For some years now, we have been witnessing a prodigious growth of research into the beginnings of mental life, and scientific effort has tended to become increasingly centered on furthering our understanding of the developmental mechanisms themselves.

While the developmental psychologists had already progressed beyond the troublesome dichotomy of maturation versus learning, the advent of new theories of language, stemming from the linguistic work of Harris and, above all, Chomsky, have reopened the controversy between empiricism and nativism. Their studies have shown decisively that grammars, i.e., linguistic competence, have features which cannot be explained by recourse to the empiricist and associationist theories. Chomsky's work led him to make two hypotheses on the acquisition of language: first, that the basic linguistic structures are innate, and second, that when the child is in contact with the language spoken around him he makes a choice between the possible grammars (there are important restrictions on these grammars). His followers went further and stressed this rationalist aspect of linguistic theory; they saw in language the most important example of human cognition and from this evolved a neonativist argument going well beyond language itself.
As regards linguistic competence, this led to the hypothesis of a language acquisition device with a strong inner structure—a concept with which we can hardly quarrel. However, we begin to disagree when this structure is considered genetically preprogrammed and when no attempt is made to link the appearance of the first comprehensible utterances to the sensorimotor forms of behavior which precede their appearance.

Considering the question from the Genevan developmental angle, we think it is possible to trace continuous links between the first sensorimotor coordinations and truly cognitive structures, and to hypothesize that language and, in a more general way, the semiotic function of which it is the most obvious expression are not suddenly constructed but prepared by the elementary development of knowledge at the sensorimotor level.

Such a developmental point of view fits in with an explanatory system according to which the hereditary (both genetic and epigenetic) connections and the learning processes are controlled by more fundamental and more general mechanisms (e.g., regulatory and self-regulatory).

In the first part of this chapter, we shall try to trace the development of the fundamental categories of knowledge (space, time, and causality) which, according to Piaget, are developed as early as during the preverbal period and form the basis of the fundamental operations and concepts of thought, culminating in the structures of scientific thought. We are trying to show that these first cognitive elaborations can be explained in biologic terms such as assimilation; the development of intelligence is to be understood as a particular case of biologic adaptation.

Second, we shall describe some current research which we hope will throw light on the passage from sensorimotor activity to the semiotic function such as it appears in the first forms of symbolic play and language.

We shall conclude with a few remarks on the heuristic value of a constructivist genetic concept which, of necessity, leads us to have recourse to self-regulatory models such as those found in modern biology and cybernetics.

THE DEVELOPMENT OF THE UNIVERSE: THE ORIGIN OF THE CATEGORIES OF KNOWLEDGE

Certain remarkable studies of animal psychology, some of which have been transposed to the human level, have long convinced us of the existence of a sensorimotor intelligence which phylogenetically and ontogenetically precedes language. Nowadays, according to the epistemological perspective, the Kantian problem of the origin of knowledge has