1

Piaget's Theory

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The following theory of development, which is particularly concerned with the development of cognitive functions, is impossible to understand if one does not begin by analyzing in detail the biologic presuppositions from which it stems and the espistemological consequences in which it ends. Indeed, the fundamental postulate that is the basis of the ideas summarized here is that the same problems and the same types of explanations can be found in the three following processes:

a. The adaptation of an organism to its environment during its growth, together with the interactions and autoregulations which characterize the development of the "epigenetic system." (Epigenesis in its embryologic sense is always determined both internally and externally.)

b. The adaptation of intelligence in the course of the construction of its own structures, which depends as much on progressive internal coordinations as on information acquired through experience.

The present chapter is, in part, the expansion of an article on my conceptions of development published in *Journal International de Psychologie*, a summary of previous publications, but it also takes into account recent or still unpublished work by the author or his collaborators and colleagues. As a matter of fact, "Piaget's theory" is not completed at this date and the author of these pages has always considered himself one of the chief "revisionists of Piaget." (Author's note)

B. Inhelder et al. (eds.), *Piaget and His School*

c. The establishment of cognitive or, more generally, epistemological relations, which consist neither of a simple copy of external objects nor of a mere unfolding of structures preformed inside the subject, but rather involve a set of structures progressively constructed by continuous interaction between the subject and the external world.

We begin with the last point, on which our theory is furthest removed both from the ideas of the majority of psychologists and from "common sense."

THE RELATION BETWEEN SUBJECT AND OBJECT

1. In the common view, the external world is entirely separate from the subject, although it encloses the subject's own body. Any objective knowledge, then, appears to be simply the result of a set of perceptive recordings, motor associations, verbal descriptions, and the like, which all participate in producing a sort of figurative copy or "functional copy" (in Hull's terminology) of objects and the connections between them. The only function of intelligence is systematically to file, correct, etc., these various sets of information; in this process, the more faithful the critical copies, the more consistent the final system will be. In such an empiricist prospect, the content of intelligence comes from outside, and the coordinations that organize it are only the consequences of language and symbolic instruments.

But this passive interpretation of the act of knowledge is in fact contradicted at all levels of development and, particularly, at the sensorimotor and prelinguistic levels of cognitive adaptation and intelligence. Actually, in order to know objects, the subject must act upon them, and therefore transform them: he must displace, connect, combine, take apart, and reassemble them.

From the most elementary sensorimotor actions (such as pushing and pulling) to the most sophisticated intellectual operations, which are interiorized actions carried out mentally (e.g., joining together, putting in order, putting into one-to-one correspondence), knowledge is constantly linked with actions or operations, that is, with *transformations.*

Hence the limit between subject and objects is in no way determined beforehand, and, what is more important, it is not stable. Indeed, in every action the subject and the objects are fused. The subject needs objective information to become aware of his own actions, of course, but he also needs many subjective components. Without long practice or the construction of refined instruments of analysis and coordination, it will be impossible for him to know what belongs to the object, what belongs to himself as an active subject, and what belongs to the action itself taken as the transformation of an initial state into a final one. Knowledge, then, at its origin, neither arises from objects nor from the subject, but from interactions—at first inextricable—between the subject and those objects.

Even these primitive interactions are so close-knit and inextricable that, as J. M. Baldwin noted, the mental attitudes of the infant are probably "adualistical." This means they lack any differentiation between an external world, which would be composed of objects independent of the subject, and an internal or subjective world.

Therefore the problem of knowledge, the so-called epistemological problem, cannot be considered separately from the problem of the development of intelligence. It reduces to analyzing how the subject becomes progressively able to know objects adequately, that is, how he becomes capable of objectivity. Indeed, objectivity is in no way an initial property, as the empiricists would have it, and its conquest involves a series of successive constructs which approximates it more and more closely.

2. This leads us to a second idea central to the theory, that of *construction*, which is the natural consequence of the interactions we have just mentioned. Since objective knowledge is not acquired by a mere recording of external information but has its origin in interactions between the subject and objects, it necessarily implies two types of activity—on the one hand, the coordination of actions themselves, and on the other, the introduction of interrelations between the objects. These two activities are interdependent because it is only through action that these relations originate. It follows that objective knowledge is always subordinate to certain structures of action. But those structures are the result of a *construction* and are not given in the objects, since they are dependent on action, nor in the subject, since the subject must learn how to coordinate his actions (which are not generally hereditarily programmed except in the case of reflexes or instincts).

An early example of these constructions (which begin as early as the first year) is the one that enables the 9- to 12-month-old child to discover the permanence of objects, initially relying on their position in his perceptual field, and later independent of any actual perception. During the first months of existence, there are no permanent objects, but only perceptual pictures which appear, dissolve, and sometimes reappear. The "permanence" of an object begins with the action of looking for it when it has disappeared at a certain point *A* of the visual field (for instance, if a part of the object remains visible, or if it makes a bump under a cloth). But, when the object later disappears at *B*, it often happens that the child will look for it again at A. This very instructive behavior supplies evidence for the existence of the primitive interactions between the subject and the object which we mentioned (¶ 1). At this stage, the child still believes that objects depend on this action and that, where an action has succeeded a first time, it must succeed again. One real example is an 11-month-old child who was playing with a ball. He had previously retrieved it from under an armchair when it had rolled there before. A moment later, the ball went under a low sofa. He could not find it under this sofa, so he came back to the other part of the room and looked for it under the armchair, where this course of action had already been successful.

For the scheme* of a permanent object that does not depend on the subject's own actions to become established, a new structure has to be constructed. This is the structure of the "group of translations" in the geometric sense: (*a*) the translation $AB + BC = AC$; (*b*) the translations $AB + BA = O$; (*c*) $AB + O = AB$; (*d*) $AC + CD = AB + BD$. The psychologic equivalent of this group is the possibility of behaviors that involve returning to an initial position, or detouring around an obstacle (*a* and *d*). As soon as this organization is achieved—and it is not at all given at the beginning of development, but must be constructed by a succession of new coordinations—an objective structuration of the movements of the object and of those of the subject's own body becomes possible. The object becomes an independent entity, whose position can be traced as a function of its translations and successive positions. At this juncture the subject's body, instead of being considered the center of the world, becomes an object like any other, the translations and positions of which are correlative to those of the objects themselves.

The group of translations is an instance of the construction of a structure, attributable simultaneously to progressive coordination of the subject's actions and to information provided by physical experience, which finally constitutes a fundamental instrument for the organization of the external world. It is also a cognitive instrument so important that it contributes to the veritable "Copernican revolution" babies accomplish in 12 to 18 months. Whereas before he had evolved this new structure the child would consider himself (unconsciously) the motionless center of the universe, he becomes, because of this organization of permanent objects and space (which entails moreover a parallel organization of temporal sequences and causality), only one particular member of the set of the other mobile objects which compose his universe.

3. We can now see that even in the study of the infant at sensorimotor levels it is not possible to follow a psychogenetic line of research without evolving an implicit epistemology, which is also genetic, but which raises all the main issues in the theory of knowledge. Thus the con-

* Throughout this chapter the term *scheme* (plural, *schemes*) is used to refer to *operational* activities, whereas *schema* (plural, *schemata*) refers to the figurative aspects of thought—attempts to represent reality without attempting to transform it (imagery, perception and memory). Later in this chapter the author says, ". . . images . . . , however schematic, are not schemes. We shall therefore use the term schemata to designate them. A schema is a simplified image (e.g., the map of a town), whereas a scheme represents what can be repeated and generalized in an action (for example, the scheme is what is common in the actions of 'pushing' an object with a stick or any other instrument)."

struction of the group of translations obviously involves physical experience and empirical information. But it also involves more, since it also depends on the coordinations of the subject's action. These coordinations are not a product of experience only, but are also controlled by factors such as maturation and voluntary exercise, and, what is more important, by continuous and active autoregulation. The main point in a theory of development is not to neglect the activities of the subject, in the epistemological sense of the term. This is even more essential in this latter sense because the epistemological sense has a deep biologic significance. The living organism itself is not a mere mirror image of the properties of its environment. It evolves a *structure* which is constructed step by step in the course of epigenesis, and which is not entirely preformed.

What is already true for the sensorimotor stage appears again in all stages of development and in scientific thought itself but at levels in which the primitive actions have been transformed into *operations*. These operations are interiorized actions (e.g., addition, which can be performed either physically or mentally) that are reversible (addition acquires an inverse in subtraction) and constitute set-theoretical structures (such as the logical additive "grouping" or algebraic groups).

A striking instance of these operational structurations dependent on the subject's activity, which often occurs even before an experimental method has been evolved, is *atomism* invented by the Greeks long before it could be justified experimentally. The same process can be observed in the child between 4 to 5 and 11 to 12 years of age in a situation where it is obvious that experience is not sufficient to explain the emergence of the structure and that its construction implies an additive composition dependent on the activities of the subject. The experiment involves the dissolution of lumps of sugar in a glass of water. The child can be questioned about the conservation of the matter dissolved and about the conservation of its weight and volume. Before age 7 to 8 the dissolved sugar is presumed destroyed and its taste vanished. Around this age sugar is considered as preserving its substance in the form of very small and invisible grains, but it has neither weight nor volume. At age 9 to 10 each grain keeps its weight and the sum of all these elementary weights is equivalent to the weight of the sugar itself before dissolution. At age 11 to 12 this applies to volume (the child predicts that after the sugar has melted, the level of the water in the container will remain at its same initial height).

We can now see that this spontaneous atomism, although it is suggested by the visible grains becoming gradually smaller during their dissolution, goes far beyond what can be seen by the subject and involves a step-by-step construction correlative to that of additive operations. We thus have a new instance of the origin of knowledge lying neither in the object alone nor in the subject, but rather in an inextricable interaction between both of them, such that what is given physically is integrated in a logicomathematical structure involving the coordination of the subject's actions. The decomposition of a whole into its parts (invisible here) and the recomposition of these parts into a whole are in fact the result of logical or logicomathematical constructions and not only of physical experiments. The whole considered here is not a perceptual "Gestalt" (whose character is precisely that of *non*additive composition, as Kohler rightly insisted) but a sum (additive), and as such it is produced by operations and not by observations.

4. There can be no theoretical discontinuity between thought as it appears in children and adult scientific thinking; this is the reason for our extension of developmental psychology to genetic epistemology. This is particularly clear in the field of logicomathematical structures considered in themselves and not (as in ¶ 2 and ¶ 3) as instruments for the structuration of physical data. These structures essentially involve relations of inclusion, order, and correspondence. Such relations are certainly of biologic origin, for they already exist in the genetic (DNA) programming of embryologic development as well as in the physiologic organization of the mature organism before they appear and are reconstructed at the different levels of behavior itself. They then become fundamental structures of behavior and of intelligence in its very early development before they appear in the field of spontaneous thought and later of reflection. They provide the foundations of these progressively more abstract axiomatizations we call logic and mathematics. Indeed, if logic and mathematics are so-called "abstract" sciences, the psychologist must ask: Abstracted from what? We have seen their origin is not in objects alone. It lies, in small part only, in language, but language itself is a construct of intelligence. Chomsky even ascribes it to innate intellectual structures. Therefore the origin of these logicomathematical structures should be sought in the activities of the subject, that is, in the most general forms of coordinations of his actions, and, finally, in his organic structures themselves. This is the reason why there are fundamental relations among the biologic theory of adaptation by self-regulation, developmental psychology, and genetic epistemology. This relation is so fundamental that if it is overlooked, no general theory of the development of intelligence can be established.

ASSIMILATION AND ACCOMMODATION

5. The psychologic meaning of our previous points (¶ 1 to 4) is that the fundamental psychogenetic connections generated in the course of development cannot be considered as reducible to empirical "associations"; rather, they consist of *assimilations*, both in the biologic and intellectual sense.

From a biologic point of view, assimilation is the integration of external elements into evolving or completed structures of an organism. In its usual connotation, the assimilation of food consists of a chemical transformation that incorporates it into the substance of the organism. Chlorophyllian assimilation consists of the integration of radiation energy in the metabolic cycle of a plant. Waddington's "genetic assimilation" consists of a hereditary fixation by selection on phenotypes (phenotypic variations being regarded, in this case, as the genetic system's "answer" to stresses produced by the environment). Thus all the organism's reactions involve an assimilation process which can be represented in symbolic form as follows:

$$(T + I) \rightarrow AT + E \tag{1}$$

where T is a structure, I the integrated substances or energies, E the eliminated substances or energies, and A a coefficient > 1 expressing the strengthening of this structure in the form of an increase of material or of efficiency in operation.* Put in this form it becomes obvious that the general concept of assimilation also applies to behavior and not only to organic life. Indeed, no behavior, even if it is new to the individual, constitutes an absolute beginning. It is always grafted onto previous schemes and therefore amounts to assimilating new elements to already constructed structures (innate, as reflexes are, or previously acquired). Even Harlow's "stimulus hunger" cannot be reduced simply to subordination to the environment but must rather be interpreted as a search for "functional input" ("éléments fonctionnels") that can be assimilated to the schemes or structures actually providing the responses.

At this point it is appropriate to note how inadequate the well known "stimulus-response" theory appears in this context, as a general formulation of behavior. It is obvious that a stimulus can elicit a response only if the organism is first sensitized to this stimulus (or possesses the necessary reactive "competence" as Waddington characterizes genetic sensitization to specific inducers).

When we say an organism or a subject is sensitized to a stimulus and able to make a response to it, we imply it already possesses a scheme or a structure to which this stimulus is assimilated (in the sense of incorporated or integrated, as defined previously). This scheme consists

* For example, take T to be an already established classification on a set of objects, O, which divides it into two distant subclasses. I is a set of new objects that are added to the original ones and to which the classification T must be extended. When this is done (I has been assimilated to T), it turns out that there are say two new subclasses (the whole structure is now AT) and some properties of the new objects I (e.g., the number of elements in I, or their shape, size or color) have been neglected in the process. We now have $T + I \rightarrow AT + E$, where $T =$ the two original subclasses, $I =$ the new elements. $AT =$ the four subclasses, and $E =$ the irrelevant properties of the new elements, that is, the properties which are not used as criteria for classifying in this specific instance.

precisely of a capacity to respond. Hence the original stimulus-response scheme should not have been written in the unilateral $S \rightarrow R$ form, but in the form:

$$S \rightleftharpoons R \qquad \text{or} \quad S \rightarrow (AT) \rightarrow R \tag{2}$$

where AT is the assimilation of the stimulus S to the structure T.

We thus return to the equation $T + I \rightarrow AT + E$ where, in this case, T is the structure, I the stimulus, AT the result of the assimilation of I to T, that is, the response to the stimulus, and E is whatever in the stimulus situation is excluded in the structure.

6. If assimilation alone were involved in development, there would be no variations in the child's structures. Therefore he would not acquire new content and would not develop further. Assimilation is necessary in that it assures the continuity of structures and the integration of new elements to these structures. Without it an organism would be in a similar situation to that of chemical compounds, A, B, which, in interaction, give rise to new compounds C and D. (The equation would then be $A + B \rightarrow C + D$ and not $T \rightarrow AT$).

Biologic assimilation itself, however, is never present without its counterpart, accommodation. During its embryologic development, for instance, a phenotype assimilates the substances necessary to the conservation of its structures as specified by its genotype. But, depending on whether these substances are plentiful or rare or whether the usual substances are replaced by other slightly different ones, nonhereditary variations (often called "accommodates") such as changes in shape or height may occur. These variations are specific to some external conditions. Similarly, in the field of behavior we shall call accommodation any modification of an assimilatory scheme or structure by the elements it assimilates. For example, the infant who assimilates his thumb to the sucking schema will, when sucking his thumb make different movements from those he uses in suckling his mother's breast. Similarly, an 8-year-old who is assimilating the dissolution of sugar in water to the notion that substance is conserved must make accommodations to invisible particles different from those he would make if they were still visible.

Hence cognitive adaptation, like its biologic counterpart, consists of an equilibrium between assimilation and accommodation. As has just been shown, there is no assimilation without accommodation. But we must strongly emphasize the fact that accommodation does not exist without simultaneous assimilation either. From a biologic point of view, this fact is verified by the existence of what modern geneticists call "reaction norms" —a genotype may offer a more or less broad range of possible accommodations, but all of them are within a certain statistically defined "norm." In the same way, cognitively speaking, the subject is capable of various accommodations, but only within certain limits imposed by the necessity of preserving the corresponding assimilatory structure. In Eq. 1 the term *A* in *AT* specifies precisely this limitation on accommodations.

The concept of "association," which the various forms of associationism from Hume to Pavlov and Hull have used and abused, has thus only been obtained by artificially isolating one part of the general process defined by the equilibrium between assimilation and accommodation. Pavlov's dog is said to associate a sound to food, which elicits its salivation reflex. If, however, the sound is never again followed by food, the conditioned response, or temporary link, will disappear; it has no intrinsic stability. The conditioning persists as a function of the need for food, that is, it persists only if it is part of an assimilatory scheme and its satisfaction, hence of a certain accommodation to the situation. In fact, an "association" is always accompanied by an assimilation to previous structures, and this is a first factor that must not be overlooked. On the other hand, insofar as the "association" incorporates some new information, this represents an active accommodation and not a mere passive recording. This accommodatory activity, which is dependent on the assimilation scheme is a second necessary factor that must not be neglected.

7. If accommodation and assimilation are present in all activity, their ratio may vary, and only the more or less stable equilibrium which may exist between them (though it is always mobile) characterizes a complete act of intelligence.

When assimilation *outweighs* accommodation (i.e., when the characteristics of the object are not taken into account except insofar as they are consistent with the subject's momentary interests) thought evolves in an egocentric or even autistic direction. The most common form of this situation in the play of the child is the "symbolic games" or fiction games, in which objects at his command are used only to represent what is imagined.* This form of game which is most frequent at the beginning of

* The categories of play defined by Piaget (in *Play, Dreams and Imitation*, 1961b, for example) are the following:

a. Exercise Games. These consist of any behavior without new structuration but with a new functional finality. For example, the repetition of an action such as swinging an object, if its aim is to understand or to practice the movement, is *not* a game. But the same behavior, if its aim is functional pleasure, pleasure in the activity in itself, or the pleasure of "causing" some phenomenon, becomes a game. Examples of this are the vocalizations of infants and the games of adults with a new car, radio, etc.

b. Symbolic Games. These consist of behaviors with a new structuration, that of representing realities that are out of the present perceptual field. Examples are the fiction games where the child enacts a meal with pebbles standing for bread, grass for vegetables, etc. The symbols used here are individual and specific to each child.

c. Rule Games. These are behaviors with a new structuration involving the intervention of more than one person. The rules of this new structure are defined by social interaction. This type of game ranges over the whole scale of activities, starting with simple sensorimotor games with set rules (the many varieties of marble games, for instance) and ending with abstract games like chess. The symbols here are stabilized by convention and can become purely arbitrary in the more abstract games. That is, they bear no more relation (analogy) with what they represent. (Translator's note) representation (between 1½ and 3 years of age), then evolves toward constructive games in which accommodation to objects becomes more and more precise until there is no longer any difference between play and spontaneous cognitive or instrumental activities.

Conversely, when accommodation prevails over assimilation to the point where it faithfully reproduces the forms and movements of the objects or persons which are its models at that time, representation (and the sensorimotor behaviors which are its precursors and which also give rise to exercise games that develop much earlier than symbolic games) evolves in the direction of imitation. Imitation through action, an accommodation to models that are present, gradually extends to deferred imitation and finally to interiorized imitation. In this last form it constitutes the origin of mental imagery and of the figurative as opposed to the operative aspects of thought.

But as long as assimilation and accommodation are in equilibrium (i.e., insofar as assimilation is still subordinate to the properties of the objects, or, in other words, subordinate to the situation with the accommodations it entails; and accommodation itself is subordinate to the already existing structures to which the situation must be assimilated) we can speak of cognitive behavior as opposed to play, imitation, or mental imagery, and we are back in the proper domain of intelligence. But this fundamental equilibrium between assimilation and accommodation is more or less difficult to attain and to maintain depending on the level of intellectual development and the new problems encountered. However, such an equilibrium exists at all levels, in the early development of intelligence in the child as well as in scientific thought.

It is obvious that any physical or biologic theory assimilates objective phenomena to a restricted number of models which are not drawn exclusively from these phenomena. These models involve in addition a certain number of logicomathematical coordinations that are the operational activities of the subject himself. It would be very superficial to reduce these coordinations to a mere "language" (though this is the position of logical positivism) because, properly speaking, they are an instrument for structuration. For example, Poincaré narrowly missed discovering relativity because he thought there was no difference between expressing (or translating) phenomena in the "language" of Euclidian or of Riemanian geometry. Einstein was able to construct his theory by using Riemanian space as an instrument of *structuration,* to "understand" the relations between space, speed, and time. If physics proceeds by assimilating reality to logicomathematical models, then it must unceasingly accommodate them to new experimental results. It cannot dispense with accommodation because its models would then remain subjective and arbitrary. However, every new accommodation is conditioned by existing assimilations. The significance of an experiment does not derive from a mere perceptive recording (the "*Protokollsätze*" of the first "logical empiricists"); it cannot be dissociated from an *interpretation.*

8. In the development of intelligence in the child, there are many types of equilibrium between assimilation and accommodation that vary with the levels of development and the problems to be solved. At sensorimotor levels (before 1½ to 2 years of age) these are only practical problems involving immediate space, and as early as the second year, sensorimotor intelligence reaches a remarkable state of equilibrium (e.g., instrumental behaviors, group of displacements; see ¶ 2). But this equilibrium is difficult to attain, because during the first months, the infant's universe is centered on his own body and actions, and because of distortions due to assimilation not yet balanced by adequate accommodations.

The beginning of thought creates multiple problems of representation (which must extend to distant space and can no longer be restricted to near space) as well as the problem of adaptation no longer measured by practical success alone; thus intelligence goes through a new phase of assimilatory distortion. This is because objects and events are assimilated to the subject's own action and viewpoint and possible accommodations still consist only of fixations on figural aspects of reality (hence on states as opposed to transformations). For these two reasons—egocentric assimilation and incomplete accommodation—equilibrium is not reached. On the other hand, from the age of 7 to 8 the emergence of reversible operations ensures a stable harmony between assimilation and accommodation since both can now act on transformations as well as on states.

Generally speaking, this progressive equilibrium between assimilation and accommodation is an instance of a fundamental process in cognitive development which can be expressed in terms of centration and decentration. The systematically distorting assimilations of sensorimotor or initial representative stages, which distort because they are not accompanied by adequate accommodations, mean that the subject remains centered on his own actions and his own viewpoint. On the other hand, the gradually emerging equilibrium between assimilation and accommodation is the result of successive decentrations, which make it possible for the subject to take the points of view of other subjects or objects themselves. We formerly described this process merely in terms of egocentrism and socialization. But it is far more general and more fundamental to knowledge in all its forms. For cognitive progress is not only assimilation of information; it entails a systematic decentration process which is a necessary condition of objectivity itself.

THE THEORY OF STAGES

9. We have seen that there exist structures which belong only to the subject (¶ 1), that they are built (¶ 2), and that this is a step-by-step process (¶ 7). We must therefore conclude there exist stages of development. Even authors who agree with this idea may use different criteria and interpretations of stage development. It therefore becomes a problem that requires discussion in its own right. The Freudian stages, for instance, are only distinct from each other in that they differ in one dominant character (oral, anal, etc.) but this character is also present in the previous—or following—stages, so that its "dominance" may,well remain arbitrary. Gesell's stages are based on the hypothesis of the quasi-exclusive role of maturation, so that they guarantee a constant order of succession but may neglect the factor of progressive construction. To characterize the stages of cognitive development we therefore need to integrate two necessary conditions without introducing any contradictions. These conditions for stages are (a) that they must be defined to guarantee a constant order of succession, and (b) that the definition allow for progressive construction without entailing total preformation. These two conditions are necessary because knowledge obviously involves learning by experience, which means an external contribution in addition to that involving internal structures, and the strucures seem to evolve in a way that is not entirely predetermined.

The problem of stages in developmental psychology is analogous to that of stages in embryogenesis. The question that arises in this field is also that of making allowance for both genetic preformation and an eventual "epigenesis" in the sense of construction by interactions between the genome and the environment. It is for this reason that Waddington introduces the concept of "epigenetic system" and also a distinction between the genotype and the "epigenotype." The main characteristics of such an epigenetic development are not only the well-known and obvious ones of succession in sequential order and of progressive integration (segmentation followed by determination controlled by specific "competence" and finally "reintegration") but also some less obvious ones pointed out by Waddington. These are the existence of "creodes," or necessary developmental sequences, each with its own "time tally," or schedule, and the intervention of a sort of evolutionary regulation, or "homeorhesis." Homeorhesis acts in such a way that if an external influence causes the devloping organism to deviate from one of its creodes, there ensues a homeorhetical reaction, which tends to channel it back to the normal sequence or, if this fails, switches it to a new creode as similar as possible to the original one.

Each of the preceding characteristics can be observed in cognitive development if we carefully differentiate the construction of the structures themselves and the acquisition of specific procedures through learning (e.g., learning to read at one age rather than another). The question will naturally be whether development can be reduced to an addition of procedures learned one by one or whether learning itself depends on developmental laws which are autonomous.