

Book Reviews

POSSIBILITY AND NECESSITY: VOLUMES 1 AND 2

by Jean Piaget, translated by H. Feider.

Minneapolis: University of Minnesota Press, 1987. Vol. 1, 159 pp. \$25.00; Vol. 2, 149 pp. \$25.00.

Possibility and Necessity is Jean Piaget's last work. Other important works are appearing that have been completed by coauthors after Piaget's death, and Volume 2 of this set received its careful final editing from Bärbel Inhelder, but this will remain the last complete work written by Piaget himself. It is fitting that it focuses on a topic that has been central to Piaget's epistemology throughout his oeuvre: the genetic epistemology of possibility and necessity.

Issues of possibility and necessity are inextricably embedded in even the simplest forms of knowing: any decision, even an infant's choice of which toy to pick up, is in some sense a selection among understood possibilities. Similarly, any exploration is an exploration of a space of possibilities. Further, all knowledge and understanding are of something being *possible or impossible*, or of something being *actually* the case within some space of possibilities, or of something being the *only* possibility—being *necessary*. *Modal logic* explores the formal logical relationships among such notions as actuality, possibility, and necessity, and between such modal notions and other forms of knowledge. But modal logic does *not* explore the *epistemology* of such modal notions—how we come to know and understand them. Piaget is virtually unique among contemporary psychologists and developmental psychologists alike, for not

only addressing the epistemological problems of modality, but, still more deeply, for arguing and demonstrating that modality is not just one additional realm of knowledge and development alongside many others, but is fundamentally central to *all other* knowledge and development. If this view is correct, then any model of development, and correspondingly, any model of education, that does not account for this centrality of modality is thereby inaccurate, limited, distorted, and ultimately misleading.

Volume 1 of *Possibility and Necessity* examines the child's developing understanding of possibility. It presents the results of thirteen studies exploring the development of children's knowledge of what is possible—of what *can* be done or cannot be done in various tasks. As he has in his earlier work, Piaget reveals remarkable differences in young children's thinking. Here is an example from a child of 4 years and 11 months, who was asked to indicate all the ways that a toy car could get from a point A to a point B in a room:

Pie (4;11): "Show me all the ways one can go from A to B." *Straight ahead*. "Can you make another?" *No*. "Try it." *You could put the car in the garage* (he repeats the straight path). "But do another one." He describes a slight curved line. "And another." *No*. "There are only two to do?" *Yes*. "Why?"

Because there's only one car. We set up the post [a post set on the floor in between A and B]. "Now, do it." *It's impossible, because there's a post, so we can't go to B, it would make an accident.* "Try." He makes a curved path. *I got around it.* "And another." He repeats the same curved path, but turns back at the post, having bypassed it, instead of going to B. "Another." A curve from A to B, by passing the post at the right instead of left. *That's not the same.* "Are there others?" *No.* "When you go to school, you always take the same way?" *No.* "And from A to B? Always the same?" *Yes.* (p. 19)

Accounting for such *prima facie* incredible differences, and for the development of adult understandings from such beginnings, has always been at the core of Piaget's genetic epistemology. Volume 2, organized around ten studies, focuses on the development of a sense of necessity — what *must* be done — with similarly fascinating reports of children's engagements with the tasks.

Piaget's theoretical goals in these two volumes are extensive and deeply important to his entire epistemological system. He attempts to account theoretically for the development of an understanding of possibility and of necessity, and for the relationship between the two. A second major focus for Piaget is the role that the development of an understanding of the modalities of possibility and necessity plays in general development. The importance of these issues for Piaget is twofold: first, the development of possibility and necessity is interesting and important in its own right; and second, for Piaget, such *modal* epistemology and its development is intrinsic and fundamental to *all* epistemology and its development.

This claim, and Piaget's abundant support for it, already distinguishes Piaget's model from virtually all other approaches to child development in the contemporary literature. This contrast is most striking with respect to current information-processing approaches, in which the modalities of possibility and necessity are simply absent, and can be introduced in only the most ad

hoc manner — the "information" that is "processed" has to do with *actualities*, and possibilities and necessities could be introduced (should anyone care to try) only as additional ad hoc informational codes: there is no intrinsic relationship at all. I will argue that the importance of Piaget's position is even deeper and broader than this comparison can illustrate.

A crude outline of Piaget's position begins with an initial *indifferentiation* in the youngest children among actualities, possibilities, and necessities. Modal epistemological issues are intrinsically present for the child, as evidenced by the previous example of the toy car, but actualities, possibilities, and necessities are not differentiated from each other, and, therefore, cannot be coordinated with each other, and, therefore, are not understood. This involvement of modality in even the earliest forms of the child's knowledge carries forward a central aspect of Piaget's epistemology: Piaget has always argued for the intrinsic and superseding importance of the operative aspect of knowledge over the figurative aspect. But the operative aspect is precisely the knowledge of *possible* transformations upon the actualities of the world (while the figurative aspect focuses on the *states* of the world). As Piaget states: "The essential aspect of thought is its operative and not its figurative aspect. . . . To know is to assimilate reality into systems of [possible] transformations" (Piaget, 1970, p. 15). Crudely, this may be construed as a superseding of knowledge of the *possibilities of action* over knowledge of the *actualities of perception*. A key intuition is to realize that unless one knows something about the possibilities of how a certain state of the world could be transformed into other states, one essentially knows nothing about that state in the first place.

As the child develops procedures for approaching a problem, those new procedures will generate new possibilities of action and transformation for that problem. Sufficient organization of such procedures will lead to the child's being able to consider sets of several or many such possibilities at a time —

Piaget calls such sets of simultaneously considered possibilities “co-possibilities.” This part of the model carries forward the 1970s introduction of procedures concurrent with structures as central conceptions in Piaget’s theory. *Procedures* perform actions and build structures—making use of the knowledge available in already-constructed structures—while *structures* serve as the sources of understanding (Inhelder & Piaget, 1980).

Early *local* senses of necessity are created by the child via the understanding of “signifying implications”—implications in terms of meanings. These are understandings of the necessities of certain implications—from one procedural possibility to another, for example—not simply through observation of an empirical connection, but in terms of the “meanings” or “intentions” of the possibilities: this possibility *must* imply that possibility (Piaget, 1986). One example of this would be the child’s understanding that if a toy is “placed on” a strip of cardboard, and if the cardboard is pulled toward the child, then the toy will be pulled toward the child—this understanding follows “necessarily” from an understanding of the signifying implication of the relation “placed on,” a more advanced example might be the understanding that, if the toy car can go around the post once, then it *must* be able to go around the post twice.

A full *global* understanding of necessity, however, develops only when the co-possibilities opened up by procedural development exhaust a space of such possibilities, yielding a “closure” of those possibilities, and yielding a notion of necessity as something that holds true with respect to every such possibility. The relationships in such an organization of procedurally generated possibilities do not remain simply the particularized temporal and instrumental relationships of procedures to their goals, but, instead, the overall organization of relationships attains the atemporal *logical* status of a *structure*. Procedures “open up” possibilities, and structural necessity emerges with the “closure” of such possibilities.

Piaget’s notion that early local necessities arise from signifying implications originates

in his recognition that standard logics, with their *extensional* focus on what is in the world instead of an *intensional* focus on what is in the mind, are simply inadequate for modeling knowledge and epistemology, and in his consequent recognition that we must turn to the more powerful intensional and relevance logics instead (Anderson & Belnap, 1975; Apostel, 1982). The notion of a global necessity arising from the structural closure of a space of possibilities carries forward Piaget’s longest-standing conception of necessity, and embeds it within his later innovations of procedures and intensional logic.

In sum, the development of procedures generates sets of co-possibilities, which, when they exhaust all relevant possibilities, establish a closure of those possibilities and a resultant structure and understanding of global necessity. The core intuition is that a structure is a logical organization of an *exhaustive* or *complete* set of possibilities, and thereby captures properties that hold with respect to *all* such possibilities—that is, those that are necessary. It is this general process that is at the heart of *all* of development. The interplay between possibility and necessity, then, *is* the interplay between procedures and structures and constitutes the basic dynamic of development. This unique perspective on epistemology and development is enormously rich and powerful. In stark contrast, information-processing approaches not only have no intrinsic involvement of modality, they also offer nothing akin to Piaget’s structures—no model of necessity emerging with closure over possibilities, no locus of understanding, and, perhaps most important, no model of the emergence of knowledge out of action. Information-processing or functionalist approaches are fundamentally limited to issues of pragmatics, of how to *do* various things; they lack either any epistemic dimension whatsoever—that is, any dimension of knowing, understanding, and representation—or, most commonly, they tack on a grossly inadequate substitute by positing ad hoc structures of encoded data (Bickhard, 1982). Piaget’s program attempts to address both pragmatics and epistemics

and the emergent relationship between them (Brown, 1988).

I turn now to some evaluations, from several perspectives: Piaget's oeuvre, developmental psychology in general, epistemology, education, and my own judgments. In terms of the half-century of development of Piaget's insights and understandings, this work represents a final integration of his genetic epistemology. It reaffirms Piaget's basic insight that the epistemological problem of necessity is central to all epistemology; it elaborates his emphasis on the operative aspect of knowledge—with modal issues intrinsic at the root of epistemology, and the dynamic between possibility and necessity at the heart of development; and it maintains his notion of necessity as emergent in structural closures. Moreover, it integrates with these points his later introduction of procedures concurrent with structures and his move to intensional logic. It represents, among other things, the ever-deepening and increasingly comprehensive dynamic of Piaget's own thought. It is essential to understanding the depth and richness of Piaget's later theory.

From a somewhat broader perspective, we find that American developmental psychology has long survived on the orts from the Piagetian feast. These have consisted largely of the developmental problems he posed, the investigative tasks that he introduced, and, to a much lesser extent, the theoretical insights and perspectives that he presented. In general, only those aspects of Piaget's theory that could be easily assimilated into pre-existing American conceptions have had much of an impact (in ironic consistency with Piaget's constructivism). Piaget's early model of "structures of the whole" as defining developmental stages caught the attention of a psychometrically minded psychology, and furious research followed in the 1960s. When that part of Piaget's system proved untenable, a general turning away from Piaget followed in the 1970s; as a result, we are just now catching up to the fact that Piaget himself was moving away from the structures of the whole model during the 1960s—with much more

fundamental innovations than can be found elsewhere (such as reflective abstraction, which is integrated into but not theoretically developed in *Possibility and Necessity*). We have missed some fifteen years of subsequent development of his thought; in addition, of course, we must realize that Piaget's most important theoretical insights, such as the central involvement of modality in all epistemology and development, never have been understood or assimilated. *Possibility and Necessity* not only introduces a number of new investigative tasks that others may elaborate and explore further, but it also reintroduces the developmental tasks of modality, and the theoretical centrality of modality. Let us hope that, in contrast to the incomplete assimilation of his earlier works, the assimilation of Piaget's later works, including this one, will be more thorough. Time will tell.

Widening our perspective once again, Piaget always described himself as a genetic epistemologist, and not as a psychologist per se. His concerns were the basic epistemological issues of the nature and origins of knowledge. Piaget tries to confront, throughout his work, the epistemology of naive empiricism, in which the world simply impresses itself on a passive mind, thereby producing knowledge of that world. The classic metaphor is that of the waxed slate passively receiving impressions. Piaget argued instead for an active mind, which actively constructs knowledge. Such a position is in fact logically forced by Piaget's realization of the epistemological centrality of modality: actual things or events in the world might conceivably impress themselves on a passive mind—should such a thing be possible in the first place—but the *potentialities* of operative knowledge, of possible transformations of the world, are not *present* to be able to impress themselves on anything. Knowledge of possibility *must* be actively constructed, not passively impressed.

Further, the epistemology of necessity has classically been a battleground for empiricism and rationalism. It is barely conceivable that we might learn that $2 + 2 = 4$

by mere empirical observation, but no amount of experience will ever generate knowledge of the necessity of that relationship. Similarly, 3×3 is necessarily 9, whereas the number of planets, while in fact equal to 9, is *not necessarily* 9. In this sense, Piaget's emphasis on the fundamental importance of necessity for epistemology addresses a basic challenge to empiricist epistemologies. His theoretical view of modality as central to the nature of all knowledge and to the dynamics of all development, and his demonstration of such involvements in young children's knowledge (as in this work) carries forward an investigation of epistemology and development that would be impossible within an empiricist epistemological framework. Consequently, this work constitutes a challenge and an invitation to transcend the empiricist epistemologies that are still dominant in American psychology (and philosophy).

Empiricist presuppositions have generated a view of education as consisting of the teaching of facts and the training of techniques. Education consists of the pouring of correct knowledge into the "empty buckets" of children's minds (for a discussion and critique of "empty bucket" notions see Popper, 1972). Piaget's emphasis on the intrinsic importance of action and modality is deeply inconsistent with such views. Active exploration, feedback, and critique are required for the discovery of possibilities and the realization of their exhaustive closure as necessities. The active exploration implications of Piaget's work have, in the past, tended to resonate with themes of "freedom" in educational conceptions of the spontaneous, unfettered development in learning of the child, but this sets up feedback and critique as being on the "dark side," the side of lack of freedom—of constraint, discipline, and the inhibition of spontaneity. This framework of freedom versus constraint rather than exploration with feedback distorts Piaget's position and introduces tensions and inconsistencies that do not belong. Within mathematics education, for example, consider how a method that uses problem sets as a means for drill and

strengthening of knowledge contrasts with a method that uses problem sets as aids in the exploration of spaces of possible organization and structure among numbers and number transformations (Cooper, 1988). Drill yields a very different conception of, and demands a very different design for, problem sets than does exploration and feedback. Greater attention to Piagetian implications would result in wide-ranging changes along these lines.

My own view of Piaget's genetic epistemology, and of this work in particular, is obviously deeply positive. In my judgment, for fifty years Piaget has been asking questions about, and developing insights about, issues that go far beyond the scope of what most of psychology has even learned to address. Indeed, too much of the rest of the world has yet to understand the importance of the questions that Piaget struggled with, not to mention to grasp his insights. Yet, Piaget's system is not free of error. Problems in his earlier "structures of the whole" stage model have already been mentioned above, but his deeper error may have been in his structural notion of the nature of knowledge. Piaget is one of only a few thinkers who have seriously addressed the problem of the emergence of knowledge and representation out of action, but I contend that his structuralism leads him to incorrect answers. Basically, I argue that, in his structuralist conceptions of knowledge and representation, Piaget has inadvertently carried over errors from the empiricism that he so rightly argues against—not so much concerning the constructivist *origins* of knowledge, but concerning the *nature* of knowledge and representation—and that these foundational problems have produced other dislocations in his system. I leave the development of that argument for elsewhere (Campbell & Bickhard, 1986; Bickhard, in press; Bickhard and Campbell, 1988), but the issue it addresses appears in this context in that the relationship between the *instrumental* necessity of an action to a goal and the *logical* necessity of a statement or proposition is, in my judgment, not well explicated. In effect, Piaget's structuralism does

not differentiate instrumental necessity from logical necessity, and, therefore, cannot integrate them in a larger whole. On the other hand, it should be clear that we learn more from understanding Piaget's errors that we do from most other thinkers' successes.

Possibility and Necessity is only one of many books that Piaget wrote during the last phase of his thinking. Many of those have not yet been translated into English. The intellectual vitality and importance of this book, as well as of others that have appeared in English, attest to the richness of what remains. Non-French readers await translations and hope they will appear soon.

This translation of *Possibility and Necessity*, by Dr. Helga Feider of the University of Quebec in Montreal, is quite good. Piaget's works have not always been so favored. It is accurate to Piaget, and it also manages to render Piaget's sometimes difficult prose in readable form. (There are always some points to take issue with: one translator's choice has four-year-olds speaking "One does . . ."; a potentially more confusing translation is of a term that Piaget uses to refer to the general or knowing subject — it is rendered as "subjects," which could be misinterpreted as referring to actual empirical subjects.) *Possibility and Necessity* reinforces the realization that translators of Piaget must not only be fluent in French, but must also understand Piaget (see, for example, Piaget, 1985). Future publishers of English versions of Piaget's works should recognize this critical point.

Possibility and Necessity is an important work. It is important to an understanding of Piaget's later developments; it is important in its implications for developmental psychology and for education; and it is important in its challenge to empiricist epistemologies. It is also fascinating in its accounts of children's engagements with a richness of ingeniously designed problems. Most fundamentally, it demonstrates that

psychology, philosophy, and education alike *must* take into consideration the modalities of possibility and necessity if they are to progress. It demonstrates the necessity of possibility and necessity.

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