Jean Piaget's theory of the development and structure of the intelligence unquestionably represents the greatest intellectual achievement of any living behavioral scientist. Together with the general conceptual perspectives and epistemological considerations upon which it rests, it has implications that extend far beyond psychology to the other behavioral sciences, philosophy, and logic. The publication of Piaget's Structuralism (1970a) and Genetic Epistemology (1970b) in English translations affords an opportunity to reflect upon the general significance of Piaget's work, especially its implications for the concept of "structure," now as inconsistently employed and poorly understood as it is fashionable.

Psychologists and social scientists of the English-speaking world have known of Piaget almost exclusively as a child psychologist, chiefly preoccupied with the formal aspects of the development of cognitive processes. The two books under review clearly demonstrate the inadequacy of this conception. Piaget's thought is in fact nothing less than a general theory of the structure of natural and artificial (logico-mathematical) systems, conceived as dynamic, "constructive" (genetic or homeostatic) processes. Since the system in which Piaget is primarily interested is the human mind and its knowledge, his theory is also an epistemology, the first to be systematically grounded in experimental data. After more than fifty years of research by himself and a small army of assistants, Piaget's theory is extensively elaborated, consistently integrated, and massively supported by empirical research. In Genetic Epistemology and Structuralism, he sums up many of his general ideas and offers trenchant criticisms of a wide variety of "structuralist" approaches in psychology, linguistics, and the social sciences, as well as illuminating accounts of allied developments in mathematics, logic, physics, and biology.

Genetic Epistemology consists of a set of four lectures delivered at Columbia in 1968. It presents an admirable and concise account of the general concept of genetic epistemology and some of its most interesting applications. The translation is excellent. Genetic epistemology is essentially an attempt to explain human knowledge (particularly formalized knowledge such as science, mathematics, and logic) by studying the correspondences between the structure and historical development of particular scientific or mathematical concepts and the structure and genesis of their psychological counterparts in individuals. A number of instances of research of this kind that are briefly alluded to in Structuralism are here described much more fully: the three "mother structures" of the Bourbaki mathematicians and their psychological counterparts; the research of Piaget, Sinclair, and others on the relation between the origins of logical thought and the origins of language; the genesis of the notion of "identity" as a fundamental logical principle; and the development of the child's concepts of number, speed, and time as evidence for their logical composition and structure. Piaget's hypotheses regarding the structure of time and other basic categories are suggestive of new approaches in the anthropological analysis of cultural categories and cosmological systems. The concept of time, for example, is shown to be compounded of simpler notions of speed and "work accom-
plished” or events elapsed. Number is similarly shown to be constructed on the basis of a coordination of primitive notions of class inclusion and seriation.

Piaget rests his model of intellectual development, which forms the foundation of genetic epistemology, upon a sharp distinction between what he calls the “figurative” and “operative” modes of thought (1971b:14f). The former comprises a broad category including perception, imitation, and mental imagery or “symbols” (in the Saussurian sense of “motivated” or iconic signs). Piaget dismisses “figurative” thought as a whole as “the imitation of states taken as momentary and static.” “Operational” thought, on the other hand, is defined as consisting essentially of logical manipulations of a dynamic character, e.g., inverse or reciprocal transformations (1971b:14). Operational thought relies upon non-figurative “signs,” i.e., arbitrary, collectively standardized tokens that typically denote general concepts. The collective cultural character of “signs” is opposed to the private, individual nature of “symbols” (for a full discussion of Piaget’s views on symbolism, see Piaget 1962).

Just as “operative” thought consists essentially of dynamic operations, Piaget treats it as the sphere of dynamic intellectual development: his model of the genesis of the intelligence is for all intents and purposes exclusively a model of the development of operational thought. Figurative thought is passed over as a lower form of mental activity which plays no active role in mental development after early childhood, and which, because of its personal, individualistic nature, lacks any cultural significance (1971b:14).

This formulation seems inadequate in two respects. In the first place, it begs the question of the viability of de Saussure’s sharp distinction between sign and symbol. Specifically, Piaget’s attempt to deny all dynamic operations to figurative or symbolic thought flies in the face of massive evidence for the dynamic qualities of much figurative imagery (e.g., symbolic forms such as myth, ritual, and the arts). Symbolic forms in these categories can be “dynamic” both in the sense of representing transformations or temporal processes and in the sense of producing affective, conative, and motivational effects. In the second place, as the examples just cited attest, much figurative symbolism is neither private, individualistic, nor childish in character, but collective and cultural.

It is an interesting question what in Piaget’s theory has led him to discount or overlook the overwhelming evidence for the inadequacy of his conception of figurative thought. The answer appears to lie in his basic conception of the nature of intellectual development itself. For Piaget, this consists essentially of three parallel and intercorrelated transformations in the nature of the cognitive relations of the subject to its objective environment: from the concrete and particular to the general and abstract, from the static to the dynamic, and from “ego-centric” to “decentered.” The latter terms denote the passage from a condition in which the subject is incapable of separating objective reality from the particular conditions of its own immediate relationship to that reality to a more sophisticated and relativistic perspective in which reality is no longer seen as revolving around the ego. In the latter, “decentered” state the subject is able to comprehend the independence of objective reality from his perspective upon and affective involvement with it, and thus becomes capable of imaginatively assuming other points of view than his own toward the same objective situation. The acquisition of these capabilities coincides with the mastery of dynamic logical operations (i.e., transformations). Dynamics in mental operations are therefore directly correlated with the “mobility of the ego,” i.e., the ability of the subject to realize the relativity and contingency of its position and mentally to assume other relationships to the object than the one it actually stands in at the moment. The “decentered” system of cognitive operations made possible by these developments is integrated around a set of ego-independent principles of “conservation” or invariance, which constitute the constant parameters of the relationships between the dynamic mental operations of which the mature intelligence is composed.

This view of intellectual development lends itself readily to a theory of the evolution of science, logic, and mathematics. All of the problems and examples discussed in Genetic Epistemology and other works on the same topic by Piaget and his collaborators are drawn from these three fields. Genetic epistemology is thus in effect presented primarily as a philosophy of science.
It is obvious, however, that the same model does not lend itself as easily, at least in the same terms, to the analysis of art, religion, or other symbolic forms of a non-scientific nature (i.e., those that characteristically employ figurative symbolism or modes of thought).

Piaget has shown that ethical judgment is to a considerable extent capable of treatment in terms of his genetic model (see The Moral Judgement of the Child, 1965), yet a "genetic aesthetics," for example, along the same lines seems almost a contradiction in terms. There seems to be some crucial missing element which the progressive "decentration" model fails to capture that forms the essential principle of symbolic structures of the figurative type, both at the cultural level and that of individual psychological behavior (e.g., fantasy and dream).

It is widely recognized that traditional forms of art and religion, including myth, ritual, magic, poetry, painting, etc., consist essentially of the imposition of forms upon objective reality which serve, at the same time, as models for the subject's affective and cognitive orientation to that reality. Such forms are often apparently fixed and "static" in character, yet they typically consist of combinations or condensations of elements which represent either transformations of reality or the principles of invariance or conservation (to use Piagetian language) upon which such transformations are based. In both senses, "figurative" symbolic forms are capable of encoding and expressing dynamic principles and relations. In other words, figurative symbolism can assert a determinate paradigm of relationships as a dominant principle ordering a series of variations or contrasts, in a way that expresses, at the same time, a particular "sensibility" or subjective relationship to the phenomena it represents. Such forms might therefore be said, in Piaget's terms, to effect a kind "recentering" of the subject-object relation. This "recentering" is in many ways the opposite of the "decentering" process which constitutes the leitmotiv of Piaget's model of mental development, but it should not be confused with the primitive egocentricity of childhood. On the contrary, it presupposes that "decentering" has already occurred, and stresses the reflexive definition of the subject by reference to the objective model it provides as much or (depending on the nature and function of the form) more than the definition of the object as a projection of the egocentric affective and cognitive aspects of the subject. In other words, the symbolic structure of a myth, ritual, painting, or poem, interpreted as a figurative model of an objective situation, functions as much as an objective template for the molding of subjective experience and the restructuring of subjective identity as a projection of subjective states onto the objective environment (for a brilliant treatment of Australian Aboriginal ritual from this point of view, see Munn n.d.). Even if, in many cases, the "figurative" symbolic form itself has a static character, the creative process of which it is the end result, and the process through which it is experienced, decoded, and reacted to by the members of the culture of which it forms a part are of a profoundly dynamic and transformational character. Both encoding and decoding processes exemplify the principle of "recentering." Like the dynamic logical transformations of "decentered" thought, figurative symbolism may facilitate the reciprocal coordination of subject and object and the creation of a balance of assimilative and accommodative relations. It may also serve as a vehicle for creating a stable equilibrium between experiencing actor and experienced object. It achieves these ends, however, by means of a procedure which is the opposite of that of logical "operations." Instead of interposing between subject and object a flexible and relativistic system of transformational rules capable of responding to a wide variety of pragmatic variations in the relations between the two, figurative symbolic forms transform such systems of variations into determinate, non-relativistic structures by imposing upon them patterns of a higher order, which dictate the outcomes of their transformations and prescribe specific sets of relations among their components. The imposed patterns thus assume the role of the principles of conservation or invariance in Piaget's decentered "operational" structures: like their "operational" counterparts, they are defined and expressed as the fixed principles underlying a series of related transformations at the level of concrete form or "surface structural" relations.

Although "decentering" and "recentering" are opposites in a structural sense, they
are by no means conflicting or mutually exclusive. The comparative cultural evidence, on the contrary, suggests that the two represent complementary principles which are in some sense mutually interdependent (since all cultures appear to possess symbolic forms of a "figurative" type). What is the nature of this complementarity? "Decentered" thought in its mature, "operational" form is essentially abstract and generalized in character. Its basic premise is the independence of the objects upon which it is focused from the identity, feelings, and purposes of the subject. The identity (in the full sense of the personality of "self") of the subject, on the other hand, exists at a relatively concrete and particular level: its essential functional property is the integration of cognitive world-picture and logical operations with affect and value in the forms of purposive action. Affect is inherently concrete, particular, and associated with the unique relationship of the self to its objective environment. For this reason the integration and shaping of the personality or subjective self, on both conscious and unconscious levels, cannot be achieved by a decentered, abstract, and generalized mode of thought alone. A more concrete symbolic medium, centered upon the particular position of the subject and capable of condensing affective with cognitive associations, is required. It is this need that is filled by figurative imagery and symbolic forms. Figurative symbolism and "decentered" logical thought thus fulfill complementary functions and ideally reinforce one another. "Recentered" forms such as ritual or myth, for example, afford mechanisms by which the structural principles of "decentered" cognitive systems (e.g., social or moral norms) can be invested with affective and motivational power. Alternatively, "recentered" forms can compensate for the depersonalization of "decentered" structures of social or cosmic reality at either the collective or the individual level by creating concrete, affectively charged worlds of meaning of a subjectively "centered" character.

Piaget's theory of the structure of the intellect and its processes is a theory of "decentered" logical structures. What I am suggesting is that this theory must be supplemented by a theory of "recentered," figurative symbolic structures before it can provide a comprehensive account of cultural and psychological structures. The process of "decentering" does not operate in isolation, but seems everywhere to proceed in complementary interdependence with the "recentering" function. Neither process has a monopoly on dynamics, and all cultures (as well as individual psyches) seem to require, or at least to possess, both types of symbolic structure.

While anthropologists will find much that is fascinating in Genetic Epistemology (and the other works of Piaget and his collaborators in this area), they will be struck by the complete absence of comparative cultural considerations in an enterprise devoted to studying the "development" and conceptual composition of the basic categories of human thought. In place of cross-cultural comparison, and performing roughly the same functions within Piaget's theoretical perspective, is what appears to be a relatively simplistic form of psychological reductionism, coupled with evolutionistic assumptions based upon an equally simplistic ontogeny—recapitulates—phylogeny argument. The following passage is typical:

The fundamental hypothesis of genetic epistemology is that there is a parallelism between the progress made in the logical and rational organization of knowledge and the corresponding formative logical processes. Well, now, if this is our hypothesis, what is our field of study? Of course, the most fruitful, most obvious field of study would be reconstituting human history—the history of human thinking in prehistoric man. Unfortunately, we are not very well informed about the psychology of Neanderthal man... Since this field of biogenesis is not available to us, we shall do as biologists do and turn to ontogenesis [1970b:13].

A closer examination of Piaget's argument, however, reveals significant discrepancies between it and more familiar forms of psychological reductionism and evolutionism, which compel a quite different assessment of Piaget's work. These aspects of Piaget's thought are, however, more fully expounded in Structuralism, and it will accordingly be more convenient to discuss them with reference to that work.
I. THE BASIC ELEMENTS OF PIAGET'S CONCEPT OF STRUCTURE

A. The Process of Construction and the "Functional Invariants"

Piaget's essentially dynamic approach to the concept of structure is reflected in two representative statements from Structuralism:

the "being" of structures consists in their becoming, that is, in their being "under construction" [1970a:139].

There is no structure apart from construction [1970a:140].

"Construction," or the process through which structures are formed, is thus the most important concept in Piaget's theory of structure. Construction consists of an adaptive interaction between a system or entity already organized at some level, which plays the functional role of "subject," and its objective environment. The adaptive orientation of the "subject" is toward the achievement of a more stable equilibrium within the total system constituted by itself and its environment. To achieve this goal, it must make a series of accommodations to the objective conditions imposed by its environment, and incorporate these accommodations into its own structure as the basis of its future behavior. The subject attempts to encompass each new set of accommodations on the basis of its capacity to "assimilate" objective reality at its existing level of structural development. Should this prove impossible, adaptive pressure leads the subject to attempt to subsume the new accommodations together with its old structure under principles of a higher order, abstract and general enough to serve as common denominators for both. These principles in turn become the basis of a new and more "powerful" structure.

The process of abstracting the common properties of operations performed upon distinct sets of objects as the basis of a new or higher level of structure is one of the two major aspects of the constructive processes. Piaget calls it reflective abstraction to distinguish it from the simpler and more direct form of abstraction of the properties of objects. The other major aspect of construction is equilibration, or the attempt to reconcile and integrate the two main types of functional activity (accommodation and assimilation). In assimilation, the subject acts toward the environment so as to bring it into accord with, or at any rate modify its relationship to, its existing structures. The structure of the subject is, in other words, taken as the independent variable and that of the object as the dependent variable. Accommodation, as we have already seen, represents the complementary opposite of this procedure. The two functions must be coordinated or equilibrated for the subject to attain a measure of stability in relation to its environment. Equilibration and reflective abstraction, then, form the two complementary aspects of the process by which structures are generated and maintained. Equilibration is the locus of the functional or adaptive aspects of the process, reflective abstraction of its organizational and structural aspects.

Equilibration, or the adaptive coordination of the actions of the subject with reference to its objective milieu, is only possible on the basis of the organization of its accommodations to that environment into a coherent pattern or structure. Piaget therefore considers organization and adaptation (the latter defined as comprising the two principal functions of accommodation and assimilation) as the "functional invariants" or basic factors indispensable to the genesis and maintenance in being of any structure, at any level of development.

Function (adaptation) is inseparable from structure (or, more broadly, organization) for Piaget because of the primacy of behavior and its dynamic, processual aspects in his thought. Here it should be noted that Piaget does not treat all behavioral processes as of equal theoretical interest or structural significance. He gives the overwhelming bulk of his attention to generic or logical processes that lead from "weaker" or less developed levels of organization to "stronger" and more complex levels. Nothing in his basic conceptual scheme, however, limits its application solely to such processes: it can be applied equally well to homeostatic, regenerative, or restitutive processes involving the interaction of hierarchically related levels within a relatively stable social or cultural system. The reasons for Piaget's almost exclusive concentration on "genetic"
developmental processes and his comparative disinterest in homeostatic systems will occupy us later. It will be more useful at this point to clarify a few further aspects of Piaget’s concept of structure.

B. Structure

Piaget uses the term structure in a relatively restricted sense to denote a “mature” or developed form of organization. A structure is an organization which has reached a level of equilibration which the necessary accommodations to its environment do not call for further changes of a fundamental or genetic character. Such a system is a self-regulating system of reversible transformations that forms a totality (i.e., a whole that is greater than the sum of its parts). Structures, identified in terms of these three basic criteria, consist of operations, related to each other on the basis of “coordinations.” Operations are internalized (i.e., symbolic) actions. They are reversible, but at the same time are based on a principle of conservation or invariance that specifies an immutable aspect of the reversible relationship (for example, the volume of water remains invariant as its shape is varied by being poured from a tall thin glass to a shorter, wider one). Finally, operations are always grouped into sets on the basis of determinate principles of interrelationship, or coordinations. Coordinations are, as it were, second-order operations, or operations upon operations. They take the form of reversible transformations of various types. A structure, at the highest level of organization, can always be represented as a group of such transformations, correlated on the basis of invariance rules that render the transformations mutually commutative, and therefore jointly applicable to the same situation or problem. The holistic character of structures thus arises directly from the relationships among their component parts (which are themselves elementary relationships), rather than being imposed upon the parts by virtue of some “emergent” principle (a position Piaget ascribes to Durkheim, among others).

Two striking aspects of this conception of structure are its extreme formalism and its uneven mixture of generalized, formal elements with specifically psychological concepts (e.g., “internalization” as a criterial attribute of operations). The formal aspects are characteristic of Piaget’s later thought, in which he has increasingly striven to isolate the generic forms that characterize all structures. These generalizing and formalizing tendencies, however, arose directly from his earlier attempts to formalize his own empirical findings. There is an impressive continuity between Piaget’s observational data, the descriptive and quasi-formalized models he at first developed to fit them, and his later more generalized logico-mathematical models. The trouble is that this continuity is not so immediately obvious with the models or data of other fields: Piaget does not always help matters by leaving portions of his model in relatively ungeneralized psychological terms, while other portions are treated at the highest level of logico-mathematical abstraction (the treatment of the concept of “operations” is a case in point). The use of Piagetian models in other disciplines is thus likely to require a complex effort of translation, calling for the adaptation of both formal and psychological elements to the requirements of a particular field. The effort is by no means impossible or necessarily unrewarding in itself, as many examples from both Structuralism and Genetic Epistemology go to show.

Structure, in Piaget’s conception, is essentially a mediatory code. This intermediary role is, at the same time, defined on several different dimensions. Structure is, to begin with, interposed as a “deep” structure between what might be called the surface structure of behavior and the fundamental infra-structure represented by the “functional invariants” of organization and adaptation. In a diachronic, developmental sense, it is suspended, so to speak, between its own past and future. A basic implication of Piaget’s conception of the constructive process as the primary structural datum is that any given level of structure must be explained with reference to the immediately preceding level, which formed the basis for the particular set of adaptive responses that gave rise to it. By the same token, any structure must be seen as already engaged in adaptive interactions that pose challenges which can only be resolved by further modification and development. In a somewhat parallel sense, a structure at a given level (say, the psychological) owes much of its
specific character to its intermediary position between the lower and upper adjacent macro-levels in the hierarchy of structures (in this case, neuro-physiology, on the one hand, and sociology and culture, on the other). Finally, and most importantly, a structure is a code for the regulation of the interaction between a "subject" and its objective milieu. It is on this point that Piaget's thought departs most widely from other current structuralist approaches, and where its implications are perhaps the most profound and far-reaching.

C. Subject and Object

Piaget defines the subject as "the center of functional activity" (1970a:59). It is, in other words, the locus of the functional invariants of the equilibration process, organization, and adaptation. These invariant factors are, in a sense, prestructural: they are not identified with any particular structure, but constitute the basic components of the process by which structures are formed or "constructed." The subject is thus conceived by Piaget as the locus of the dynamics of the constructive process. Its structure is (potentially if not actually) in flux and relative at any given time to the circumstances of its interaction with its objective situation, as conditioned by the level of structure it has attained. Yet it is never wholly identical with its own structure, since it also embodies the infra-structural capacity to transform itself by internalizing its responses to new external or internal stimuli, which it can generate through its own activity. The subject's relation to its structure at a particular time in Piagetian thought is thus closely analogous to the relation between the "I" and the "me" in G. H. Mead's theory of symbolic interaction, or between the living, spontaneous, and creative self and the dead, static self composed of accumulated past experience in the Realdialektik of Dilthey and Ortega y Gasset (Mead 1934; Ortega y Gasset 1936). There are, however, important differences between Piaget and these thinkers, especially with regard to the identification of the concept of subject with consciousness, lived experience (Lebenswelt, vecu) or individuality. We shall consider some of these differences in a moment.

The object, insofar as it can be acted upon, and therefore "known" or related to by the subject, is also an indeterminate entity whose definition is always relative to the actions of the subject and the level of structure upon which they are based. The object imposes limitations upon the subject's actions. Its reality for the subject at any given time is the product of the subject's cumulative accommodations to these limitations, and the manner in which the subject has been able to organize them in structural form. Since the subject defines itself (and in the process elaborates structures) by acting upon objects and accommodating itself to the resistance they offer to its actions, the object enters reflexively into the organization of the subject. The system of operations and coordinative principles (i.e., assimilated accommodations) that constitutes a structure is thus itself an indirect reflection of the structure of the objective behavioral environment.

Behavior (that is, purposive action directed at external or internalized objects) is for Piaget always prior to structure, even though any given act of behavior always itself pre-supposes a structural foundation (which may be, however, of a simpler order than the structure that is the eventual result of the action). Behavior, in turn, must always be defined in relation to objects. The object, however, never imposes its own structure directly on the subject or on structures; as Ding an sich it remains as structurally and epistemologically inexhaustible as the subject.

Structure, in other words, simultaneously constitutes a reflection of the pattern of interaction between the subject and object and the code of rules and categories by which the subject regulates its activities in relation to the object. As a sort of abstract model of the reciprocal interplay of assimilation and accommodation between subject and object, it comprises the rules that generate the structure of each in terms of its relations to the other: at the same time, it serves as the medium through which the two are interconnected.

"Structure" in Piagetian theory is thus a category composed of two complementary and directly related aspects. There is, on the one hand, the "subjective" component: the set of operations and coordinations that
regulate the subject's orientation and behavior toward the object. On the other hand, there is the "objective" component, consisting of a representation of the object (i.e., a set of categories), derived from the accommodations forced upon a subject of determinate structure by the "real" (but ultimately inexhaustible and undefinable) structure of the object. It is a fundamental proposition of Piagetian theory, following directly from the basic concepts that have just been discussed, that these two complementary aspects of structure are generated by the same set of rules. Both the system of operations (constituting the effective structure of the subject) and the system of categories making up the representation of the object are, in other words, complementary products or reflections of the same set of assimilated interactions between the two. These interactions, in their assimilated form, constitute a set of generative rules. Such a set of generative rules or transformations, in turn, represents a model of the "constructive" process briefly described in the beginning of this section. It is the direct expression and product of the subject's efforts to "equilibrate" (i.e., integrate within a stable "organization") its accommodative responses to its objective situation with its "assimilative" behaviors toward the object (in its accommodated form). The necessary level of organization is constructed by the "reflective abstraction" of the principles common to the actions and reactions of the subject in the equilibration process. These abstracted principles become the operations and coordinations which form the elements of the new structure, i.e., the set of generative rules that produce the system of categories making up the subject's representation of the object and the pattern of orientations and actions that underlies the behavior of the subject.

"Structures," therefore, whether they be myths, kinship systems, languages, or psyches, can be neither understood nor explained (though they may for certain purposes be described) out of relation to the objective situations to which they refer and whose structures they incorporate, albeit in a mediate and partial manner. For the same reasons, any adequate analysis of a structure must take account of the particular "subject" (i.e., the set of operations upon the objective situation) whose orientation it reflects, and whose practical behavior is the source of the generative principles and " coordinations" of which it consists. Structures, in sum, are invariably to be understood as "internalized" representations of the field of interaction between particular "subjects" and specific systems of objects: in the case of cultural structures, these internalized (i.e., symbolic) models are, of course, re-externalized or objectified in the form of communicative codes, systems of classification, myths, etc. The lack of obvious surface-structural correspondences between a symbolic structure and its referential context is no grounds, from this point of view, for asserting the "independence" or lack of systematic relationship between structure and referent. Quite the contrary: the relative independence of structure from context at the level of surface structure is achieved only through the success of the subject in assimilating, at the level of deep structure, the underlying principles responsible for generating the "surface" phenomena of its objective environment.

In spite of the conventional associations of the term "subject" with the consciousness of individual human beings, it is clear that Piaget's concept of the subject has nothing to do with either individuality or consciousness—or, for that matter, humanity. Piaget has coined the term "epistemic subject" to denote his special use of the concept of the subject; he defines it as "the mechanism common to all subjects at a certain level, those of the average subject" (1970a:69). "A certain level" may denote mathematical, physical, biological, or sociological levels of analysis. On none of these levels would the "mechanism" of coordination of structure and function, or "subject," correspond to an individual human psyche. Even on the psychological level, where this correspondence occurs, the "subject" does not correspond to the conscious sector of the psyche. As the source and focus of the regulatory mechanisms governing the subject's actions, it pertains directly to behavior, which for Piaget is always prior to, and largely independent of, consciousness:

it is necessary to differentiate between consciousness, which is always incomplete and often distorting, and that which the subject actually does in his
intellectual activity, of which he only becomes aware of the results, while remaining unconscious of its mechanisms. But if one dissociates the subject from the "self" and its world of conscious experience, there remain its operations, which it derives by reflexive abstraction from the general coordination of its actions. Now it is precisely these operations that are the constitutive elements of the structures that form the basis of its mental activity [my translation, cf. 1970:139].

Since the construction of cognitive structures is a function of, and pertains to the subject's operational behavior and not its consciousness) its world of conscious experience can have only a small place in it [1970a:69].

In his insistence on the inseparability of structure from behavior and the objective context of behavior, and above all in his emphasis on the central importance of the subject as the focal point of integration of the set of categories, transformations, and principles of invariance ("coordinations") of which any structure must consist, Piaget is in direct conflict with most other "structuralist" approaches that have gained currency in the social sciences and humanities (chiefly anthropology, linguistics, and literary criticism). The difference is perhaps most marked between his system and that of Lévi-Strauss. The latter's penchant for stripping the concept of structure of all subjective and functional associations reaches perhaps its fullest expression in his assertion that structures have no "center" or focal point, save for that supplied by the anthropologist as an analytical convenience (Lévi-Strauss 1965:13). By firmly linking his concept of structure to the "epistemic subject," on the other hand, Piaget has developed a theoretical system of unique synthetic power. In contrast to the intellectual exclusiveness of many structuralist positions, Piaget's approach integrates structuralist concepts and methods with the pragmatic materialism of Marxism, on the one hand, and the dynamic orientation and insight into the reciprocal nature of subject-object relationships which Marxism shares with symbolic interactionism and substantial elements of Kantian, Hegelian, and post-Hegelian idealism on the other (see previous references to Dilthey and Ortega y Gasset).

"What we all dread most is a maze with no center. That is why atheism is only a nightmare," once remarked G. K. Chesterton's wise detective, Father Brown. If Father Brown were to become a structuralist, he would doubtless find Piaget's position (for all its secular materialism) most congenial. Lévi-Straussian structuralism, on the other hand, would presumably strike him as an intellectual nightmare. Father Brown might also find himself at home with the peculiar tone of some of Piaget's more abstract theoretical passages, which possess an unmistakable ring of moral conviction which makes them sound as much like prophecy as scientific generalizations. The following (unfortunately mutilated almost beyond recognition in the published English translation) is a good example:

To maintain that the subject must disappear to make way for the general and the impersonal is to forget that on the cognitive level (as well, perhaps, as with morals, aesthetic values, etc.) the activity of the subject entails a continual process of liberation from his spontaneous intellectual egocentrism. This process is not determined by any preexisting or external universal principle. It is the direct outcome of the subject's unceasing struggle to coordinate his actions and to bring them into reciprocal relationship with one another. Now it is this very process that gives rise to structures both in the phase of original construction and the subsequent unceasing process of reconstruction [my translation, cf. 1970a:139].

II. THE EPISTEMOLOGY OF STRUCTURALISM

A. Theory, Explanation, and Reality

It is a crucial point for Piaget that "reflective abstraction" as the process essentially responsible for the "construction" of structures, takes as its point of departure not the relations between elements or aspects of the objective environment but the operations performed (or capable of being performed) upon sets of environmental objects by the subject. It is symptomatic of the power and inter-disciplinary breadth of Piaget's approach that the conception of structure he derives from this emphasis on operations and the rule of the subject is identical with the
definition of structure prevailing in contemporary mathematics and physics:

the set of possible states and transformations of which the existing system is a special case [my translation, cf. 1970a: 38].

The genesis of physical (and by extension all natural and mathematical) structures, and, by the same token, structuralist analysis itself thus consists essentially in
taking account of the possible and locating the existing situation within a system of virtual possibilities [my translation, cf. 1970a:43].

The correspondence between structuralist analysis and explanation and natural or "real" structures is a fundamental principle of Piaget's epistemological position, which he defends not only with theoretical arguments but with his own massive experimental data on the genesis of human thought and intelligence. He draws a strong distinction between structuralist explanation and "logico-mathematical deduction" on precisely this issue. Formal deductive systems cannot "break through to causes" and thus cannot provide "explanations," since they are only capable of demonstrating a "fit" between their operations and the real, thus remaining "within the realm of laws." Both the idea of causality and the nature of explanation, meanwhile, presuppose a substantial correspondence between the theoretical model and reality.

B. Structure and Form

Piaget thus makes a strong distinction between "formalism" and the concept of "form," on the one hand, and structuralism and the idea of structure, on the other. "Form" is for Piaget a weaker, vaguer, and more inclusive category than structure, because it lacks the crucial and specifically structural component of a self-regulating set of transformations. Taking logic as the formalist discipline par excellence, Piaget contrasts the basic premise of formal logic, the distinction of form and content, with the working assumption of the "natural logic" of structuralist analysis. This is that "form" and "content" are not absolute opposites but correlatives ("contents" being "forms" for entities they include, and "forms" being, in turn, "contents" for entities that include them). He links this conception of "the nesting of forms" to Gödel's proof of the limitations of the axiomatic method, and thus of formalist approaches in logic and other disciplines. Gödel conclusively proved that no self-consistent formal deductive system "rich" enough to contain elementary arithmetic could demonstrate its own consistency on the basis of its own axioms. Gödel's proof showed that, contrary to the claims of formalists like Whitehead and Russell that mathematics and science could be reduced to exhaustively formalized logical systems (or "languages"), the formal integration of any logical system is inherently incapable of being derived from its own basic formal principles. No axiomatic system, in other words, can generate itself and simultaneously demonstrate its own validity. Piaget gives special emphasis to the ability of his form of structuralism to bypass the limitations of formalist approaches demonstrated by Gödel. Gödel's findings, while inimical to formalism, are fully consistent with Piagetian structuralism, above all with its dynamic, constructive quality.

Gödel showed that deductive systems could be arranged in a hierarchy of relatively "weaker" and "stronger" structures, on the basis of their ability to demonstrate one another's internal consistency and thus to "include" one another. Piaget points to the correspondence between this idea and his own concept of the "nesting of forms" and the relativity of the content-form distinction. An important corollary of this proposition of Gödel's is that the construction of a relatively complex and demonstratively consistent theory requires not merely an analysis of its presuppositions but the tentative construction of the next "higher" theory (i.e., the logical system that "includes" it). Piaget draws from these profound insights a conclusion basic to his concept of structure:

This means, in effect, that the idea of structure as a system of transformations becomes consistent with that of construction as continual formation... there cannot be a coherent structuralism apart from constructivism [1970a:34, 135].
Piagetian structuralism, through its combination of an open-ended formal perspective and a dynamic, constructivist orientation to the relationship between the successive levels of the Gödelian hierarchy of relatively "weaker" and "stronger" structures, thus circumvents the limitations of formalist approaches pointed out by Gödel, and integrates the latter's findings into its own theoretical and epistemological structure.

A possibly more profound form of Piaget's objection to formalist approaches is that the axioms upon which formal logical systems rest must inevitably have an arbitrary and \textit{ad hoc} character. They cannot be reflexively derived from, or related to, any reality external to the systems they generate. Formalist systems therefore lack any means of connecting themselves, by operations proper to themselves, to a ground in "objective" or "natural" reality. In contrast, asserts Piaget, "whether this be openly acknowledged or not, what structuralism is really after is to discover natural structures" (1971a:30). Piaget takes a strong and unequivocal epistemological position that such "natural structures" exist at every level of inorganic, organic, and human reality, that they share common properties, and that their existence and properties are prior to and independent of the formal models built up after them by the theoretician. Structure is therefore prior to formalization, and structuralism itself represents, in the last analysis, only the formalized extrapolation of the natural tendency for human thought to adapt itself to the properties of natural structures. The most striking evidence for this proposition adduced by Piaget is the dramatic correspondence between the three "mother structures" to which the group of French "structuralist" mathematicians known collectively as the Bourbaki had reduced all of mathematics and the three basic cognitive structures which Piaget had isolated as the basic components of the development of human intelligence. The discovery of this correspondence by Piaget and a member of the Bourbaki group some years ago at a joint conference in France surely represents one of the great moments of twentieth century thought.

For Piaget, then, "structuralism" is inseparable from a robust epistemological position that assumes a fundamental identity between the process of structural analysis and the form of structuralist explanation, on the one hand, and the "real" process of the genesis of natural structures, on the other. The ability of human symbolic thought to generate models that correspond with natural structures can, in Piaget's view, best be explained by recognizing that symbolic thought itself is, in its origins, merely an extension of presymbolic psychological, neurological, and organic processes, which at all levels are shaped by constant interaction with objective reality even as they participate in it. The "harmony" between the human operator "as body and mind" and "the innumerable operators in nature" is thus itself a product of an integral natural process: it is, in Piaget's words, "the most beautiful example of biological adaptation we know of (because both physico-chemical and biological at the same time)" (1970a:41).

III. SYNCHRONY AND DIACHRONY: THE PROBLEM OF LINGUISTICS

The central question that can be raised with respect to Piaget's structuralism arises directly from his pervasive emphasis on the intimate relation between structure and genesis. The nub of the problem is the relation between the process by which a structure is originally formed and the process or processes by which it is maintained in being or modified (in a non-"progressive" sense) in the course of its subsequent history. Although he often calls upon the principle that ontogeny (the generation or regeneration of a structure of a given type) recapitulates phylogeny (the genetic process by which that structure was originally developed), Piaget is the first to recognize that it has serious limitations. From a theoretical point of view, the most relevant of these is the relative independence of the laws of equilibrium (according to which any structure, once developed, tends to maintain itself in being) from the laws of development (1970a:77). The variable and potentially independent relationship between genetic and self-maintaining or homeostatic processes would seem to imply the possibility of a purely synchronic "constructivism," based upon the cyclical or self-regulating processes
of systems considered as maintaining themselves in equilibrium over virtual or relatively short periods of time, which could dispense with "diachronic" (historical, developmental, and genetic) considerations. It would also leave room for a diachronic (historical) but non-genetic structuralism, that would concern itself with temporal modifications in structural systems resulting from conflict, maladaptation to changing circumstances, contacts with other systems, or other forms of relative "disequilibrium," without binding itself to any overall scheme of genetic development or evolution.

Piaget, however, is clearly reluctant to accept such alternatives as general possibilities for "constructivist" structuralism. His ambivalence with respect to both synchronic and historical, non-genetic diachronic approaches is most clearly revealed in his discussion of linguistic structuralism. In the first section of his chapter on linguistics, Piaget attempts to make a case for linguistics as a privileged domain of "synchronic structuralism" on the basis of an untenable distinction between language as a "conventional" system, and other social and natural systems as "normative" systems. According to Piaget, norms, defined as possessing an "intrinsic" value deriving from their obligatory, binding character, are necessarily "dependent upon antecedent history," for the distinctive character of their development is that it is "always directed toward...equilibrium" (1970a:79). "Conventional signs," such as words, on the other hand, have no "intrinsic value," since they bear, by definition, only an arbitrary relation to the entities they signify. "Conventional" systems, as such, are "at opposite poles, as regards the relations between synchronics and diachronics" from "normative" systems, because

the history or rather chronicle of a word...may consist simply of a series of changes of meaning without any mutual relations except such as result from the necessity of answering to the expressive requirements of the successive synchronic systems to which the word belongs [1970a:79]).

Linguistics, Piaget asserts, is unique in that, alone among the sciences, it deals with "conventional" systems (or "the means of expression"), whereas others (presumably including psychology, sociology, and anthropology) deal with "the expressed" (that is, in Piaget's terms, with "realities which have intrinsic value and normative power" [1970a:79]).

It is unnecessary to list more than a few of the more obvious objections to this curious formulation. In the first place, the distinction between "conventional" and "normative" systems is untenable in any social science, once it is recognized that "conventions" such as those of language have binding force as "norms" (Piaget himself recognizes their "coercive," "collectively imposed" aspects [1970:74]), and that many "normative" rules and symbols, together with the cultural entities which they "express," turn out upon analysis to owe their supposedly "intrinsic value" to cultural and social "conventions." It is, at any rate, impossible to draw an absolute distinction between "means of expression" and "expressed" when talking about language or any other cultural (or even personal) symbolic code, since it is characteristic of the human use of such codes that they themselves often become the objects, rather than merely the means, of expression. In the second place, the principle of the relative independence of laws of equilibrium from laws of development, invoked by Piaget earlier in the same discussion, calls for serious qualification of his assertion that "the equilibrium of norms" must in every case depend upon "their past history." The "norms" of social or cultural systems can hardly be understood without reference to the systems of which they are components at a given time, and their structural and functional properties can be studied in this synchronic perspective without reference to the vicissitudes of their "past histories," as anthropologists have recognized since Radcliffe-Brown. In this they do not differ from the "conventions" or elements of symbolic codes such as language, nor indeed from the organs of biological systems, whose functions in a particular organism may be quite different from, and relatively independent of, the functions the same organ fulfilled earlier in its evolutionary history. Finally, an objection must be raised to Piaget's use of De Saussure's contrast between synchronic and diachronic approaches in linguistics. When De Saussure argued that the question of a word's place
and functions within the synchronic linguistic system of which it forms a part is independent of the diachronic history of its previous meanings and forms, he was arguing for the independence of structural linguistics from nineteenth century historical philology. Piaget attempts to generalize directly from De Saussure’s contrast (that is, the contrast between the study of the function of a linguistic element in its systematic context and the study of the history of that element as an isolated datum) to make a quite different point, to wit that the structural study of “conventional” (e.g., linguistic) systems qua systems is of necessity confined to the synchronic plane, to the exact contrary of “normative” structures. The opposition between synchronic structure and diachronic anti-structure in linguistic analysis is, however, false. As Roman Jacobson has said (in a footnote most helpfully provided by the translator of the English edition, who however mistakenly cites it as an example of “some of the points Piaget presumably has in mind”),

synchronic investigation should be of primary interest, but that does not mean that the history of language should be excluded ... History of language acquires its real sense if the evolution of a language is seen as the evolution of the system as a whole [Piaget 1970a:80, n. 6; italics mine].

“Conventional” systems, in short, are the outcome of systematic processes of the same type as “normative” systems: both can be the objects of diachronic structural analysis. The real difficulty is that it is impossible to treat the history of language as a “genetic” process in the sense of a progressive evolution of higher levels of structure. This is, of course, ultimately a question of the temporal scale of the investigation: the history of a particular language, insofar as we can have access to it, cannot be “genetic” in Piaget’s sense, but the history of language as a whole, could it be known, presumably would have genetic aspects. The same problem of the scale on which problems are posed complicates the relationship between Piagetian theory and anthropology, as we shall see below.

Piaget’s use of the synchronic-diachronic opposition departs even further from the normally accepted usages of these terms in his discussion of transformational grammars (entitled “Transformational structuralism and the relations between ontogenesis and phylogensis”). In this section, he hails the “generative” approach of Chomsky and Harris as an escape from the “synchronic confines” of traditional linguistics (1971a: 81). The implication is that syntactic transformations as formulated by Chomsky are somehow “diachronic.” This is simply not true in terms of the ordinary definitions of these terms. Syntactic transformations are unambiguously components of langue, i.e., the synchronic structure of language, in De Saussure’s terms. The fact that a syntactic transformation involves a sequence of operations with a temporal extension and duration does not make it “diachronic,” for it involves no irreversible modification of the system of which it is a part. It is an element of the repertoire of expressive devices available to a speaker of a language at a given (synchronic) time. Piaget would have done better to substitute terms such as “dynamic” or “generative” for “diachronic,” and “static” for “synchronic.”

There is at stake here a great deal more than a mere quibble over the definition of terms: the essence of Piaget’s concepts of structure and structuralist explanation is involved. Piaget is committed to the essentially diachronic nature of both structure and explanation because he identifies both, in practice if not completely in theory, with genetic processes. He accordingly tends, again in practice if not completely in theory, to be committed to the corollary proposition that any dynamic or generative explanation must necessarily be diachronic. The result is to exclude the possibility of dynamic or generative synchronic models. Piaget of course recognizes the existence of equilibrium systems based on generative (transformational) principles: his own model of the mature human intelligence is exactly such a system (i.e., a “structure”). But Piaget wants to preserve his causal-genetic explanatory perspective on such structures by treating them as stages (albeit the final stage) of developmental (and therefore diachronic) processes. Confronted with the “synchronic structuralism” of De Saussure, the Prague School, and American linguistics, Piaget therefore attempts to treat it as the excep-
tion that proves the rule, by arguing that language is a structure of a unique type which is objectively the opposite of those dealt with by all other sciences. The advent of transformational grammar presents him with a special problem from this point of view precisely because of its similarity to his own conception of structures as generative, hierarchically organized transformational systems. He is therefore led to attempt the anomalous task of separating transformational syntax from the remainder of linguistic theory on the grounds that it is basically diachronic.

IV. SOME LIMITATIONS OF PIAGET’S “GENETIC” APPROACH AND ITS APPLICABILITY TO SOCIAL AND CULTURAL STRUCTURES

Piaget’s difficulties with linguistics are instructive because they point to certain inherent limitations of his general model with respect to its application to social and cultural phenomena. To some extent these limitations spring directly from the success of the model in dealing with psychogenetic processes. In the development of the intelligence, for example, the transformations and coordinations of transformations that constitute the structures of the higher levels of mental functions directly embody the nature of the developmental processes that give rise to those levels. There is, in short, a minimum of differentiation between genetic (diachronic) transformations and the synchronic transformations that constitute the regulations of the operations of a structure at a given point in time (or stage of development). Such considerations help to explain Piaget’s tendency to consider all transformations as essentially diachronic and his reluctance to grant the existence of dynamic, transformational, generative, or processual components within the synchronic domain. To some extent also, as we have already suggested, the problem is one of the scale or level upon which questions are posed. Piaget approaches all structural phenomena within a genetic perspective because he is committed to total causal explanations of all the features of a given “level.” If, however, as in the case of linguistics (and, for most purposes, the cases of sociology and social anthropology as well) all the known phenomena are more or less on the same structural “level,” “genetic” hypotheses must be posed on a grand scale far removed from the relatively microscopic level of analysis of particular societies, cultures, or languages at which most analytical work in these fields is carried on. Piaget’s attempts to subsume problems of structural analysis and comparison in these fields within a genetic or evolutionary perspective thus often appears as a violation of relationships of temporal or structural scale, ignoring the importance, or even the existence, of “micro”-level synchronic processes, and attempting to assimilate them prematurely to an overall “genetic” or evolutionary perspective.

Piaget’s tendency to apply the genetic frame of reference of his work on psychological development to structural analysis in other areas is at once the most distinctive characteristic of his variant of the structuralist approach and the greatest obstacle to its acceptance and application in fields where developmental questions are less salient and the central problems are bound up either with the analysis of synchronic systems or historic processes. Three broad areas of difficulty can be readily defined in Piaget’s approach to social and cultural questions. Above all there is his tendency to subsume synchronic functions or relations under diachronic processes, and then to limit the field of significant diachronic processes to genetic development. This seems, on the face of it, to rule out most of the analyses of social and cultural systems carried out by anthropologists, as well as the greater part of the work of historians. A second major difficulty, which follows directly from the first, is that Piaget’s model of the genetic process is formulated in unswervingly unilinear terms which, however appropriate they may be to the growth of biological organisms or the development of the intellect, are notoriously ill-suited to the development of human societies and cultures. The third problem is the lack of a social or cultural dimension in Piaget’s psychological theory of the developmental process of the intellect itself. As it stands, Piaget’s model of psychogenesis is formulated in an artificial sociological vacuum; he has never confronted the question of the socio-cultural components of the mind at the level of the basic structure of the psychogenetic process itself.
In discussing the limitations of Piaget's approach with respect to these three questions, it is essential to distinguish between Piaget's idiosyncratic intellectual interests and the implications and potential applications of his general theoretical concepts considered in themselves. Piaget is interested in the genetic aspects of structures because he is interested in causal explanations of why they exist. From a logical point of view, this is the most powerful question and it subsumes all others: in order to explain a thing's existence one must first analyze and describe it. As Piaget's painstaking analysis of logical processes at each stage of mental development bears witness, he does not oppose or exclude synchronic analysis: he merely sees it as a stepping-stone to the solution of more challenging and interesting problems of a diachronic nature. Similarly, Piaget's genetic approach seems at first glance to eschew the analysis of hierarchically stratified synchronic systems, and to dismiss the problems presented by the maintenance of equilibrium in such systems on the basis of feed-back mechanisms between levels as structurally insignificant. Piaget characteristically prefers to formulate the question of hierarchical relationships between structural levels in terms of the diachronic relations between successive developmental stages. The truth is, however, that Piaget bases his model of the genetic sequence of stages of mental development on a sophisticated and detailed model of the hierarchical structure of intellectual processes at each stage. It was the attempt to relate the hierarchical relations of each stage to its antecedent and subsequent stages of development that led Piaget to his most important insight into the nature of the hierarchical organization of psychological and other systems. This is the principle of "reflective abstraction," which has already been discussed. By this principle, higher system-levels are seen as consisting essentially of sets of rules or procedures for coordinating the actions or operations of lower levels, while these coordinating principles themselves are seen as consisting of generalized or "abstracted" properties of the operations they regulate. There is no intrinsic reason why this principle, like the rest of Piaget's basic theoretical concepts, could not be applied to the analysis of synchronic systems outside of a "genetic" context. The fact that Piaget does not do so reflects only his own disinterest in non-genetic problems rather than any inherent limitations of the applicability of his theory. The same can be said of the absence of any attention by Piaget to the non-genetic aspects of the historical vicissitudes of structures. Piaget is uninterested in history per se for the same reasons that he is not primarily concerned with structural variation or dynamics at the "synchronic" level (i.e., variations or transformational operations that cannot be ascribed to different stages of genetic development or the passage between them). Piaget's dictum that the nature of structure consists in the continual process of becoming structured does not lead him to history because for all important purposes of diachronic analysis he identifies the concept of structure with that of "stage" or "level." He is, in other words, interested in the "coming to be" of each level of generalized structural properties. Variations in the expression or combination of these properties that do not lead to the next higher level are of no theoretical interest to him. This, however, does not foreclose the possibility of treating either historical processes or synchronic variations in structures of the same "level" from the perspective of Piaget's concepts of structure and equilibrium. Piaget himself calls attention to this possibility by stressing the independence of homeostatic from genetic processes (1970a:77). This, of course, leaves the problem of defining the concept of "level" in operational terms, which is one of the most controversial aspects of Piagetian theory within psychology itself.

It must be admitted that Piaget himself has been slow to recognize the applicability of his general structuralist model outside the purview of his own genetic interests. The possibility of a relatively synchronic, non-genetic "constructivism," which would focus on homeostatic and regenerative cyclical and restitutive processes (e.g., as a basis for the structural analysis of social or cultural systems) seems not to have occurred to him. Instead, he repeatedly states the alternatives for structuralism as if they were limited to a choice between his own orientation ("genetic constructivism") and the static "preformationism" of Lévi-Strauss and others, who regard structures as essentially fixed, static, and atemporal, so that dynamic questions of a diachronic or genetic char-
acter cannot arise. Piaget's exclusion of the possibility of a dynamic "constructivist" approach based on regenerative and homeostatic rather than developmental processes, in the absence of data of a "genetic" type, is implicit in statements such as the following, intended to explain the static, anti-functional character of Lévi-Strauss' approach (note the implicit equation of dynamic, functional, genetic, and diachronic factors):

It is only natural that, in areas where the genetic data are unknown and beyond recovery, as in ethnology, one puts a good face on a bad situation and pretends that genesis is quite irrelevant [1970a: 140].

Piaget's disinterest in synchronic constructivist (perhaps "reconstructivist" would be a better term) analyses or diachronic but non-genetic (i.e., historical) approaches where either cannot be subsumed within a genetic framework presumably accounts for the curious lack of any concerted discussion of "cybernetic" models or any of the various forms of "systems theory" in a book devoted to a critical survey of major structuralist developments in mathematics and the natural and social sciences. Piaget's scattered references in Structuralism to cybernetic models and principles such as "feedback" seem somewhat ambiguous in relation to his own concept of "structure," no doubt as a result of their extreme brevity and the lack of any attempt at synthesis. At some points he contrasts cybernetic systems, defined as comprising temporally irreversible "regulations," with structures, which ideally consist of temporally reversible "operations," which are defined as "perfect regulations."

Cybernetic systems, then, except for the limiting case of "perfect regulations," are intermediate or imperfect structures (1970a: 15). There are nevertheless many obvious points of correspondence between cybernetic theory and Piaget's thought. For example, Piaget refers to computer simulation of artificial intelligence as "the best model" for his concept of the "epistemic subject," since it is based on a generalized set of operations and not on a model of "consciousness" (1970a:69). Elsewhere he praises Waddington's "feedback" model of the relation between evolutionary adaptation and genetic modification in biology (1970a:50, 57, 69). It is hardly accidental that Piaget's most extensive treatment of "feedback" models comes in his discussion of Waddington's application of them to a prototypically "genetic" process, viz., genetic modification in biological evolution.

The reason for Piaget's relative neglect of cybernetic models and "feedback" systems is thus only partly that, as a general category, they represent homeostatic rather than genetic processes. It stems in equal measure from his overriding concern with the properties of the limiting case of the perfectly coordinated, generalized, formalized, and above all fully reversible structure. This interest forms the corollary and complement of his interest in genetic processes: the strongest form of the problem of how structures are generated through diachronic processes is the question of how such processes can give rise to structures that succeed in transcending time itself through the attainment of perfect reversibility. Piaget, as always, reserves his primary attention for the strongest form of the problem. The mathematical group is the prototype of the completely reversible and therefore "timeless" structure, and Piaget points to several "natural" instances of groups in the logico-mathematical sense. The most important of these examples is the structure of the mature intelligence, Piaget's model for which is a group of four mutually commutative transformations. In spite of such examples, however, Piaget recognizes that most natural structures never attain perfect reversibility and remain at the level of time-bound irreversible processes. Cybernetic models are the most appropriate conceptual forms for such systems:

there is, of course, an immense class of structures which are not strictly logical or mathematical, that is whose transformations unfold in time: linguistic structures, sociological structures, psychological structures, and so on. Such transformations are governed by laws ("regulations" in the cybernetic sense of the word) which are not in the strict sense "operations," because they are not entirely reversible (in the sense in which multiplication is reversible by division or addition by subtraction). Transformation laws of this kind depend upon the interplay of anticipation and correction (feedback) [1970a:15-16].
It is not that Piaget is unconcerned with this "immense class of structures" or that his theoretical system is incompatible with the type of model required to analyze them. On the contrary, Piaget has concentrated on developing a model of the strongest case, that can subsume less powerful (i.e., less integrated, generalized, or reversible) instances in the same way that it subsumes anterior stages in the genetic process of the development of a fully reversible structure.

Just as Piaget bases his concept of structure on the strongest and most fully developed instance (the fully reversible group of transformations), his conception of the genetic process and of "genetic constructivism" as an analytical perspective applies directly only to the most powerful sub-class of genetic processes: those that give rise to structures of a higher level of structural integration. Processes leading to variations within the same level (however defined) or even a disintegration and decline to lower levels, are also "genetic" processes in the general sense of giving rise to "new" structures or states. Piaget's conception of the genetic process as a unilinear progression from lower to higher states (the "strongest" form of the process) is adapted to his interests and problems but also arises directly from his primary research experience, the study of biological and psychological growth. Both of these cases afford relatively clear-cut examples of unilinear development toward a final mature state, in which all aspects of the biological or psychological entity develop in a functionally integrated manner.

A distinction should perhaps be made between Piaget's model of unilinear genetic development as a tool that serves to define and focus the interesting aspects of any diachronic sequence of structural stages and the conviction that all things naturally develop in such sequences, to which Piaget has never subscribed. The relevance of such distinctions in Piaget's case notwithstanding, it cannot be denied that at least some of Piaget's forays into anthropological territory bear an uncomfortable resemblance to unilinear evolutionist theories of the nineteenth century variety. This remains true after due allowance has been made for Piaget's far more sophisticated criteria of "progress" in terms of the complexity, generality, and flexibility of the organizational forms of successive "stages." Piaget's anthropological problems are somewhat simplified by the limitation of his interest to the progress of scientific knowledge and logico-mathematical thought. In this sector it is easier to speak of cumulative and progressive development of a unilinear type than in other areas such as social or political organization. It remains true that anthropologists have failed to agree on criteria for ranking societies and cultures in evolutionary terms, and have turned up a wealth of evidence for the multilinearity of the historical development of human culture. Piaget cannot be said to help his case as an evolutionist, where anthropologists are concerned, by formulating his great enterprise of "genetic epistemology," the study of the development of human scientific and logico-mathematical knowledge, in terms redolent of the "ontogeny recapitulates phylogeny" notions of the speculative evolutionists of the nineteenth century (see passage quoted on page 354). Piaget's suggestions that primitive peoples may have logically less developed levels of mental functioning than contemporary Westerners, and that they may in this sense be more "childlike," certainly reinforce the parallelism. On such ground as these anthropologists are likely to dismiss Piaget's ethnological remarks (and no doubt in many cases his theoretical system as a whole) as of little relevance to contemporary anthropological problems.

Such a judgment would be ill-considered, to say the least. The basic concepts of Piagetian theory are not intrinsically bound up with Piaget's evolutionist perspective and can be applied quite independently of a genetic framework. It is also worth remembering that much of the difference between Piaget's approach and that of social anthropologists derives from Piaget's interest in different questions, and the fact that he is asking those questions on a different temporal scale. Piaget's questions are also not those of traditional evolutionist approaches. He is interested in the development of the formal principles by which human knowledge is organized, the logical structures men have developed to deal with their experience. He has never attempted to generalize his ideas in this field to other areas such as the development of social or
economic systems, religion, etc. He has never, in short, presented his ideas as a general theory of social or cultural evolution. The formal structures in which he is interested, meanwhile, are defined at such a high level of generality that they can be treated independently of particular cultural considerations. It is not that Piaget denies the validity of questions involving the relation of such structures to their particular social and cultural contexts; on the contrary. It is simply that he is interested in a different level of problems, involving the order of appearance of particular conceptual structures in cumulative scientific, logical, or mathematical traditions, and the relations between developments within a given science or body of thought with those in other areas. He has, upon occasion, demonstrated a sophisticated grasp of the socio-cultural underpinnings of particular scientific or philosophical structures (1950).

Piaget's work on the historical development of logical structures and the parallelisms between it and the genesis of intellectual structures in the individual in fact presents a challenge to contemporary social anthropology of an entirely different kind from the nineteenth-century speculative evolutionism which it superficially resembles. It is, to begin with, based on a far more sophisticated and conceptually elaborated theory of the nature of "progressive" genetic development. This theory, however, as Piaget and his collaborators have demonstrated in their psychological and historical work, is capable of being operationalized and tested. There have, in fact, already been some impressive results (published in the series *Études d'Epistemologie Genetique*, Presses Universitaires de France). With respect to the ontogeny-phylogeny argument, it is necessary to remember that Piaget's basic model of the genetic process is not, in its present state of development, a specifically "psychological" theory. It is a formal logical model, capable of being applied to developmental processes of any kind or level, whether "ontogenetic" or "phylogenetic," psychological or cultural. In pointing to parallelisms between the development of the individual psyche and the history of the sciences and mathematics, therefore, Piaget is not making the sort of psychological reductionist argument that might appear at first glance. Finally, it is worth mentioning that some field data reported by observers trained in Piagetian techniques seems to support Piaget's contention that certain logical structures may be less developed, or developed later, in primitive cultures such as the Arunta of Australia (1970a:118). Whatever the value of these data, many students are now going to the field to test Piaget's hypotheses with non-Western groups, and anthropologists would do well to prepare themselves for the possibility that their findings will tend to bear out at least some of Piaget's contentions.

If this does happen, it will present perhaps a greater challenge to basic Piagetian theory than to anthropology. Anthropologists will easily be able to accommodate their cultural perspective to the proposition that some cultures encourage the development and internalization of certain generalized abstract mental processes more than others. They will be likely to object only if mature, culturally well-adapted adults in such cultures, with the relatively low level of development of formal operational processes their cultures demand, are directly compared or considered on the same footing with retarded individuals or children with a similar "low" rating from societies where such capacities are culturally encouraged, in a way that could appear to give support to popular prejudices about the innate mental capacities of "primitives." Piaget, on the other hand, has never confronted the fundamental implications for his own theory of the possible existence of significant cultural differences in levels of logical or intellectual development, even though he has for long suggested the possibility of such differences in the context of his ideas about the historical development of logic and the sciences. Piaget's basic model of the genetic development of the intelligence is formulated as it were in a social and cultural vacuum. While recognizing Gödel's lesson that

the construction of a demonstrably consistent relatively rich theory requires not simply an "analysis" of its "presuppositions", but the construction of the next higher theory... the pyramid of knowledge no longer rests on foundations but hangs by its vertex [1970a:34],

Piaget has never attempted the theoretical
task of “hanging” his psychological theory from its “vertex” in socio-cultural phenomena. He has, in other words, not yet come to grips with the problem of the specific social and cultural mechanisms through which cultures and societies participate in and control the genetic development of the individual psyches of their members. Here there is a possibility for fruitful collaboration between social anthropologists and Piagetians. The latter have developed a theory of the stages and components of the developmental process of the intellect; the former have begun to analyze the basic developmental processes of the social groups that form the immediate context for this psychological development (the domestic group and family). It would be interesting to see whether the formal properties of such developmental processes on the sociological level might not turn out to correspond in important respects to the formal structure of the developmental process of the mind as analyzed by Piaget (Turner n.d.). This would provide a basis for the social and cultural relativization of Piagetian theory that it has heretofore lacked and better enable it to incorporate the results of the cross-cultural research now beginning to be carried out by Piagetian students.

VI. PIAGET’S CRITIQUE OF STRUCTURALISM IN THE SOCIAL SCIENCES

Piaget devotes the last two chapters of Structuralism to a discussion of structuralist approaches in social psychology, sociology, economics, jurisprudence, Marxism, and above all anthropology, as represented by Lévi-Strauss. Compared to the earlier chapters on mathematics, physics, biology, and psychology, fields of which Piaget has a broad command and from which he has drawn heavily in constructing his own theories, the treatment of the social sciences is relatively disappointing. It is obvious that Piaget approaches them as an outsider, trying to find some points of correspondence with his own ideas, rather than as a fully involved participant and critic. This does not mean that his criticisms are not often trenchant and valuable: it is simply that his discussion lacks the edge of the earlier chapters because he treats the social sciences only from the standpoint of whether they parallel or differ from his own theoretical concepts and problems, not as partners in a creative dialogue—which is, in itself, an important insight into Piaget’s theoretical perspective.

Piaget’s brief commentary on the work of Talcott Parsons is an example of his failure to bring the best in his own thought to bear in a constructive critique of one of the principal figures he chooses to discuss. He hails Parsons for going beyond the “too modest empiricism” of Anglo-Saxon sociology in his conception of social structure as a deductive system of abstract and generalized variables. He singles out for special comment Parsons’ treatment of the relation between functions and values, which he regards as implying “the necessity of distinguishing and connecting structure and function,” which is of course a fundamental tenet of Piaget’s own approach (1970a:103). Parsons’ manner of relating structure to function is, however, radically different from Piaget’s. The differences are important and highly revealing of the relative power and utility of the Parsonian and Piagetian approaches.

Parsons’ structural-functional model is a wholly deductive construct. It is based on the definition of a set of general “functional invariants,” conceived as generic properties of the interaction between an “actor” and an object or objective “situation of action.” So far, Parsons’ basic concepts are virtually identical with Piaget’s. Parsons, however, proceeds to identify this functional paradigm directly as the fundamental structural paradigm of “systems of action” in general and social organization in particular. There is thus no differentiation between “structure” and the actor or subject. Structures are conceived as actors or systems of action engaging directly in functional activity. As a result, there is no basis for treating structure as either the product or the regulatory mechanism of a conceptually distinct functional process (i.e., the activity of a “subject” or actor that cannot be wholly identified with the structure itself). For this reason, Parsons has no other alternative than to construct his model of structure by identifying the components of his functional paradigm directly with distinct structures or sub-structures on a one-to-one basis. This in
turn necessitates the deductive equation of particular components of the structural model with particular substantive functional contents. Structure, in other words, is treated as a direct expression of function: there is no way of distinguishing in practice between the structure of function and the function of structure.

For Piaget, on the other hand, the concept of function (and the generic paradigm of “functional invariants”) applies, not to structures directly, but to the constructive process by which they are generated or maintained. This process is conceived as the activity of the “subject,” which is conceptually distinguished from structure. Piaget further distinguishes between the functional aspects of subjective activity (“equilibration”) and the aspects leading directly to the generation of structure (“reflective abstraction”). Structures, in turn, are not conceived as directly fulfilling functions, or, indeed, as “acting.” They consist, rather, in generalized codes or mechanisms for regulating the functional activities of “subjects.” These distinctions provide Piaget, in contrast to Parsons, with important degrees of freedom in conceptualizing the relation between function and structure, and between the formal aspects and substantive contents of both. The formal aspects of structure can be seen in this perspective not as reflecting a pattern of functions but the pattern of a given “subject’s” operations in fulfillment of those functions with reference to a specific empirical situation. The formal properties of structure thus lose their deductive primacy and assume the role of empirical variables, dependent upon the existing structural level of the subject and the particular circumstances of the objective “situation of action.” Piaget’s model, in contrast to Parsons’, thus makes a stronger distinction between function and structure: function is not considered to “have structure,” nor is structure considered to fulfill functions. There is no formal parallelism between them, as in Parsons’ theory, nor are particular formal aspects of structure identified with particular functions. Piaget, of course, allows for the possibility of the existence of an indefinite number of functionally specialized structures in the overall constitution of a given subject or system. Because he does not attempt to equate the specialized functions of these structures directly with the generalized functional invariants of the constructive process, however, Piaget avoids the numerological rigidity of the Parsonian model of structural differentiation, in which each successive level of the hierarchy of differentiation has four functionally specialized structures, each one of which is internally differentiated according to the same fourfold pattern, and so on ad infinitum.

The differences between Parsons and Piaget are fundamental. In Piaget’s terms, Parsons’ model is actually not “structural” at all, but “formal”: its self-regulatory and abstract character is an artifact of the definition of its components rather than the incorporation of generative or transformational elements. Piaget is in an excellent position to have provided a valuable and much-needed structuralist critique of Parsons. Instead, he offers only uncritical comments on points “in common” between the two models and takes no notice of the major discrepancies between his and Parsons’ handling of the issues he mentions.

Piaget approaches Lévi-Strauss in much the same spirit as he does Parsons, with the declared intention of finding some points of correspondence between Lévi-Strauss’ concept of structuralism and his own. It is a hard job. Although Piaget is extravagantly generous and goes to great lengths to stress such parallels as he can find, by the time he finishes his review of the more glaring and unavoidable contradictions between the two systems it is clear that very little remains in common. The tone of the discussion is set by Piaget’s deferential characterization of Lévi-Strauss’ position at the outset of his critique as “this grand doctrine”—after insisting earlier that structuralism is essentially a method and can under no circumstances be understood as “doctrine”!

The outstanding quality of Lévi-Strauss’ thought for Piaget (and virtually the only one that in the end survives his criticisms), is its commitment to a deductive concept of structure (“the most strongly deductive so far developed in an empirical human science”). By “deductive” Piaget means the idea that “structure” cannot be found at the level of overt, observable relations, but must be deductively attained through the construction of models of the system of organizational principles that underlies, regulates,
or generates "surface" behavior. Piaget also
gives tentative approval to Lévi-Strauss' con-
tention that the logical operations of the
mind are prior to "mental phenomena" such
as the laws of association, and his inversion
of Durkheim's pervasive emphasis on the
primacy of the social by giving the intellect
primacy over social and cultural factors. He
notes approvingly Lévi-Strauss' "precise
placement" of his concept of structure
"midway between infrastructures and super-
structures" or "practices" (which Piaget
defines as "conscious systems of conduct or
endorses Lévi-Strauss' position, thus in-
terpreted, since

as psychogenetic studies have shown, the
mechanisms on which the individual sub-
ject's acts of intelligence depend are not in
any way contained by his conscious-
ness, yet they cannot be explained except
in terms of 'structures' (that is, only by
appealing to the [formal and mathe-
matical structures previously discussed]—
'groups', 'networks', 'semi-groups', and so
on—can we make sense of the intel-
ligence of intelligent behavior) [1970a:
138].

It is at once apparent that Piaget's endorse-
ment of Lévi-Strauss' contention that "eth-
nology is first of all a psychology" is in fact
based upon a complex misunderstanding of
Lévi-Strauss' position. Piaget's statement
proceeds from the assumption that "con-
sciousness," "superstructures," and social
(or cultural) structures are equivalent and
interchangeable terms—something Lévi-
Strauss himself has never maintained. Else-
where in his discussion, in fact, Piaget deals
with the same point in precisely the opposite
terms: commenting on Lévi-Strauss' assertion
of the primacy of the logical structures of the
intellect over both mental functions and
socio-cultural structures, he vigorously main-
tains that a dynamic and genetic structuralism
(i.e., his own position) leads to quite different
conclusions:

From [the genetic-constructivist] point
of view, the problem of the primary of the
intellect over the social or vice-versa
does not arise: the collective intellect is
simply the social, equilibrated by the play
of operations involved in all cooperations.
[Similarly] the intelligence does not
precede mental activity, nor result from it
as one among a number of the effects of
mental life. Rather, it is itself the form of
equilibrium of all cognitive functions [my

These are, however, relatively minor
issues beside the fundamental points of dis-
sonance between Piaget's theory and that of
Lévi-Strauss. Lévi-Strauss' concept of struc-
ture, as Piaget notes, is static, atemporal,
anti-functionalist, and leaves no place for
"the activity of the subject." In all of these
respects it stands in direct contradiction to
Piaget's own position. Piaget observes that
Lévi-Strauss' concept of structure as the
expression of an invariant, static and pre-
determined "human mind" (which is none-
theless conceived as prior to mental phe-
nomena) leaves open the question of the
ultimate nature of structure. If the latter is
neither social nor organic, nor mental, what
then is it? Piaget offers his own reply: there
exists a process at all three levels capable of
generating the major characteristics Lévi-
Strauss ascribes to structure (the integration
of form and content, reversibility, and syn-
chrony). This process is equilibration,
declared as "the location of a system within
its group of possible transformations" (my

As Piaget observes, to accept the notion
of equilibration as the basis of structure is
immediately to render most of the distinc-
tive features of Lévi-Strauss' position un-
tenable. To begin with, once structure is
conceived as the product of a genetic
process, it can no longer be treated in isola-
tion from function. Piaget therefore insists
that "social structure" must be conceived
along "cybernetic" lines, as consisting of
"responses" to "problems." Even primitive
systems of classification, such as those dis-
cussed in The Savage Mind, should be recon-
cceptualized as the products of the applica-
tion of sets of generative principles to prob-
lematic phenomena rather than merely as
the reflections of a static repertoire of
mental structures (1970a:115-116). Most
important of all, the human mind cannot be
regarded as static or finite. The reversibility
of the mature intelligence (and thus the
measure of atemporality it achieves) is
always itself the outcome of a complex and
irreversible temporal process. The mind must
therefore be regarded in evolutionary per-
spective as "the yet-open end-product of a continual process of auto-construction." Piaget generously grants that Lévi-Strauss' decision to focus his attention only on certain types of cultural materials partly accounts for the distortion of his conception of "l'esprit humain":

Because Lévi-Strauss' analysis installs itself from the start in finished products, the traits which are perhaps the most characteristic of human activity, even in its cognitive aspect, tend to be overlooked... man can structure himself by constructing structures; and these structures are his own, for they are not eternally predestined, either from within or from without. So, then, the history of intelligence is not merely an 'inventory of elements'; it is a bundle of transformations [1970a:119].

Piaget follows the implications of this position to their conclusion by insisting on retaining the idea of genuine differences in logical development between members of primitive and modern Western societies. Piaget takes, in effect, a modified Lévy-Bruhlian position, which he defends against Lévi-Strauss' contention that no qualitative differences exist between the "natural logic" of La pensée sauvage and that of the contemporary scientist. He presses what he calls "the real problem" of the logical level of individuals in primitive societies as they manipulate their collective cultural representations and institutions, but admits that the question must still be regarded as open for lack of conclusive evidence.

Finally, Piaget takes up the debate between Lévi-Strauss and Sartre over the nature of dialectic thought and dissents for different reasons from the positions of both (roughly, because Lévi-Strauss misunderstands the dialectic while Sartre misrepresents analytical thought). He then firmly identifies his own constructivist approach with dialectical thought, while insisting on the fundamental continuity between analytics and dialectics. From this discussion he moves on to a brief discussion of the contemporary French school of structuralist Marxists, notably Althusser and Godelier. He strongly identifies his own theory of intelligence with their interpretation of Marx's concept of thought as production. thought being a kind of 'theoretical practice' which is not so much the work of an individual subject as the outcome of interactions between the subject and his personal environment [1970a:125-126].

Piaget also gives a sympathetic account of Althusser's interpretation of Marx's idea of contradiction as the result of "over-determination," which is in turn "a necessary consequence of the inseparability of interactions" in a productive process (1970a:126). Here, however, the implications of the Althusserian-Marxist concept of contradiction for Piaget's conception of structures as self-regulating equilibrium systems seem problematic, to say the least. Perhaps Piaget feels that his own system incorporates the concept of contradiction through over-determination in its account of the passage from one stage of mental development to the next (a process that always involves a disruption of the prevailing state of equilibrium by attempts to accommodate to objective conditions that are incompatible with its "assimilative" structure). The resolution of the crisis for Piaget, however, is always another state of equilibrium or near-equilibrium, with no inherent "contradictions." It would have been interesting to have had a more extended discussion of this crucial point by Piaget, rather than the laconic summary he provides.

Piaget makes up for his relatively diplomatic treatment of Lévi-Strauss with a withering destruction of Michel Foucault, whose work he treats as the embodiment of "the negative aspects of contemporary structuralism." These he lists as "the devaluation of history and genesis" (i.e., the static character of Foucault's structures of "epistemes"); "the contempt for functional considerations"; "the radical ouster of the subject"; and the complete lack of a method. On the latter point, Piaget complains that Foucault provides no canon for the selection of an episteme's characteristics, important ones are omitted, and the choice between alternative ones is arbitrary [1970a:132].

Finally, Foucault neglects to account for the mechanisms that unite the elements of his "epistemes," so that

Indeed, in the end, his structures are mere
Piaget's critique of Foucault is less interesting as a discussion of Foucault than as a more general manifesto against much of what passes as structuralism in the contemporary social sciences. It can hardly escape notice that the sins for which Piaget belabors Foucault have all been laid directly at Lévi-Strauss' door, either by Piaget himself or other recent critics (Leach 1970; Beidelman 1971). It is hard to avoid the impression that the hapless Foucault is to some extent pressed into service as a doppelgänger for other exemplars of "static structuralism" whom Piaget did not wish to treat so roughly out of respect for their more considerable positive contributions.

The English edition of *Structuralism* (Basic Books 1970) is provided with some features lacking in the original: an index, footnotes providing bibliographical and other background information on certain points in the text, and at several places, additions to the text itself. The latter two items have been added on the initiative of the translator, in aid of "the primary purpose" of the book, "that of orienting the uninitiated American or English reader." Most of the footnotes and amplified passages do indeed serve this purpose, and for this many readers will be indebted to the translator for her conscientiousness and solicitude. The translation itself, unfortunately, leaves much to be desired, both as a rendering of the French and as coherent English (so much so that I have found it necessary to retranslate a number of the passages quoted in this review; page references in the review, however, are uniformly to the English edition).

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