Development of the Object Concept: Implicit vs. Explicit Knowledge

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What's the Problem

Previous findings from experiments on the perception of spatiotemporal displacements of objects and predictive tracking have been used to draw conclusions about the development of the object concept or object permanence. Both of these terms imply that infants possess specific knowledge about the properties of objects, but it is rarely stated whether this knowledge is implicit in the actions of infants or instead constitutes explicit, retrievable knowledge. These accounts generally follow Piaget, for whom the permanence of objects (the object concept) represented a conceptual achievement. Michotte, on the other hand, maintained that object permanence (or non-permanence) depended only on the perception of the spatiotemporal properties of the stimulus, rather than on a conceptual understanding of the permanence of objects.

This distinction between perceptual or implicit knowledge and conceptual or explicit knowledge remains a source of considerable discussion and debate for interpreting findings during early development (e.g., Haith, 1998). In this talk, I will review recent evidence suggesting that infants are prepared to understand core properties of object motion (such as continuity, inertia, etc.), but this understanding is based on implicit knowledge that should be distinguished from more explicit knowledge.

Implicit vs Explicit Knowledge of Objects

At an implicit level, object continuity is consistent with the manner in which the brain is organized to process object motion (Bertenthal, 1996). Moving objects are perceived as persisting through space and time, and their paths are defined by inertia and gravity. As true for adults, this information is mapped directly to the eye tracking system (Bertenthal & von Hofsten, 1998). Thus, predictive tracking of briefly occluded moving objects is learned implicitly and does not require explicit knowledge about the continued existence of objects. Infants are automatically prepared to predict the reappearance of a moving object by extrapolating from its past behavior.

At an explicit level, object knowledge requires going beyond the information given via some analysis and redescription of the visual event. Mandler (2000) suggests that explicit knowledge is required for tasks such as deferred imitation, object examination, and inductive inference. These tasks all demand some recall of the functional properties of the objects to control future actions. Unlike the automatic actions mediated by implicit knowledge, these actions are mediated by both observed and unobserved object properties. For example, explicit knowledge is necessary to control, or more specifically inhibit, a predictive response when prior information specifies that a moving object will be prevented from reappearing from behind an occluder because of an obstacle located in its path (Berthier et al, 2001). In this case, recall of past events and an analysis of the location of the target relative to the obstacle will be required to inhibit the real-time tracking response. A similar level of knowledge is necessary to inhibit a prepotent response in a search task.

Empirical Evidence

Recent studies on object tracking and object individuation will be reviewed to show that object knowledge does not develop all-at-once nor do all tasks measure the same level of object knowledge (Berthier et al., 2001; Bertenthal et al., 2006). These studies include experiments testing predictive tracking and reaching, individuation of faces and objects, and predictive tracking of objects that disappear in possible and impossible ways. Infants' knowledge is tested with predictive tracking, habituation, and violation-of-expectancy paradigms. By differentiating tasks in terms of the criteria discussed above, we will show that implicit knowledge of objects (e.g., predictive tracking) develops as early as 3 months of age, but that explicit knowledge of objects (e.g., manual search) does not begin to develop before 7 to 9 months of age. These findings help to reconcile current confusions and contradictions in the literature concerning the age at which the object concept develops.

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