

Sensorimotor Period

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The developing mind does not merely follow a linear trajectory—say from knowing little to knowing more. Instead, the mind appears to actively organize information into coherent structures. According to Jean Piaget, these mental organizations – referred to as schemas – go through qualitatively distinct stages, the first of which is the *sensorimotor period*. Cognition at this stage is characterized by a reliance on reflexes and primary sense, rather than on symbolic or abstract thought. The argument is that children younger than 2 years base their cognition on immediate actions-perception loops, making distinctive mistakes when the task requires an ability to represent hidden events. In what follows, we provide a brief overview of the sensorimotor substages, after which we discuss how the claims of a sensorimotor period have affected the field of cognitive development.

There are six substages within the sensorimotor stage. Substage 1 (known as “*Reflexes*”) is characterized by a lack of voluntary behavior: Neonates make sense of external stimulation merely through innate reflexes. The baby’s own intentions emerge in Substage 2 (known as “*Primary Circular Reactions*”). Here, babies can intentionally repeat actions of their own bodies, for example, to perpetuate a pleasurable outcome. Intentional actions are expanded beyond the baby’s own body in Substage 3 (known as “*Secondary Circular Reactions*”). Rather than merely

using their bodies, babies can now use external objects intentionally to generate a response in the environment. An often-cited example is to shake a rattle to produce a sound intentionally.

The first three substages of the sensorimotor phase are generally assumed to take place during the first year of life. The schemas that emerge during this time are centered on the baby's own actions in the immediate task context. In contrast, Substage 4 is characterized by combining schemas to reach a specific goal, beyond the here-and-now of the baby's own actions (known as "*Coordinating Secondary Schemes*"). This allows babies to imitate observed behaviors or appreciate that objects could have different qualities. For instance, infants can now understand that a rattle could be used as a tool to reach something they want.

The final two substages, spanning through the second year of a baby's life, mark the beginning of representational thought. During Substage 5 (known as "*Tertiary Circular Reactions*"), babies not only experience objects but can explore them actively. For example, rather than merely repeating a desirable action, infants can now explore how different actions lead to different outcomes. Finally, during Substage 6 (known as "*Early Representational Thought*"), babies have developed the ability to mentally represent objects that are no longer in sight. Known as object permanence, this ability allows infants to understand that objects occupy in their own space, even when objects are no longer visible.

Piaget's idea that babies go through a 2-year period without symbolic thought has led to a sharp increase in research with infants. The general argument of this line of research is that Piaget has gravely underestimated the representational abilities of young children. Using clever

research designs, young infants were found to not only represent hidden events, but also to reason about them. For example, Baillargeon and DeVos (1991) showed that 4-month-old babies could distinguish between a physically possible and physically impossible event that took place behind a screen (i.e., a car either rolled by a toy placed next to the track, or it rolled through the toy placed on the track). Numerous studies followed, eager to demonstrate babies' cognitive precociousness, whether in the area of causal reasoning, numeric cognition, social interactions, or reasoning about physical truisms.

After decades of infant-cognition research, two broad camps have formed, standing largely antagonistic to each other: On the one hand, there are the so-called nativists who continue to insist that infants are far more competent than what Piaget claimed to be possible during the sensorimotor stage. On the other hand, there are those who have raised methodological concerns about nativist research. Notably, these studies document a baby's reasoning on the basis of looking time exclusively, not on the basis of the baby's overt actions. For example, even though toddlers were sensitive to physically impossible behavior according to their looking patterns, they could not carry out an overt action to demonstrate the same competence. This suggests that looking time might provide an only limited windows into cognition.

Today, the idea that babies go through a sensorimotor period has been essentially abandoned. Even so, the sensorimotor tasks that were pioneered by Piaget are still being researched (e.g., A-not-B task). The hope is that these tasks might ultimately shed light on early cognitive processes—to contribute theoretical insights that go beyond the currently existing camps. A promising alternative lies in dynamic systems approaches: These approaches argue that

cognition (whether low-level perception-action cycles or high-level symbolic thought) has its base in the emergence of functional networks of activations that can amplify themselves to remain 'alive' past a perceptual experience.

Further Readings

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