The Body and the Self

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Infants' Understanding of People and Things: From Body Imitation to Folk Psychology

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Our interest is in the relation between the development of infants' understanding of physical objects and that of persons. We will suggest that the two are closely interwoven, so that infants' developing grasp of the nature of objects profoundly influences their idea of persons. We further suggest that newborns begin life with some grasp of people and of how people are like themselves.

Our approach to these issues is to study psychological development. Philosophers often consider abnormal patients and cultural universals as reference points in their analyses of mind. Infants have less often been considered. Nonetheless, infancy is a good place to look if one is interested in the origins of human knowledge. All adult minds were once infant minds. The nature of the infant's construal of the world and how it is revised to become the adult's conception should contribute to a fuller understanding of mind.

We suggest that accounting for infants' performance involving physical objects and persons requires that we recognize a progression through increasingly sophisticated concepts. This view stands in opposition to the idea that infants are born with adult concepts in full play (nativism) and to the idea that they start with only reflexes and have to bootstrap themselves up into anything remotely like our concepts (Piaget).

Although the idea of progression through increasingly sophisticated concepts has some intuitive appeal, the problem has always been to find the parameters to describe this development in ways that are both theoretically plausible and empirically valid. In what follows, we will first illustrate the parameters for explaining infants' progressive grip on the notion of a physical object. Then, through a consideration of imitation, we will show how there is, from the start, a special treatment of the movement of human bodies, and we will suggest parameters for describing infants' progressive grip on the concept of a person.

This essay has three major parts. First we analyze what infants understand a physical object to be. We examine the criteria infants use to maintain

object identity over successive perceptual contacts. We also examine infants' understanding of human bodies as a special case of physical objects and their grasp of the idea that their own bodies are like other human bodies. In the second part we analyze infants' developing conception of persons. We examine how infants distinguish human individuals and determine their particular identity. We also examine the development of infants' understanding of humans as bearers of psychological properties. In the third part we conclude by analyzing how the developments previously described might lead to a concept of the self as an entity in a world full of others and a concept of the other possessing a subjectivity as rich as the self.

1 Early Understanding of Physical Objects

Identity

How do infants interpret an object's entering into or exiting from their field of view as it moves, as their heads turn, or as they are carried from one place to another? The adult conception of "object" does that work for us. What is the infant's conception? There is reason to suggest that the infant's conception is quite different from the adult's. Our view is that (a) infants have concepts about objects, not simply lists of actions they perform on them, (b) these concepts undergo radical change, and (c) it is not a one-step, dichotomous change but rather successive cognitive restructurings that yield a causally related series of infant conceptions. This developmental view requires a careful use of language. Because the infants' earliest conceptions of objects are not the same as adults' but only early steps toward the mature attainment, we need a new word for object when it refers to the infant's conception. In this essay we call these "proto-objects."

These proto-objects do some of the work that the concept of an object does for adults, but they do not have all the properties of the adult's objects. Our use of the notion of proto-objects relates to certain philosophical considerations as to what it means to be a physical object or thing. In particular, Campbell (1993) has recently analyzed some distinctions between feature and object and between the internal causal connectedness inherent in objects and their spatiotemporal continuity. These distinctions seem to have some empirical reality in the world of infants. For example, we will show that infants can reidentify a proto-object as the same one across two encounters without their requiring that it followed a continuous space-time path between the encounters.

Our notion of proto-objects and how they relate to the mature adult notion differs from other psychological views of the "object concept" (as it is called in the psychological literature). It differs from that of Piaget (1954), who thought that there was no concept of object that remotely resembled

the adult notion during infancy (his theory focused on actions and the inseparability of objects from action), from that of Bower (1982), who thinks that young infants develop a concept of object but that only one important conceptual shift occurs (around 5 months of age), from that of Spelke (Spelke, Breinlinger, Macomber, and Jacobson 1992; Spelke and Van de Walle 1993), who thinks that infants innately hold the core adult conception of object with no significant change or overturning of this understanding, and from that of Baillargeon (1991, 1993), who attributes sophisticated knowledge about objects to young infants (like Spelke) but allows for cognitive development in certain aspects of physical reasoning to account for changes in performance.

For an adult, the flux of object appearances is organized by noting which of the many appearances are encounters with the same object. Thus an object seen at time t in place p may be identified as the same object when seen at t' in place p' by a rule for object identity. The identity referred to in this case is the object's unique or essential identity with itself and not featural sameness. No two objects, however exactly they may share the same features, are identical in this sense. Strawson (1959) calls this numerical or particular identity when it is the mature adult concept, and we call it "unique identity" when referring to the infant's less mature notion. We will argue that at different ages infants use different criteria for numerical identity, which suggests they are operating with distinct concepts of objects in development (hence the notion of proto-objects).

Three classes of events involving spatial transformations of objects seem to be significant for infants (Moore and Meltzoff 1978). Table 1 summarizes the

Table 1
Developmental levels in infants' understanding of unique (numerical) identity over spatial transformations of objects

Level	Age (months)	Description of level	Examples of events for which an object's unique identity is maintained
1	0–4	Identity is maintained for a steady state of the visual world.	Objects moving on a trajectory Objects staying at rest in a place
2	5–8	Identity is maintained for transformations of visible objects.	Objects in motion stopping Objects at rest starting to move
3	9–18	Identity is maintained for transformations producing occluded objects.	Objects disappearing in motion Objects disappearing at rest

marizes this typology and the corresponding developmental changes in infants' understanding from birth to 18 months of age.

In our terms, the three levels display a developmental progression from proto-object to object. The first two levels are developmental changes within the realm of proto-objects; it is only by level 3, at about 9 months of age, that a notion of an object as such is achieved.

In the first 4 months of life, infants are concerned with the identity problems associated with the steady-state structure of the visual world: objects in motion continue in motion; objects at rest stay at rest. At this level, an infant's notion of object identity is that for each perceptual encounter, an object in motion is the same one at any point on its trajectory and an object in the same place is the same object.[1] At about 5 months of age there is a shift such that infants can solve identity problems associated with changes from the steady-state structure of the visual world. At this level, they have extended their notion of objects to encompass the idea that unique identity is maintained across visible transformations of visible objects, such as an object in motion stopping, a stationary object moving, etc. At about 9 months of age there is a third developmental change, one that allows them to make sense of identity problems associated with changes from the visible to the nonvisible world, the transformations producing occluded objects such as a stationary object being covered by a moving screen or a moving object going behind a stationary screen.[2]

Moore, Borton, and Darby (1978) investigated some predictions from this developmental sequence for the transition from level 2 to level 3. They designed an experiment that distinguished three rules for object identity that infants might employ when visually tracking a moving object as it disappeared and reappeared from behind an opaque screen: featural, spatiotemporal, and permanence. Adults use the permanence rule: we believe that the object remains permanent behind the screen when it is invisible and therefore that the pre- and posthidden object are the same one (provided there is no trickery). However, more primitive construals of object disappearances and reappearances can be imagined. The experiment was designed to diagnose whether infants conceived of objects according to the permanence rule or whether they operated with only proto-objects and hence lacked this belief. Figure 1 provides a schematic diagram of the object tracking problems posed to the infants.

Young infants might possess a featural rule for object identity and treat the pre- and postocclusion objects as the same if they are featurally identical. The featural task tests this by changing the object's features while it is obscured by the screen so that it emerges with a different appearance. A spatiotemporal rule for identity treats the pre- and postocclusion objects as the same if they share the same trajectory of motion on either side of the screen.
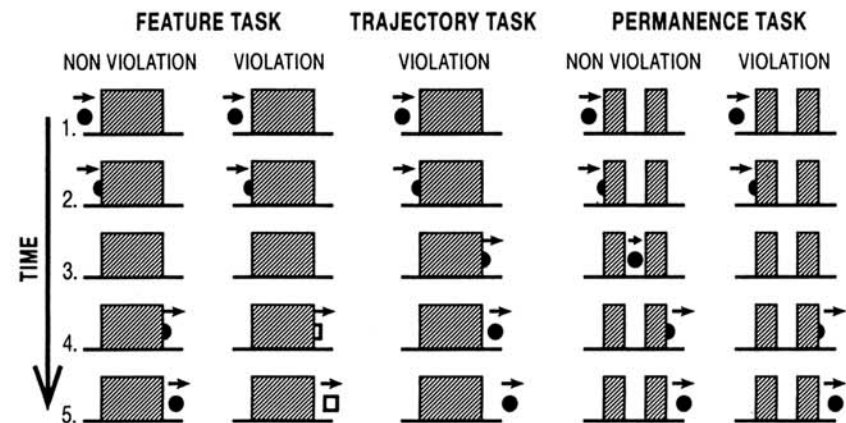

Figure 1
Schematic diagram of the object tracking tasks used to assess infants' rules for maintaining numerical identity. The diagram shows the feature, trajectory, and permanence tasks at five sequential points in time. The nonviolation condition in the trajectory task was the same as the nonviolation condition in the feature task. (Adapted from Moore, Borton, and Darby 1978.)

The trajectory of the preocclusion object specifies a unique speed, direction, and time of appearance for the postocclusion object. The trajectory task tests this rule by having the postocclusion object emerge much too soon to be on the trajectory of the preocclusion object even though their observed speeds and directions are identical. A permanence rule for identity treats the pre- and postocclusion objects as the same if an unbroken path of motion links them. The permanence task tests this rule by having the object disappear behind the first screen and emerge from the second screen still on the original trajectory but without appearing between the screens. Thus on some portion of its trajectory the object apparently did not exist.

As depicted in figure 1, the method used in the experiment was to create three object-tracking tasks (the featural, trajectory, and permanence tasks). For one condition of each task, an object disappeared and then reappeared in accord with all three identity rules; the other condition violated one of the rules. If infants showed a violation response (more disrupted tracking in the violation condition than in the nonviolation condition), this was taken as evidence that they used the identity rule in question. These tasks were presented to 5- and 9-month-old infants.

The results showed that 5-month-old infants displayed violation responses for both the feature and trajectory tasks but *not* for the permanence task. Evidently, the 5-month-olds saw no contradiction to their notions of object in the permanence-violation task. In contrast, the 9-month-olds showed violation responses in all three tasks. Moreover, the 9-month-olds