

Special Section

PIAGET'S LEGACY

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There have been many published assessments of Jean Piaget's work over the years, both during his lifetime and since his death in 1980. One has only to look in any introductory textbook on developmental psychology or cognitive development to find examples. Most of these assessments mention both praiseworthy and criticizable aspects of his work, but often give more space to the latter than to the former. This is understandable. In most cases, identified weaknesses in his work are proxies for important scientific discoveries made by subsequent researchers. That is, we learn that some Piagetian developmental story is probably wrong by doing research that points to some alternative, more correct-seeming story. Naturally, it is important for the people who write about cognitive development to communicate both the weaknesses and the scientific discoveries that revealed them and took us the next step forward.

In the present assessment, I take a different tack, however. Useful though it is to examine the criticizable in Piagetiana, I focus entirely on the praiseworthy in this article. My objective is to summarize what I believe to be Piaget's contributions to what we know about cognitive development and how we think about it. Everyone knows that Piaget was the most important figure the field has known; the purpose of this article is simply to explain why.

PIAGET'S CONTRIBUTIONS

1. Piaget's greatest contribution was to found the field of cognitive development as we currently know it. As Miller (1993) explained:

Piaget transformed the field of developmental psychology. If a developmental psychologist were somehow plucked out of the 1950's and set down today, he would be bewildered by the talk around him. He would hear psychologists discussing strategies, rule-governed behaviors, cognitive structures, schemes, plans, and representations, instead of stimulus generalization, mean length of utterance, mental age, conditioning, discrimination learning, and learning set. To a great extent Piaget was responsible for this change. He altered the course of psychology by asking new questions that made developmentalists wonder why they had ever asked the old questions in the first place. Once psychologists looked at development through Piaget's eyes, they never saw children in quite the same way. (p. 81)

As a developmental psychologist who began his career in the 1950s, I can attest to the accuracy of Miller's characterization. Piaget provided the field with an entirely new vision of the nature of children, and of the what, when, and how of their cognitive growth. This vision invaded the field during the 1960s and 1970s and largely supplemented the rather limited and uninteresting visions that were already there. The result was that

"almost everything people think and do in this field has some connection with questions that Piaget raised" (Flavell & Markman, 1983, p. viii). Thus, Piaget's role in cognitive development was similar to Chomsky's role in language development: He created and shaped a new field of inquiry.

2. Piaget's *assimilation-accommodation* model of cognitive growth correctly emphasizes the active, constructive nature of the child. This model allows us to view cognitive development as a gradual, step-by-step process of structural acquisition and change, with each new mental structure growing out of its predecessor through the continuous operation of assimilation and accommodation. It is largely due to Piaget that we now take for granted that

children are clearly not blank slates that passively and unselectively copy whatever the environment presents to them. Rather, the cognitive structures and processing strategies available to them at that point in their development lead them to select from the input what is meaningful to them and to represent and transform what is selected in accordance with their cognitive structures. As Piaget correctly taught us, children's cognitive structures dictate both what they accommodate to (notice) in the environment and how what is accommodated to is assimilated (interpreted). The active nature of their intellectual commerce with the environment makes them to a large degree the manufacturers of their own development. (Flavell, 1992, p. 998)

Views similar to Piaget's constructivist conception are widely held by present-day cognitive psychologists as well as by cognitive developmentalists. As Halford (1989, p. 326) has pointed out, Piaget's conception also anticipated schema theory and the concept of constraints on learning. Bates and Elman (1993) even went so far as to predict that

we will soon see a revival of Piagetian theory within a connectionist framework—not a mindless reinterpretation of the old theory in modern jargon, but a return to Piaget's program of genetic epistemology, instantiating his principles of equilibration and adaptation in concrete systems that really work—and really change. (p. 17)

3. Piaget helped us to accept the idea that children's cognitive behavior is intrinsically rather than extrinsically motivated. Although social and other reinforcements may influence children's curiosity and cognitive explorations to some degree, basically children think and learn because they are built that way. For Piaget, cognitive adaptation to the environment via the mechanisms of assimilation and accommodation is a form of biological adaptation, and adaptation is something organisms have evolved to do. Cognitive functioning, and cognitive-structural change through repeated cognitive functioning, have their own internal power source and are certain to occur in every human child. It might be objected that everyone has always believed this, but that is not the case. In the 1950s, psychologists were just beginning to play with such notions as curiosity, competence, exploratory, and sensory motives and

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drives, and in the early 1960s it was natural to write, "It seems less improbable today than it once did to imagine that the Piagetian infant really does need to look at, listen to, and otherwise assimilate stimuli, even (perhaps especially) when he is not hungry" (Flavell, 1963, p. 410).

4. Piaget saw that to characterize human cognitive development adequately, one needs something less general than the functional invariants of assimilation and accommodation, co-present in all cognitive activity, but also more general than an endless list of specific acquired concepts. For Piaget, that something was cognitive structure:

There has to be some *tertium quid*: something which changes with age, as the functional invariants do not; but also something more general than individual contents, something which will pull diverse contents together into a single chunk. Piaget realized this early and wisely resisted what we think was the guiding spirit of the 1930's: to move upward towards function (the child "learns" more and more things as he grows, but the mind which learns is homogeneous throughout) and to move downward toward content (as he grows, the child acquires this, and this, and this, and this—*period*). However critical one may be of the particular structural analysis Piaget has made, we are much in his debt for seeing so clearly, and so early, the necessity for making one. (Flavell, 1963, pp. 409-410)

Although developmental psychologists have indeed criticized the particular structures Piaget proposed in the years since those lines were written, most continue to see the need for structural analyses of one kind or another. Thus, we continue to read about grammars, schemas, scripts, rules, systems, central conceptual structure, and other structural concepts. Similarly structural in nature are characterizations of cognitive development as the acquisition of naive theories within specific domains (Wellman & Gelman, 1992). One would not be licensed to describe the child's knowledge about the mind as a theory of mind unless one thought it consisted of a set of interrelated concepts—and thus a knowledge structure—rather than a set of unrelated ones.

5. In elaborating his *equilibration* model, Piaget was one of the first psychologists to make a serious try at explaining as well as describing cognitive development. He argued that all significant intellectual advances are made through an equilibration process consisting of three major steps: first, cognitive equilibrium at a lower developmental level; then, cognitive disequilibrium, induced by awareness of puzzling, contradictory, discrepant, or otherwise unassimilable phenomena not previously noticed; and finally, cognitive equilibration (or reequilibration) at a higher developmental level, as the result of reconceptualizing the problem in such a way as to make sense of the previously nonassimilable phenomena. Although this model clearly has its problems (lack of clarity and specificity, apparent inapplicability to certain types of developmental change), we are only now beginning to see attempts at explanations of cognitive-developmental changes that appear more promising (Siegler, 1996). Moreover, recent explanations of naive theory development in children feature a change process very reminiscent of Piaget's equilibration model (e.g., Bartsch & Wellman, 1995; Gopnik & Wellman, 1992).

6. Piaget proposed many insightful concepts and ideas in the course of his extensive theorizing about cognitive development.

The Piagetian concept of *scheme* (or *schema*) is one such. The image of children searching for objects to assimilate to their developing action schemes—for example, searching for countables with which to exercise their newly minted counting scheme—seems very true to life (Gelman, 1979). Similarly, his concept of *vertical décalage* captures the possibility that there are hidden similarities or recursions in children's functioning across different stages of development. "Development in the Piagetian mode has a cyclic character which buttresses the feeling that it is somehow all of one cloth" (Flavell, 1963, p. 408). Neo-Piagetian theorists such as Case and Fischer have also found it necessary to build such recursiveness into their stage theories. For example, Case et al. (1991) proposed that the three substages of *unifocal*, *bifocal*, and *elaborated* coordination are found within each of four major stages of development. Piaget's belief that images are active internal imitations rather than passive copies of external objects and events anticipated the concept of mental rotation (Shepard & Metzler, 1971). The concepts of *egocentrism*, *centration*, and *decentration* have proven to be very useful in understanding the development of both social and nonsocial thinking. Piaget's idea that a person's own point of view tends to be more salient and available to him or her than the points of view of other people finds its modern counterpart in Tversky and Kahneman's (1973) availability heuristic. Piaget's concepts of *reflective abstraction* and *formal operations*, involving the idea of cognition about cognition, live on in Karmiloff-Smith's (1992) developmental theory and in the large developmental and nondevelopmental literature on metacognition.

Gelman (1979) described another insight thusly:

Piaget was the first to point out the role of transformations in a theory of cognition. The world is known not only in terms of static representations of it; we "know" how transformations will affect objects or classes of objects. Likewise our representations include knowledge of those transformations that do and do not change certain properties of an object or class of objects. How such knowledge develops is a central concern of Piagetian theory. Since I cannot imagine anyone denying the central role of transformations in a theory of cognition, I think we will continue to be influenced by Piaget's ideas and related observations on the object concept, conservation, etc. (p. 5)

Finally, although we often think of Piaget as focused on developmental discontinuities from one age to the next (qualitatively different stages, etc.), his emphasis on invariant developmental sequences strongly highlights underlying continuities in development. He emphasized the idea that, despite their novel features, later structures grow out of and build upon earlier ones:

He at once shows us wherein a new structure is really new, is a true emergent, and at the same time shows us wherein it is not new, is not something inexplicable in terms of antecedent events. In Piaget's scheme of things, all structures are emergents but no structures are emergents *ex nihilo*. (Flavell, 1963, p. 416)

7. Piaget contributed importantly to our stock of research methods for studying children's intellectual growth (Beilin, 1992). He pioneered the use of a clinical method, in which the researcher probes for the child's underlying understanding and

knowledge through repeated questioning. Most of us still use variants of this method in our research, especially in the pilot-testing phases. A related contribution is that early in his career he had the insight—novel at that time—that one can learn more about children's thought by noting and querying their incorrect answers than by just tallying their correct ones. That is, he recognized that "the 'wrong' or 'cute' notions that preschool children have about the world are the symptom of a complex, probing intellectual system that is trying to understand reality" (Miller, 1993, p. 84).

8. For many people, of course, Piaget's most important contributions have been his remarkable empirical discoveries, far too numerous to summarize here:

What may well be one of Piaget's most important and enduring legacies to the field is simply that he has revealed the development of cognition to be a thing of unsuspected and extraordinary richness. Piaget has systematically ploughed his way through most of the principal modes of human experience and knowledge—space, time, number, and the rest. And in each case he has laid bare a complex succession of preforms and precursors for the most mundane and obvious of cognitions, cognitions we had no reason to assume needed a prehistory, let alone such an involved one. It is an uncommon experience to find out something about children's behavior which really surprises, which produces a sense of shock and even disbelief; after all, people have been child-watching for a long time. But Piaget may have discovered more things about children which shock and surprise than anyone else, and this alone is an immense accomplishment. (Flavell, 1963, p. 411)

Gelman (1979) further noted that Piaget gave us "some of the most reliable phenomena in psychology" and that "they are amongst the phenomena that make it possible to claim there is a field of cognitive development" (p. 6). Clearly, Piaget had the greenest thumb ever for unearthing fascinating and significant developmental progressions. Just compare what Piaget discovered in his career with what the rest of us have discovered in ours (considered singly or—it sometimes almost seems—even collectively!).

9. Piaget's descriptions give us a highly memorable and at least fairly true picture of how children at different ages think. The qualitative thought of the preschooler, the more quantitative and logical thought of the elementary school child, the more abstract and metacognitive thought of the adolescent—although these pictures are not wholly accurate, they do capture much of the essence of the child's mental tendencies during these age periods. Siegler (1991) expressed this point well:

What explains the longevity of Piaget's theory? Perhaps the basic reason is that Piaget's theory conveys an almost tangible sense of what children's thinking is like. His descriptions feel right. Many of his individual observations are quite surprising, but the general trends that he detects appeal to our intuitions and to our memories of childhood. (p. 18)

10. Piaget's work has had important influences on fields other than cognitive-developmental psychology. For example, his ideas and tasks have been used extensively in the fields of educational psychology, special education, socioemotional development, childhood psychopathology, and comparative psychology. His ideas have also influenced the thinking of profes-

sionals (e.g., Brazelton) who provide advice about parenting practices to the general public. His conception of children as active, constructive thinkers who learn only what they are structurally ready to learn has had an especially profound influence on educational thinking and practice. Indeed, it is hard to see how the contemporary field of instructional psychology would have developed as it did had there been no Piaget.

11. Ultimately, Piaget's most important and enduring legacy may not be his theory and research findings as much as the deep questions and issues he raised: What development-making cognitive equipment is the child born with? What role do interactions with the environment play in the child's development? How can we diagnose the child's competencies accurately, without either overestimating or underestimating them? What would it mean to claim that cognitive development is stagelike, and how stagelike is it in fact? Are there invariant developmental sequences and, if so, why are they invariant? What are the mechanisms or processes that cause cognitive development to occur? And so on and on. Piaget got us started, and by continuing to wrestle with the issues he bequeathed us, we will continue to learn more about children's intellectual development (Siegler, 1991).

CONCLUSION

This description of Piaget's contributions has been very laudatory. Has it been too laudatory? Some readers may think so, but I do not. I think we are in more danger of underappreciating Piaget than of overappreciating him, for much the same reason that fish are said to underappreciate the virtues of water. That is, many of Piaget's contributions have become so much a part of the way we view cognitive development nowadays that they are virtually invisible. The invisible would quickly become more visible if one were to examine a child psychology textbook written in the 1950s and compare what the field was like then to what it is like now. A footnote in Beilin's (1992) article on "Piaget's enduring contribution to developmental psychology" says it all:

An anonymous reviewer of a draft of this article . . . observed that "assessing the impact of Piaget on developmental psychology is like assessing the impact of Shakespeare on English or Aristotle on philosophy—impossible. The impact is too monumental to embrace and at the same time too omnipresent to detect." I agree. (p. 191, fn. 1)

Me too.

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