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1 Introduction

Overview

This introduction is in three parts. In the first part, we comment on the relevance of epistemology for psychology and vice versa. In this context, we briefly elaborate on Piaget's epistemological framework, address some common misconceptions that arise from an overly psychological interpretation of his theory, and introduce the different chapters of this volume. In the second part, Leslie Smith provides a short biography of Piaget. The third part, also by Leslie Smith, points out a number of problems that readers of the English translations of Piaget's work will encounter.

INTRODUCTION I. THE CONTEXT OF PIAGET'S THEORY

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The reception of Piaget's work and Piaget's reaction toward this recognition present an interesting puzzle. On the one hand, Piaget is widely recognized for his work on child psychology. For example, in an article on Piaget appearing in a series of papers summarizing the work of eminent developmental psychologists, Harry Beilin (1992, p. 191) wrote the following: "No one affected developmental psychology more than Jean Piaget (1896–1980). From his earliest publications in the 1920s to the time of his death, the influence he exercised was extraordinary. His theory . . . has no rival in developmental psychology in scope and depth. . . . The number of experiments conducted by Piaget and his colleagues has never been tabulated, but it is unrivaled in the history of developmental psychology." On the other hand, Piaget expressed mixed feelings about the reception of his work. For example, toward the end of his career, Piaget (Bringuier, 1977/1980, p. 54) made this comment on the recognition of his work: "I am pleased by it, of course. But it is pretty catastrophic when I see how I'm understood."

We submit that one of the reasons Piaget did not feel well understood is that psychologists as well as philosophers generally failed to grasp that at the heart of Piaget's research program lies a unique way of integrating empirical research and epistemology. Psychologists have generally ignored the epistemology, that is, theoretical framework, that drives Piaget's work. Philosophers, on the other hand, have dismissed the relevance of Piaget's empirical work for epistemological questions because "philosophical and psychological questions . . . are different from each other, and . . . there are no grounds for the belief that philosophical questions can be answered by appeal to empirical evidence or vice versa" (Hamlyn, 1971, p. 19).

Epistemology and Psychology

In his Foreword to a major commentary on his work, Piaget (1963, p. viii) remarked that his interpreters tended to focus on the empirical side of his work and did not pay enough attention to the epistemological foundation of his approach. One reason for the one-sided reception of Piaget's work by psychologists may be a failure to see the relevance of, or need for, examining the assumptions on which theories are based. However, as noted by Piaget (1970/1983, p. 105), it is not possible to study the psychology of human development without making epistemological assumptions that have to be addressed in the study itself, for example, assumptions about the relations between mind and world, and biological and psychological functioning.

One outcome of this lack of appreciation of the relevance of epistemology for the study of psychology and psychological development is that epistemological assumptions often remain tacit. Practically, this amounts to many psychologists basing their theories on assumptions that originate in the empiricist tradition (Piaget, 1970/1972a, p. 10). According to Piaget, the central idea of empiricism is that "the function of cognitive mechanisms is to submit to reality, copying its features as closely as possible, so that they may produce a reproduction which differs as little as possible from external reality" (Piaget & Inhelder, 1969/1976, p. 24). Essentially, empiricism explains our knowledge of the world in terms of sensory experience and the causal play of associations (Piaget, 1965/1972, pp. 53–56). In contemporary psychology, the functionalist framework carries on the legacy of the empiricist tradition. The central idea of functionalism is that mental states (e.g., beliefs, desires) are determined by their causal relations to other mental states, sensory inputs, and behavioral outputs. According to the functionalist

framework, mental states function as mediators between input and output.

Piaget argued that these empiricist assumptions are conceptually flawed and are not consistent with empirical findings (Piaget & Inhelder, 1969/1976). The idea that knowledge consists of a copy of reality is, according to Piaget, flawed because there would be no way to evaluate the accuracy of such copies which cannot be directly compared to reality itself: "[I]n order to make a copy we have to know the model that we are copying, but according to this theory of knowledge the only way to know the model is by copying it, until we are caught in a circle, unable ever to know whether our copy of the model is like the model or not. To my way of thinking, knowing an object does not mean copying it – it means acting upon it" (Piaget, 1970, p. 15; cf. Piaget & Inhelder, 1966/1971, pp. 385–386). Notice that this objection applies with equal force to any theory of mind based wholly on representation – a commitment ubiquitous in modern psychology – in that the knower can only ascertain the degree of fit between a representation and reality by recourse to another representation, never to reality (see Bickhard, 1993, 1999, 2009).

As an alternative view to this passive interpretation of knowledge, Piaget (1970/1983, p. 104) proposed that "in order to know objects, the subject must act upon them, and therefore transform them." Piaget's constructivist view implies that knowledge does not pre-exist in the world to be imposed on the children, nor is it already innately preprepared in children. In consequence, this version of constructivism is incompatible with nativism, normally regarded as the standard alternative to empiricism. In this context, Piaget's distinction between particular properties of an organism and general properties of organization is relevant. Particular properties of an organism (e.g., eye color) are due to hereditary transmission. General properties of organization (e.g., classification abilities) are due to something else: "Amoeba, sponges, fish, and mammals transmit all their characteristics [and this is] a truly hereditary transmission; but they also transmit quite equally the most general properties of life in virtue of organization, and that is not transmission in the same sense. [This is because] at every step of hereditary transmission, a *living* organization is present as the necessary condition of particular transmissions because it determines the *activities* arising in that transmission" (Piaget, 1967/1971, p. 323; our emended translation).

Piaget's third way (i.e., alternative to empiricism and nativism) is that knowledge develops through the child's actions on the world. In addition, knowledge is always tied to a particular framework (see Chapter 3,

this volume), a paradigm case of which are the structures that emerge as any knowing subject interacts with the world. More specifically, the relation between subject and world is characterized by the functional processes of assimilation and accommodation. At the psychological level, assimilation captures the intrinsic directedness of consciousness and refers to the incorporation of new elements into already existing schemes – and schemes are organized wholes composed of affect, sensation, motor movement, perception – thereby giving meaning to those elements (Piaget, 1975/1985, p. 16); for example, in grasping a new toy, this toy is assimilated to the grasping scheme, the toy attains the functional meaning of being "graspable." Accommodation refers to the modification of existing schemes to take account of particular features of the new object or situation (e.g., in the very same assimilatory act, the pre-existing grasping scheme needs to be modified to take hold of the new toy). In the context of the functions of assimilation and accommodation, structures take a dynamic function in a double sense. First, structures do not exist independently of structuring activity: "Assimilation is hence the very functioning of the system of which organization is the structural aspect" (Piaget, 1936/1953, p. 410). Second, structures change as a result of the subject's interaction with the world: Every genesis originates from one structure and results in another structure, and, conversely, every structure has a genesis (Piaget, 1964/1967).

Two questions follow: First, which structures are in fact constructed by the mind? Second, what is the process enabling this to happen?

As to the first question, influenced by the Bourbaki group of mathematicians (see Aczel, 2007), between 1940 and 1965 Piaget (1970, p. 23) identified three cognitive structures that characterize children's thinking at different points in development. His evidence during this period was gained with a view to finding out whether these structures are in fact constructed. Piaget interpreted his evidence as confirmation that this is the case. But there are important qualifications usually disregarded in commentary. (a) It is an empirical question for investigators to check out the evidential basis of these three structures. "The average subject knows his own intelligence only in its performances, for the operative structures elude him, as moreover nearly all mechanisms affecting his behaviour and, even more, his organism. That structures exist is, therefore, something for the observer to ascertain and analyse them" (Piaget, 1973, p. 46; our emended translation). Thus, the key question is whether these three structures can be identified at points in development, not whether each and every aspect of a child's mental life can be described in these terms. (b) To the question "Are there any general stages?" Piaget gave the clear and specific answer "No." If a general

stage is such that it includes "at the same time, for a given level, the totality of the organic, mental and social aspects of development . . . [then] there are no general stages. [Rather] in the various neurological, mental and social fields, we see an intermingling of processes of development which are evidently interrelated, but to different extents or according to multiple temporal rhythms, there being no reason why these processes should constitute a unique structural whole at each level" (Piaget, 1960, pp. 14–15). For Piaget, at any developmental level there is no singleton structure for all action and thought, emotion, will and all the rest of the human psyche. Rather, there are various functional instances of these formal structures that characterize thinking throughout human development. (c) Piaget provided formal descriptions of the cognitive structures he identified, but at different points in his career he employed alternative formal models (see Chapter 10, this volume; see also Piaget & Garcia, 1987/1991), and it has been argued that his greater contribution was his insight regarding the role of operations (i.e., the active processes of coordinating actions and thoughts) rather than the particular logical models he employed (Apostel, 1982).

As to the second question, throughout, and especially during 1965–1980, this was the central issue in Piaget's work. Note that it is largely bypassed *in toto* in most Anglo–Saxon work in psychology. Piaget's research on this dynamic process was also overlooked. A key claim of his constructivism is that cognitive structures always have a process that enabled their construction. It is therefore a fundamental error to detach a structure from its formative process, as in some critical commentary on Piaget's position. Several chapters in this book (Chapters 3, 4, 5, 6, 9, 14, 17) focus on the process of construction.

One primary reason for common misinterpretations of Piaget's theory and for overlooking the epistemological core of Piaget's theory appears to be that the epistemological framework guiding contemporary research is fundamentally different from Piaget's epistemological framework. For Piaget, a structure is not some internal mediating device triggered by incoming information; rather, a structure is the activity of form-giving that is always intentionally directed toward the world. The operations Piaget describes are coordinated internalized actions with implicatory and meaningful relations, that is, "implication between the meanings of actions" (Piaget, 2004/2006, p. 5). Actually, his position is long-standing and evident in his first book on infancy: "Every act of intelligence presupposes a system of mutual implications and interconnected meanings" (Piaget, 1936/1953, p. 7; cf. Mays, 1987, p. 235).

Working within an empiricist framework, however, contemporary developmental psychologists have misconstrued Piaget's concept of

structure as a functional device, that is, as "a hypothetical construct that is related to an observable performance as an antecedent to consequent" (Chapman, 1987, p. 289). This leads to a common interpretation of Piaget's notions of stage and structure. According to this common, or "received view" of Piaget's theory, stages are thought to be global structures that define a child's thinking. Once a child has developed the structure of concrete operational reasoning, he or she should be able to use it to solve all tasks in that domain (for sources of this interpretation, see Chapman, 1988; Lourenço & Machado, 1996). Therefore, once a child has entered a stage, such as the concrete operational stage as defined by passing concrete operational reasoning tasks, that child would be expected to pass all such tasks because they all require the "same" structure of reasoning. A prediction of homogeneity and synchrony in development follows from this interpretation. However, the abundant evidence of horizontal décalage, or inconsistency in reasoning, clearly does not fit this prediction. A classic example of asynchrony in development is that children develop conservation first for quantity then weight and then volume (Piaget & Inhelder, 1941/1974). From this interpretation of Piaget's theory, horizontal décalage has been viewed as a significant empirical difficulty for Piaget's theory, even thought to cast into doubt the structuralist framework of his theory (Siegel & Brainerd, 1978).

However, Piaget actually never claimed that stages are characterized by homogeneity or developmental synchrony, and, in fact, in many places Piaget made the opposite point that variability should be expected (Piaget, 1960; see Chapman, 1988). Furthermore, the idea of horizontal décalage is entirely consistent with, and should be expected on the basis of, Piaget's grounding assumption that thought originates in action, from which it follows that forms of thinking should, at first, be context- and content-specific. That is, the form of thought cannot be separated from its content, and although structures involving different content, such as length and weight, may be of the same logical form, they develop independently in a functional sense through the child's activity with these different areas of content. Using the analogy between developmental levels and contour lines depicting height on a map (Smith, 2002a), Reinhold Messner has climbed all 14 mountains more than 8,000 m high. But he does not live at the 8,000 m contour. Contours are levels of physical heights of things such as mountains on Earth; they are not levels of earthlings. Developmental levels are levels of intellectual construction; they are not levels of knowers. Thus, "although issues of homogeneity–heterogeneity and synchrony–asynchrony are important in their own right, they are irrelevant for testing the empirical

implications of Piaget's theory because the theory itself allowed for developmental asynchrony" (Lourenço & Machado, 1996, p. 152).

Piaget used structure to characterize "the morphological properties of a certain type of thinking or reasoning" (Chapman, 1987, p. 289). The different interpretations of the concept of structure have important theoretical and methodological ramifications: "Functionalists are likely to seek the causal or functional antecedents of particular cognitive performances, but formalists are more likely to be interested in the formal properties" (p. 289). The formal properties Piaget wanted to describe were forms of thinking, that is, different ways in which children approach the same kind of problem. In other words, this is what is common to all children at a specific level of thinking – what Piaget referred to as "the epistemic subject." His tasks were "meant to study the epistemic development of certain concepts in the child, not to determine the cognitive level of any particular child or group of children" (Sinclair, 1982, p. 180).

This misunderstanding of Piaget's notions of stage and structure is related to another misinterpretation of Piaget's theory of cognitive development, which is that the particular ages at which children acquire concepts are criterial for a particular level of thinking (e.g., Gelman & Baillargeon, 1983; Halford, 1989). According to Piaget (1956, p. 34), however, "stages can be characterized in a given population chronologically, but that chronology is extremely variable." That is why in Piaget's account "age is an indicator, but not a criterion of developmental level" (Smith, 1991, p. 77). The criterion is defined in terms of the coordinated operations or structure required by the task that is used to assess a particular level of thinking. Thus, "if a child solves a task earlier than reported by the protocol [i.e., Piagetian research], no serious conceptual damage is inflicted on the theory" (Lourenço & Machado, 1996, p. 147). Furthermore, central to Piaget position was the sequence in which different forms of thinking emerge and the mechanisms involved in level transitions, and not the age at which they emerge.

Psychologists do not see the need to work through Piaget's complex ideas about equilibration and allied processes unless they first recognize the flaws, or at least undefended assumptions, in the view of knowledge they take for granted. Because psychologists generally take knowledge as unproblematic, the complexity of Piagetian theory seems simply superfluous. Theories of cognitive development, however, are necessarily based on assumptions about the nature of knowledge. How else can true knowledge be demarcated from true belief, and both from their usurpers, such as misconception, "false memory," pseudo-reasoning, and misunderstanding? This question is fundamental and

notably complex for adult minds – witness the perennial problems of relativism and skepticism. As well, an adequate account of cognitive development has to address this question from the perspective of the developing child from infancy to adulthood. It is exactly such an account that Piaget set out to present.

Genetic Epistemology

Piaget called his answer genetic epistemology, the aim behind which is "to explain knowledge, and in particular scientific knowledge, on the basis of its history, its sociogenesis, and especially the psychological origins of the notions and operations upon which it is based" (Piaget, 1970, p. 1). Traditionally, epistemology has been a branch of philosophy, concerned with the nature, scope, and validity of knowledge. For Piaget, epistemology is no longer the sole preserve of philosophy; instead he advocated the use and relevance of empirical methods in approaching epistemological questions.

One reason for a developmental approach to knowledge is that knowing itself is not static but rather is a process. At issue for Piaget was ascertaining what in fact this process is, and for that, evidence was required as well as epistemological theory. In this context, Piaget (1970/1972a, p. 2) approvingly quotes the neo-Kantian philosopher Natorp (1910, pp. 14–15):

> Like Kant, we start with the actual existence of knowledge and seek the basis from there. But what is this existence since, as we know, knowledge is constantly evolving? Progression, method is everything . . . in consequence, the existence of knowledge cannot be comprehended except as a *fieri* [i.e., to be made, to become; our note]. This *fieri* alone is the fact. Any entity (or object) which knowledge attempts to crystallize must dissolve again in the current of development. It is in the last phase of this development, and in this alone, that we have the right to say: "this is (a fact)." What we can and must seek, then, is the law underlying this process.

But if constant evolution is constitutive of scientific knowledge, as witnessed in the natural and human sciences, and even in logic and mathematics (Piaget, 1950, 1965/1972, 1970/1972a, 1970/1972), then the study of the conditions of the possibility of knowledge must include the development of knowledge. The study of the development of knowledge, in turn, falls under the purview of the empirical sciences.

The epistemological analysis of the development of knowledge can proceed along two pathways: the historico–critical and the psychogenetic pathway:

> Clearly, then, epistemological analysis must sooner or later achieve a historical or historico–critical dimension; the history of science being an indispensable tool for a philosophical understanding of science. The question is whether history involves a pre-history. But there is a complete absence of documentation on the formation of concepts in the case of prehistoric man, for although we have knowledge of his techniques we lack sufficient complementary information on his cognitive functions. The only course open to us, therefore, is to follow the example of biologists who supplement their scanty stock of phylogenetic knowledge by turning to embryogenesis: in the case of psychology this means studying the mental ontogenesis of the child at every age. (Piaget, 1970/1972b, p. 11)

Furthermore, empirical methods are relevant for another reason: All epistemologies make statements or contain assumptions about the process of knowledge acquisition. For example, whereas classical empiricism emphasized the importance of sense data and association, rationalism highlights the activity of the intellect. Thus, "all epistemologies raise questions of fact and thus implicitly adopt psychological positions" (Piaget, 1970/1972a, pp. 4–5), but they lack effective methods to answer these questions (Piaget, 1970, p. 7). To answer these factual questions, "psychological findings become relevant and should be taken into account" (Piaget, 1970, p. 8).

Genetic epistemology fundamentally is an interdisciplinary enterprise. It draws on expert knowledge from the individual sciences and the help of logicians, mathematicians, and cyberneticists in modeling and formalizing levels of knowing and growth processes (Piaget, 1970/1972a, p. 6). Piaget's emphasis on interdisciplinary collaboration reflects his belief in the interdependence of the different sciences – an interdependence that Piaget conceived of not as a linear order but as a cyclical system (see Brown, 2003):

> Thus man cannot understand the universe except through logic and mathematics, the product of his own mind; but he can only understand how he has constructed mathematics and logic by studying himself psychologically and biologically, or in other words, as a function of the whole universe. This is the true meaning of the circle of sciences: it leads eventually to the conception of unity through interdependence between the various sciences, such that disciplines on opposite sides of this cyclic order maintain reciprocal relationships with each other. (Piaget, 1970/1972a, p. 83)

Because the different sciences constitute a cyclical system and not a linear order, concepts from a higher level (e.g., the biological concept of life) cannot be reduced to those of a lower level (e.g., physicochemical processes). According to Piaget, the coordination of two different levels leads to an enrichment and transformation of the lower level (Piaget, 1970/1972b, pp. 92–93).

This summary has highlighted only the key features of Piaget's genetic epistemology. A more systematic treatment of several aspects of this topic can be found throughout this volume. At any event, our introduction should suffice to bring home the point that Piaget's genetic epistemology has an interdependent focus on epistemological principles and psychological evidence in one and the same account, thereby ensuring its distinctiveness in being reducible to neither epistemology nor psychology, neither severally nor jointly.

Organization of the Volume

The goal of this volume is to provide a comprehensive introduction to key aspects of Piaget's work that is accessible to advanced undergraduate students. Given that Piaget was a prolific writer whose publication period spans more than 60 years (with posthumous volumes and articles still being published), the coverage of aspects of Piaget's work had to be selective. For further reading there are several excellent monographs on Piaget available in English that focus more on either his theoretical work (e.g., Kitchener, 1986; Smith, 1993, 2002b), his empirical work (Ginsburg & Opper, 1988), or both (Chapman, 1988; Vuyk, 1981).

This volume highlights the theoretical or epistemological aspects of Piaget's work and elaborates the relations between empirical research and epistemological issues. Piaget's genetic epistemology is comprehensive and ambitious in that it addresses the relations between, on the one hand, psychology and biology, and, on the other hand, psychology and sociology; Piaget's "biology" and "sociology" are discussed in separate chapters. A number of chapters highlight Piaget's work on developmental processes, a topic particularly salient in his later (i.e., 1970s) writings. Particularly relevant for current discussions in cognitive and affective neuroscience is Piaget's conceptualization of affectivity, consciousness, and morality. As the authors of these chapters point out, the current debates in these areas would benefit from the assimilation of Piaget's writings on these topics. Finally, this volume includes two chapters that present reformulations of Piaget's theory that preserve its strengths while suggesting modifications that address its weaknesses.