Introduction: Piaget from within

Jean Piaget is widely recognized as one of the greatest child psychologists of all time. His ideas are taught in psychology courses around the world and are mentioned in every textbook on child development. But to view Piaget solely as a psychologist of child development is to betray a fundamental misunderstanding of the issues that informed his work. He was a development psychologist and more. Among his many accomplishments, he was the founder of a new discipline called genetic epistemology. The goal of this discipline was investigation of the origins of knowledge. As such, it overlapped both with child psychology and with philosophical epistemology, without being coextensive with either one. Also belonging to the field of genetic epistemology are topics in biology, sociology, and the history of science and mathematics.

It was perhaps because of such a narrow focus on the psychological aspects of his work that Piaget complained, in an otherwise friendly foreword to Flavell's (1963) comprehensive survey of his work, of having been understood "more from without than from within" (Piaget in Flavell, 1963, p. viii). In evaluating Piaget's theory, Flavell had remarked that there was perhaps too great a gap between the theory and the facts available to support it. Piaget replied that there were basic differences between Flavell's outlook and his own, consisting in the fact that "his approach is perhaps too exclusively psychological and insufficiently epistemological while the converse is true for me" (ibid., pp. viii–ix). The solution was to be found in interdisciplinary cooperation like that fostered at the Center for Genetic Epistemology in Geneva, where scholars and scientists representing the individual disciplines of psychology, logic, and mathematics could bring their expertise to bear on common problems.

If the goal of this book were to be expressed in a single phrase, it would be *to understand Piaget from within*. It is an attempt to reconstruct the original questions to which his life work was addressed and to evaluate that work in the light of those original questions. The method used is undoubtedly one of which Piaget himself would have approved. The origins of his thought will be sought in its development. Specifically, the evolution of his thinking will be traced from his precocious interests in naturalism and zoology as a child to the end of his remarkably prolific scientific career. Without such a developmental approach, one would be unable to identify the themes that motivated his work and to see how

the various parts of that work fit together to form a whole. This reconstruction of Piaget's intellectual development is based on the evidence in his published work, especially his autobiographical writings (Piaget, 1918, 1952a, 1976a). These autobiographical writings provide a key for understanding the inner development of his ideas.

The picture of Piaget that emerges from this investigation differs significantly from that of the textbooks. Many of the basic ideas that informed Piaget's life work from beginning to end were conceived before he ever considered studying the development of children's thinking. The object of Piaget's epistemological orientation was the whole "circle of sciences," of which psychology formed only a single link. The study of children's thinking was a means to the end of understanding the origins of knowledge in general. But Piaget was also interested in questions concerning values, and this interest led him to reflect on problems of morality and religion. Indeed, the problem that led him as a young man to some of his original insights was the problem of reconciling the interests of truth with the interests of value, or, as he put it himself, of reconciling science and religion. In this context, he conceived his early ideas on structure, equilibrium, and the relation between action and thought. These ideas remained with him all his life and became the core-elements of his later work, although they were conceived before he became a psychologist.

THE UNKNOWN PIAGET

Piaget's inherently interdisciplinary orientation explains in part why his theory often has been misconstrued by psychologists from within the perspective of their own discipline. Assuming that his questions were the same as their own, they have frequently been disappointed in the answers that he gave. In fact, his questions were generally different from those asked by most psychologists, and it is therefore not surprising that his answers also were different. This assimilation of Piaget's goals to those of mainstream psychology has resulted in some serious misunderstandings. The portrayal of his theory in most psychology textbooks, the conventional wisdom shared by followers and critics alike, has been inaccurate on a number of important points. For example, the view that cognitive stage development is inherently linked with age and that the concept of structure implies synchrony in development across different areas of content has often been presented as the very core of Piagetian theory, and the theory has been evaluated in these terms. Study upon study has been conducted showing that the cognitive abilities studied by Piaget either do or do not develop at the ages reported by him when certain variations are introduced into the procedures or that children's structural competencies either do or do not develop in synchrony in tasks involving different content. Depending on how the weight of evidence is judged, the theory has been taken to be either supported or refuted. In fact, one searches in vain through Piaget's published writings to find any unequivocal statement of this hypothesis of global developmental synchrony. For the most

part, he did not address the issue at all. Occasionally one finds explicit denials of the views commonly attributed to him. Because he never advanced many of the hypotheses commonly believed to lie at the core of this theory, much of the evidence adduced either for or against those hypotheses is irrelevant to the questions addressed by the theory in its original form. This topic is treated in detail in chapter 7 of this book.

Other common characterizations of Piaget's theory have been based on selective readings of his voluminous writings. He has often been accused, for example, of not having paid sufficient attention to specifically social factors in development. He has been criticized both for overemphasizing environmental factors and for underemphasizing them. Many such criticisms are based on limited familiarity with the entire range of Piaget's work. This circumstance can be explained in part by his very prolificity and by the fact that many key works, including the three-volume *Introduction à l'épistémologie génétique* (Piaget, 1950/1973a, 1950/1974a, 1950a), the three books on operatory logic (Piaget, 1942, 1949/1972a, 1952b), and the *Etudes sociologiques* (Piaget, 1965/1977a), still are unavailable in English translation. Isolated passages can indeed be found that appear to support the common interpretations, especially if they are read outside the context of his work as a whole. Given the sheer volume of his writings, one can read a great deal and still miss much that is essential. It is of no help that much of what is central to an understanding of genetic epistemology is to be found in the untranslated works cited earlier. Piaget's treatment of the effects of social, environmental, and other factors in development may or may not be adequate. But he did not simply neglect those factors to the extent that is commonly believed.

This book is inspired by a growing perception of the discrepancy between the conventional image of Piaget and the picture that emerges from a broad reading of his life's work. It is an attempt to reconstruct his original questions, not primarily a defense of his answers to those questions. Much can be found to criticize in his theory. But in order to criticize it in an informed way, one must first understand it in its own terms. The first problem is how well Piaget succeeded in answering his own questions, as opposed to the questions that others might have asked in his stead. Then one can also ask to what extent his ideas are useful in contributing to the answers current in contemporary psychology.

The reconstruction of his original questions necessitates a consideration of certain problems lying outside the boundaries of psychology as it is typically defined. But Piaget's interdisciplinary perspective is not the only difficulty to be found in his writing. Many commentators have remarked on the obscurity of his style. This impression is due in part to the fact that his habits of thinking and writing were formed in the context of a much different intellectual tradition than that of present-day professional psychology. His conventions were not necessarily our conventions, his usages not always the same as ours, and even when the same terms were employed, they often had different connotations. Piaget had a penchant for attempting to express new thoughts in existing terminology. This

meant that he frequently came to use familiar terms in quite idiosyncratic ways. If such differences in meaning go unnoticed, serious misunderstandings can result.

Our task of interpreting Piaget would have been easier if his writing had more frequently taken the form of dialogues with actual or potential critics, or if he had more consistently attempted to compare and contrast his own concepts with those employed in other theoretical approaches in psychology. When he did engage in such dialogue, the results were often illuminating, but more often he continued to develop his own ideas according to their own internal logic without taking the time to interpret himself to others who did not share his basic assumptions. Given the immensity of the task he had set for himself, this procedure was perhaps inevitable, but it has made it easier for Piaget's interpreters to understand him in their terms rather than his own. Part of the task of this book is to clarify Piaget's terminology so that his theory can be understood literally "in its own terms."

The context in which Piaget conceived his basic ideas had both personal and historical dimensions. There was a strain in Piaget's early thinking that can best be described as "cosmological" – not in the sense of speculating about the ultimate nature of the universe, but in the sense of seeking in science answers to questions about the value and meaning of human life (Toulmin, 1982). This aspect of his thought was carefully subordinated to the requirements of professional rigor in his scientific writings, a fact that may have lent an added layer of ambiguity to them, for his mature theory was in part a product of this early cosmological vision. As described in chapter 1, Piaget, as a young man, envisioned a synthesis of science and values in which a new science of "types" (or "genera") would play a leading role. In the form of an empirical investigation into the foundations of knowledge, this new science would provide a means for resolving the conflict between scientific truth and ultimate value. In practice, ascribing such a role to science meant that the terms of scientific discourse became loaded with wider connotations not immediately apparent on the surface.

In this respect, Piaget's autobiography from 1952 is an important document for understanding the hidden implications of his ideas. In chapter 1, the autobiography is seen as a key for decoding the surplus meanings in many of Piaget's terms. In this autobiography, Piaget described the central formative experience of his youth: Between the ages of 15 and 17, he suffered a severe personal crisis having to do with the conflict between science and religion. This may have had something to do with the fact that his mother was a devoutly religious woman with neurotic tendencies, whereas his father was a religious skeptic. Our purpose is not to speculate on the psychological causes of this crisis, but rather to examine its intellectual content and its possible relation to his later work.

The crisis was precipitated by the young Piaget's discovery of philosophy, specifically, the philosophy of Bergson. It was overcome through the formation of an original philosophical system in which the conflicting claims of scientific knowledge and religious belief were reconciled through a new science of genera.

The fundamentals of this new science were described in detail in an autobiographical novel that Piaget wrote at the time and published in 1918 at the age of 21. This novel, entitled *Recherche*, is another key document in the interpretation of the Piagetian opus. Many of the central concepts in Piaget's later theory, including the concepts of structure, equilibrium, and action, were foreshadowed in this early system. More important, perhaps, is the fact that the system provided the young Piaget with a solution to his immediate problems of identity in the form of a life project that satisfied the conflicting sides of his personality. He would devote his life to the realization of the new science. The latter would in turn provide the basis for resolving the conflict between science and value, which he identified as the principal cause of contemporary world problems. Understood in this light, scientific research became a value-laden activity in itself, providing the young Piaget with nothing less than a mission in life.

With regard to investigating the origins of knowledge, Piaget fulfilled his adolescent ambitions to a degree he could not have foreseen. Whether or not genetic epistemology as it has evolved in practice can help to answer questions regarding the meaning of life is another question. Such questions, however, may be asked independently of questions regarding the scientific merit of Piaget's theory. The fact that this theory may have been partially motivated by adolescent aspirations of a quasi-religious nature may be useful in understanding the origins of his theory without prejudicing the evaluation of his theory as science. It is nevertheless of interest to ask how the theory fares in answering some of the questions that originally motivated it.

One such question was the age-old philosophical problem of universals. There is evidence from Piaget himself that his early conception of a new science of genera was influenced by his encounter at a crucial moment with the problem of universals, both in the philosophy of Bergson and in the lectures of A. Reymond at the University of Neuchâtel. This encounter led directly to the idea of the new science of genera as described in *Recherche*. Bergson had realized that the problem of universals recurred in modern psychology in the form of accounting for the origins of *general ideas* and in biology in terms of explaining the unity of individual organisms and their classification in genera and species. For the young Piaget, genera came to be conceived as the basic forms of organization in all life, from the structures of the human mind to the structures of the living organism. The originality of this approach consisted mainly in the fact that the problem of universals was transformed into a program of scientific research. As forms of knowing, genera could be investigated through psychological methods, and as forms of life they could be objects of biological study. Moreover, a developmental continuity was seen to exist between human cognition and other levels of biological organization. The relation between Piaget's work and the problem of universals will be treated at greater length in chapter 8. Besides playing an important role in the genesis of his core-ideas, this problem provides a convenient context for discussing the implications of his theory for some traditional issues in epistemology.

The ways in which Piaget's early conception of genera was transformed in his later work will be traced in detail in subsequent chapters of this book. In particular, his later concepts of structure and equilibrium can be seen to have developed from this source. As described in chapter 1, genera were conceived of as relational totalities, arising at all levels of reality out of the interactions among their component parts.[1] This conception of genera was a precursor of his later concepts of "total structures" and "structures-of-the-whole" (*structures d'ensemble*). The coherence of such relational totalities resulted from their particular forms of equilibrium, of which four could be distinguished: the equilibrium of the whole, the equilibrium between the parts and the whole, the equilibrium among the parts taken by themselves, and the equilibrium between the whole and the external environment. These forms of equilibrium, already outlined in *Recherche,* were the beginnings of Piaget's later attempts to explain development in terms of a principle of equilibration, a fact also noted by Inhelder, Garcia, and Vonèche (1977). In order to grasp the central importance of the notions of structure and equilibrium in Piaget's work, one must try to see how they were related to his conception of development.

STRUCTURE AND EQUILIBRIUM

Well before Piaget ever thought of investigating children's thinking, the concept of development provided him with a standard for judging the relative adequacy of different forms of knowing. According to this reasoning, more highly developed forms of knowing were by that very fact more adequate than less developed forms. In order to play this normative role, however, development had to be distinguished from mere change. Otherwise, one would be in the position of defending the dubious proposition that forms of knowing appearing later in time were necessarily preferable to forms appearing earlier. In order to distinguish developmental progress from nonprogressive change, some independent criterion was necessary.

Piaget found such an independent criterion of developmental progress in the

1 Kitchener (1985, 1986) argued that, for Piaget, relational totalities (e.g., structures) are composed of their parts, plus the relations among their parts. As such, they possess emergent properties relative to their parts but not relative to their internal relations. I agree with this formulation as long as one includes under the term "relations" all the *possible* or *virtual* relations among the parts and not merely those that have been realized at any given time, For Piaget, the whole is pregnant with new possibilities and is therefore more than the sum of its parts and their actual interactions. These "structural possibilities" nevertheless have real consequences (Inhelder & Piaget, 1955/1958, pp. 260–266). For example, the development of novel forms of action and thought was explained by Piaget as the realization of possibilities created in the formation of a structure. A structure develops from real interactions, but contains possibilities beyond those from which it was formed. Kitchener's formulation should therefore be amended as follows: For Piaget, relational totalities possess emergent properties with respect to their parts and with respect to the actual relations among the parts, but not with respect to all the virtual relations. The evidence for this interpretation is presented in subsequent chapters of this book.

idea of equilibrium. Like the notion of structure to which it is related, this central organizing concept runs like a thread through all of Piaget's life work. Already present in an intuitive form in his adolescent philosophical system, it provided the basic insight behind his views on developmental change, achieving its mature expression in his book on equilibration published only 5 years before his death (Piaget, 1975/1985). In this respect, Piaget's life work represents a remarkable unity from beginning to end.

In its original form, the concept of equilibrium referred to a system of dynamic compensations in which the effective forces at work were each balanced by reciprocal influences. From the standpoint of the system, such a balance was desirable, for the action of uncompensated forces could lead to disintegration of the whole. As described in *Recherche,* equilibrium referred specifically to the effects of totalities on their several parts and the reciprocal effects of those parts on the whole. In this interaction of the parts and the whole, either of them could be more or less altered or preserved. Of the various forms of equilibrium resulting from this interaction, the most advantageous was one in which the reciprocal effects of the parts and the wholes balanced each other out. The predominance of either the whole or the parts led to rigidity or disintegration, respectively. This interaction between parts and wholes played itself out "on all levels," including the biological, the psychological, and the social. On the biological level, the relation between parts and wholes could be seen in the relations of the cell to the organism and the organism to the species. On the psychological level, it could be seen in the relationship between general concepts and their individual instances. On the social level, it could be seen in the relation between the individual and society. Piaget's later contributions in all these fields would bear the marks of this early conception of the relation between parts and wholes in relational totalities.

Piaget's later concept of cognitive structure, for example, was a direct descendant of this early vision of totalities in equilibrium. In this case, the role of the "parts" is played by cognitive operations, and that of the "whole" by the *structure d'ensemble* that comprehends them. Structural equilibrium consists in the fact that each operation is reversible – that is, it is compensated by a reverse operation contained in the same structure. For example, the grouping structure called "primary addition of classes" refers to the classification of objects into a hierarchy of classes and subclasses (i.e., genera and species) on the basis of common attributes. The "components" of this structure are the operations of joining and separating (the "addition" and "subtraction" of classes). Their particular equilibrium consists in the fact that every operation of joining is compensated by an inverse operation of separating, and vice versa (see chapter 5).

But equilibrium was never conceived by Piaget as a state to be achieved once and for all. Every equilibrium was only partial; for every achieved equilibrium, there was a higher form of equilibrium toward which the existing one tended to evolve. This process was the primary motor of development. In *Recherche,* the "ideal equilibria" toward which all totalities tended were distinguished from real

equilibria, which were only partial, imperfect, and therefore temporary. Even among real equilibria, lower forms of equilibrium could be distinguished from higher forms, and development was viewed as a process leading from the one to the other. In his mature theory, higher and lower forms of equilibrium could be distinguished from each other in terms of the number and scope of the compensations that they comprehended. Higher forms of equilibrium were more stable than lower forms, because they were capable of compensating for a wider scope of possible operations. They could therefore function under a broader range of possible conditions without danger of disintegration. For example, formal operational structures represented a higher level of equilibrium than concrete operational structures, because the former included two types of reversibility (negation and reciprocity) and the latter only one (negation or reciprocity, but not both).

With this concept of equilibrium, Piaget could distinguish development from mere change. Development was change that led from a lower form of equilibrium to a higher one, defined in the preceding manner. Such a formulation did not yet specify *how* higher forms of equilibrium evolved from lower ones, but it did provide Piaget with what he needed in order to make his overall project viable: a normative standard for distinguishing more adequate forms of knowing from less adequate forms. In his later work on equilibration (Piaget, 1975/1985), he addressed the question of how progressive development occurs in more detail. There the focus was on the *process* by which a higher form of equilibrium succeeds a lower one.

The concept of equilibrium further provided Piaget with a normative standard for judging forms of knowing at all levels, from the earliest forms of sensorimotor functioning to the most advanced forms of scientific thought. As an end state to which all systems tend, the notion of ideal equilibrium imbued each system with implicit value. Higher forms of equilibrium were necessarily "better" than lower forms; the "good" was the progressive realization of the ideal equilibrium. In this sense, the notion of equilibrium was relevant to the question of science and value. On the one hand, equilibria as forms of organization could be investigated scientifically at every level of life, from the single cell to human society. On the other hand, such forms of organization were themselves imbued with value. Because scientific investigation could distinguish higher and lower forms of equilibrium, certain questions of relative value potentially could be settled through scientific means.

From this point of view, research in epistemology became endowed with value in its own right. In one of his more rhapsodical moments, Piaget identified the Divine with thought itself as the condition of all existence (Piaget, 1928a). In tracing the history of forms of knowing, the genetic epistemologist became a medium by which thought became aware of itself. It is easy to imagine how genetic epistemology, so conceived, could be experienced as a form of self-transcendence. In fact, Piaget produced several works on religion from a developmental point of view (Piaget, 1922a, 1928a, 1929a, 1930). These writings will be examined in chapter 2.

From one perspective, the personal connotations that genetic epistemology might have had for Piaget are irrelevant for the evaluation of his ideas. They were simply "personal preoccupations" that became "filtered out" of his scientific work (Toulmin, 1972). However, his interest in questions of ultimate values and their relation to science is interesting in its own right and relevant for understanding the origins of some of his basic intuitions. This is especially true for the central concepts of structure and equilibrium.

THOUGHT AND ACTION

Another of Piaget's fundamental intuitions had to do with the relation between thought and action. In this case as well, Piaget was decisively influenced by Bergson, and by pragmatism in general. But where Bergson tended to see a dichotomy between thought and action, Piaget preferred to see a developmental continuity. Thus, he viewed the very operations utilized by logical and mathematical thought as developing from the interiorization of action. Logico-mathematical operations of addition and subtraction developed from actions of joining and separating through a process of interiorization. This interiorization made possible a further characteristic of logico-mathematical operations: their *reversibility*.

For Piaget, operational reversibility was no mere return to the point of origin. The latter he called "the empirical return" or "revertibility" (*renversabilité*), as opposed to true operational reversibility (*réversibilité*). The difference between the two consists in the fact that revertibility of actions occurs in sequential time, but operational reversibility involves simultaneous coordination. Thus, the revertibility of an act of joining means that it can be undone by a subsequent act of separating. In contrast, the reversibility of a logico-mathematical operation consists in the fact that the subject, in applying that operation, realizes that it is simultaneously compensated by a potential inverse operation.

This reversible property of operations links Piaget's concept of action to his ideas on structure and equilibrium. He was fond of saying that an operation never exists in isolation, but always in relation to a whole system of operations. The child who has learned basic addition will be able to add not only 2 and 2 but also a whole range of other possible numbers. Moreover, each of these individual operations of addition will be reversible by inverse operations of subtraction. The whole system of direct operations and their inverses is an example of what Piaget called a *structure d'ensemble*. In terms of the young Piaget's conception of relational totalities and equilibria, logico-mathematical operations represent the "parts," the total structure represents the "whole," and the reversibility of operations is its particular form of equilibrium. The development of logico-mathematical operations out of sensorimotor actions represents a development from a lower form of equilibrium to a higher form, because sensorimotor actions are compensated only through sequential revertibility, whereas logico-mathematical operations are compensated both by revertibility (to the extent that they are se-

quentially enacted) and by operational reversibility (even if they are not sequentially enacted).

These matters will be elaborated in greater detail in subsequent chapters of this book. For the moment, one should only note that the concepts of structure, equilibrium, and action represent the core-elements of Piaget's lifelong research program (cf. Beilin, 1985). They are the basic themes developed in the symphony of his life's work. The transpositions, transformations, and modulations of these themes will be traced at the points at which they occurred in his development.

PLAN OF THE BOOK

This book is organized in eight chapters: The first six follow Piaget's intellectual development from his early preoccupations with naturalism and philosophy in adolescence to the mature expression of his ideas in the last decades of his life. Chapter 1 is primarily devoted to a description of Piaget's adolescent personality crises and the philosophical system that led him out of it. Chapter 2 follows his early career from his first works on children's thought and language to his writings on social, moral, and religious thought in the 1920s. Chapter 3 focuses on his observations of the "logic of action" in sensorimotor development that he published during the 1930s. Chapter 4 begins with the discovery of grouping structure and continues with his work on concrete operations across the decade of the 1940s. Chapter 5 covers the period from 1950 to about 1965 and describes the writings produced during this period on epistemology, logic, perception, and mental imagery. Chapter 6 completes the survey of his life's work, covering the writings on biology, equilibration, preoperational structures (functions and correspondences), and the history of the sciences.

The last two chapters undertake to provide a context for evaluating the theory from different perspectives. In chapter 7, Piaget's theory is viewed from the perspective of scientific psychology. Certain widespread misconceptions about Piaget's theory are corrected, his theory is compared to current neofunctionalist approaches (Beilin, 1983), and a possible synthesis of structural and functional approaches is proposed. In chapter 8, the implications of Piaget's theory for traditional epistemological problems, including the problem of universals, are discussed. His theory is compared to other current approaches to problems of form and structural stability. Finally, "cosmological" dimensions of Piaget's ideas are reconsidered, and the question is raised to what extent Piaget's mature views are relevant to the deeper problems of human existence that he pondered as a young man.