in one experimental paradigm, in which variables such as contingency, familiarity and movement were controlled.

To examine the evolution and the onset of this distinction, Legerstee (1986; Legerstee *et al.*, 1985; 1987) studied 3-week-old infants until they were 45 weeks of age. The infants were presented with familiar and novel people and objects who alternately acted contingently to the infant responses or remained passive. The authors reported that by 2 months, babies produced significantly more social responses (smiles, neutral, negative and positive vocalizations) towards people than toward the doll. Furthermore,

the 1–2-month-old infants were capable of modulating this affectivity. Faced with the contingently responsive person, the babies displayed signs of pleasure (e.g. they smiled, vocalized positively, etc.). Faced with the unresponsive (passive) person the infants rapidly became displeased. They turned away their gazes while arching their arms and vocalizing angrily. No such modulation of affect was noted in front of the contingent and immobile physical objects.

This differential responsiveness was also found in infants who were developmentally delayed. Legerstee and Bowman (1989) studied infants with Down's syndrome whose mean mental developmental index (MDI: Bayley Scales of Infant Development, Bayley, 1969) showed a 2 month delay. Interestingly, this delay in cognitive development coincided with the delay in the onset of differential responsiveness in these infants. Whereas the normal babies had shown this capacity at 2 months, the Down's syndrome babies showed this distinction at 4 months. They gazed longer at the puppet, but produced more neutral and positive vocalizations to the mother and the stranger. By 6 months, the infants reached significantly more to the puppet than to people. In contrast to the normal infants, the Down's syndrome sample did not distinguish as clearly and as consistently between the contingently responsive and passive adults. This distinction seemed to demand greater cognitive sophistication of the infants and was consequently responded to during the second half-year of life. Nevertheless, when corrected for developmental delay, many of the findings of the Down's syndrome infants supported in principle that found with normal infants.

Not only do infants differentiate between people and objects with gazes, vocalizations and arm movements, but infants have specific hand actions as well. Legerstee *et al.* (1990) examined the hand, arm and facial behaviours of 9–15-week-old infants when facing their responsive and passive mother and a mobile and immobile object. The authors found that the hand actions were organized with the other infant behaviours to form unique behavioural linkages that changed systematically in relation to social and non-social contexts. For instance, during the responsive mother condition, pointing was organized with smile, gaze and vocalizing, indicating positive affect in the baby, whereas during the passive mother condition the closed hand was organized, with distressed face and averted gazing indicating negative tone and stress. In contrast, during the object conditions, the

hand and arm movements did not form behavioural linkages with positive or negative states. Instead neutral facial expressions with open hands and extended arms formed behavioural linkages not found in the social conditions.

Even the suprasegmental features of infant vocalizations have been found to change consistently depending on the social nature of the context. Delack and Fowlow (1978) had demonstrated by spectrographic analyses that when young infants were facing people and objects the prosodic features of their vocalizations changed consistently in relation to the communicative context. Although objective analyses of infant vocalizations have provided invaluable information about the acoustic and phonetic properties of infant sounds, it is the caretaker's perception of these vocalizations (and also of the non-vocal gestures discussed earlier) as revealing communicative intent that ultimately has developmental implications. The development of communication is a guided process. Words evolve out of the infants' sensorimotor experiences, in particular those interactions that are supported by adults (Bruner, 1975; Lock, 1980). If parents and caretakers perceive the infant behaviours as communicative rather than as random, then they may treat their infants as 'partners' in social interactions and thereby promote linguistic development (Legerstee, 1991a). Given the importance of parental understanding of their infant's communicative bids for the development of more appropriate communicative behaviour, Legerstee (1991a) examined the changing *quality* of infant sound in relation to the changing interactional context from a social perceptual perspective. In her study, trained listeners found that 2-month-old infants produced more melodic-type vocalizations (defined as relatively long sounds, having oral resonance and varied pitch contours), to people than to objects, in particular when people were communicating with the infants. In contrast, vocalic sounds, (defined as relatively short, nasal-like sounds having uniform pitch contours), were distributed evenly throughout the various conditions, except during the inactive mother and stranger conditions, when these vocalizations increased significantly. Thus, when the infants confronted the unresponsive persons they increased sounds without the prosodic contour that gives it its speech-like quality, as if to signal protest (Carpenter *et al.*, 1983). The infants also produced more emotional sounds to people than to objects. Although laughing, crying and fussing may remain phonetically distant from speech, their occurrence

in front of people rather than objects has other features in common with speech, such as its social responsiveness (Oller, 1981, p. 21).

Infant imitation further reflects a consistent differentiation of animate and inanimate events. Legerstee (1991b) found that 5–8-week-old infants would imitate tongue protrusions and mouth openings modelled by an adult, but not by an object simulating these gestures (matched on movement, size and colour to the human models). Instead, the infants significantly opened their mouths when an elongated object (simulating tongue protrusion) approached and they stuck out their tongues towards an opening and closing object (simulating mouth opening) in order to explore it. It should be noted that in an earlier study Jacobson (1979) also found imitation of tongue protrusion to a person modelling that gesture, but also to a white ball and pen moving toward and away from the infant's mouth. Jacobson (1979) suggested that, rather than imitation, these infant responses were released responses, since they were elicited by animate as well as inanimate stimuli. Had Jacobson (1979) measured other facial responses toward the stimuli, such as mouth opening, she might have found that her babies responded to the approaching pen with increased mouth opening as well and would have had to revise her hypothesis that tongue protrusion was the specific response released by these stimuli.

Thus, these young infants noticed the movements of the social and non-social stimuli, but only imitated those produced by the social object. This imitative responsiveness of people and not of objects not only suggests that imitation is a social response, but it would support the contention put forth by Gelman and Spelke (1981, p. 54) that the 'infant implicitly "knows" that he and another person can act in kind'.

It is clear that imitation of proprioceptive gestures in very young babies provides evidence for some types of representation of the self, since they cannot reproduce gestures that are not perceptually discriminable (their own); as Bremner (1988, p. 142) puts it, 'No mean achievement in cognitive terms, let alone in terms of its implications for social awareness'.

Summary

This review of research, in which infants were facing people and objects, suggests the following about the development of the person-object distinction in infants. First, this distinction occurs very early in life. By 2 months of age, infants treat

the two classes differently. They recognize people as social stimuli (they vocalize, smile, alternate their gazes and imitate their actions) and objects as inanimate stimuli (they fixate the physical objects while emitting prereaching movements). Second, the infants have different expectations of the two classes. When facing people, they expect them to engage in reciprocal acts of communication. When people remain unresponsive, infants show distress. This distress was related to the absence of communication of the adult rather than a particular activity level, as suggested by Field (1979), since it was not produced in front of the inactive doll.

Perceptual or Conceptual Differentiation?

This early person-object differentiation we have noted in the responses of the infants by no means indicate that the animate-inanimate distinction is complete. Rather, it is a global understanding. The various attributes that distinguish people from things still need to be discovered with age. It is time to examine whether these global categories are the result of conceptual or of perceptual differentiation. Perceptual differentiation would only involve sensorimotor processes, whereas conceptual differentiation would require internal representations. Only if this differential responsiveness is based on conceptual considerations can it be said that infants distinguish between the animate and inanimate classes on their social dimensions, rather than on physical ones.

As noted, when the person and object conditions are perceptually similar, as in the inactive conditions, the infants do not appear to confuse the exemplars of the social and physical domains. This strongly suggests that performance on the person-object task is based on conceptual understandings. However, Piaget (1954) postulated that conceptual thought can only occur towards the end of the second year, after the action schemes have been internalized. Conceptual or symbolic thought does not only mean that the infant can use language, but the infants can now begin to understand that objects continue to exist when perceptually inaccessible (cf. Mandler, 1990). According to Piaget, the reason that this process is protracted over the first 2 years of life is related to several aspects. First, infants need considerable developmental experience with objects before they begin to understand the permanence of objects. Second, Piaget proposes that at birth the senses are unconnected. Until infants come to recognize correspondences between information perceived through different sense modalities,

'stable sensorimotor schemas of three-dimensional, solid, sound-producing, textured objects cannot be formed, and hence cannot be thought about' (Mandler, 1990, p. 237).

THE DEVELOPMENT OF DIFFERENTIAL RESPONSIVENESS TO INVISIBLE SOUNDING AND SILENT PEOPLE AND OBJECTS

Consequently, one of the tasks Piaget used to study conceptual thought in infants was the investigation of the infants' understanding that objects continued to exist when hidden. Irrefutable evidence that infants think is provided by their recall of events, since one cannot recreate information that is not perceptually present (cf. Mandler, 1990). Jackson *et al.* (1978) studied recall in 6- and 8-month-old infants by having them search for hidden people and objects behind doors. Although many of the 8-month-old infants successfully retrieved the stimuli, coordinated actions requiring the infants to crawl to retrieve objects are sensorimotor behaviours that are too complex for infants less than 8 months of age, and can therefore not reliably be used to assess conceptual knowledge in younger babies. As we have noticed earlier, by 4 months of age infants communicate with people and manipulate things. It makes sense in light of this differential responsiveness to people and things to assume that, if these young infants begin to understand that people and objects continue to exist when out of sight, they may use these different types of responses when they want them to be recovered. They may appeal to the motivational system of disappearing people through calling and they may attempt to retrieve hidden objects through reaching (Gelman and Spelke, 1981).

To investigate this hypothesis the various reactions of 4-, 6- and 8-month-old infants to their disappearing mother, female stranger, novel and unfamiliar object were observed (Legerstee, 1992). The infants sat in a type of playpen with solid sides, each containing a door through which a person's head or a plush animal (size of a person's head) would appear. To prevent the infant from emitting responses to the stimulus prior to hiding, the door was closed as soon as the infant fixated the stimulus. Because people make sounds when playing hide and seek with infants, the infants were presented with the following conditions: (a) a *combined* condition, during which the stimulus was heard as well as seen prior to hiding, and heard only

during the response session; (b) a *vision* condition, in which the stimuli were seen only prior to hiding; and (c) a *sound* condition, during which the stimulus was heard only prior to and during the response session. Five infant measures were coded during the 15-second response intervals: (1) reaching; (2) gaze; (3) body orientation; (4) vocalizations; and (5) smiling.

The results showed that when people and objects had disappeared, infants as young as 4 months of age used different types of responses to bring them back to view. They vocalized to people and they reached for objects. These responses suggest that infants acknowledged the continued existence of people and objects at an age Piaget (1954) did not think possible. Furthermore, the infants in this study perceived that the actions that made people disappear and reappear came from within the person, and that the best way to reverse this transformation was to act on the motivational system of the person (see also Gelman and Spelke, 1981). In addition, sound improved infant search for non-social objects. Infants reached significantly more for objects in the combined condition than in the other conditions. Thus, the added effects of visual and auditory stimulation aided infants in their search for hidden objects. This meant that infants recognized correspondences between the visual and auditory information of the stimulus. Only if there is multimodal perception will they be able to benefit from multimodal stimulation. That sound indicated the presence of an inanimate object in its visual absence has been found by other authors. Infants between 5 and 7 months apparently reached for where they expected a sounding invisible toy to be (Clifton *et al.*, 1991; Stack *et al.*, 1988). However, sound of the social objects appeared to suppress the vocalizations of the infants. Although the infants vocalized more when their mother was hiding than when objects were hidden, vocalizations in the sound conditions decreased drastically after 4 months of age. Schwartz (1984, p. 30) argues that the changing cognitive capacities of the child influence their conception of things. Whereas during the first half of the year the infants may have vocalized actively in response to sounding people, she feels that thereafter infants tend to replace their active search by attentive listening as they begin to pay increasing attention to the non-spatial information of the auditory stimulus. Thus, in contrast to what Piaget suggested, young infants perceive three-dimensional, solid, sound-producing objects, and they recognize their permanency.

It could be argued that the infants' differential responsiveness to the disappearance of people vs. objects was a conditioned response. After all, by 4 months of age infants may have had ample practice in bringing back people through vocalization, and obviously none doing the same with objects. However, it is unlikely that pre-crawling 4-month-old infants have had enough experience bringing back invisible sounding inanimate objects through reaching. Thus, rather than a conditioned response, the infants' differential responsiveness to the invisible stimuli suggests the beginnings of the object concept. Other experiments with completely invisible objects support the idea that 4-5-month-old infants can both understand and remember the persistence of hidden objects (Hood and Willats, 1986).

If 4-month-old infants recognize that people and objects continue to exist when out of sight, does proper search for people and objects still depend on the objectivity of all things? It must in part. However, the results of this study suggest that in order for infants to respond adaptively to the various social and non-social objects, they have to differentiate between the different attributes that distinguish people from things. Thus they have to learn that different types of stimuli can disappear and be returned to view in different ways. Rather than being the result of a decline of extreme solipsism during a lengthy sensorimotor stage (cf. Piaget, 1954), success on object permanence tasks may well depend on the knowledge of objects and 'of the crucial distinctions between them' (Gelman and Spelke, 1981, p. 60). Thus, knowledge about objects as separate entities should not be seen as the end result of protracted interactions with people and things, but as the simple foundation from which might develop the primitive concept of animacy, which would lead to a further refined conceptual differentiation of people and things (Mandler, 1990).

GENERAL CONCLUSIONS

The study of animate and inanimate objects has been dominated by the idea that the acquisition of knowledge about people can be explained by the same rules and principles that govern the understanding of physical things. This review of the way infants approach people and objects lends support to a different account. Namely, that the infants' conceptions of a given class does not depend only on the logical structure of the situation and the

cognitive stage of the child, but also on the nature of the domain (Gelman and Spelke, 1981).

As noted, when very young infants face people and things, they respond differently to the two classes. Rather than a perceptual differentiation, this ability appears to be conceptual and driven by different underlying mechanisms that are specific to the social and non-social domain. These structures allow the infants to act on the basis of abstract representations of events in the world. It is these forms of conceptual considerations, rather than the infants' reflexes, that allow for highly adaptive transactions with the physical and social environment (cf. Meltzoff, 1985). The specific social structures would allow the infants to recognize that they are similar to other people, which will facilitate their interactions with them. This recognition is a precondition for further social development.

Their remarkable sophistication when tested in social situations suggests not only that infants are thinking and social creatures right from the start, but that their perceptual and cognitive capacities can best be revealed when assessed in social interactions. The infants' ability to recognize, soon after birth, that they are like other human beings as opposed to inanimate stimuli allows them 'to become more interested in, identify with, and attached to exemplars from the former and not the latter' (Meltzoff, 1985, p. 28). These findings not only have implications for models of cognitive and social knowing but are useful during clinical assessments. The infants' sophisticated social abilities should provide a basis for shifting the focus of early intervention procedure from passive, sensorimotor stimulation to a more interactive, social exchange approach. In this way parents of infants experiencing developmental difficulties could be taught specific ways of interacting, thereby providing their infants with an enriched social environment, in order to stimulate interactions with both the social and the non-social world.

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