Do stages belong at the center of developmental theory? A commentary on *Piaget's stages*

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It is my conviction … that I have drawn a quite clear general skeleton, but one still full of gaps of such a kind that, in filling them, one will be lead to differentiate its connections, in various ways, without at the same time altering the main line of the system …. My secret ambition is that the hypotheses one could oppose to my own will finally be seen not to contradict them but to result from a normal process of differentiation (Piaget in Bringuier, 1980, p. 144).

Feldman seeks to align his theoretical project with Piaget's "secret ambition" as expressed in this quotation. He sensibly suggests that Piaget's four broad stages of psychological development should be re-articulated in light of "our best current understanding of how cognitive development proceeds from birth through early adulthood" (p. 4). He wants to ensure that these stages remain at the core of the psychological analysis of development, seeking to amend Piaget's original formulation by bringing about some needed theoretical repair work. We applaud Feldman's efforts to take Piaget's deep analysis seriously and improve upon it and note that many other scholars share this broad goal.

We agree that the theoretical issues Feldman highlights are central to an understanding of cognitive development in general and developmental stages in particular—including reflective abstraction, figurative and operative knowledge, taking of consciousness, stage transitions and emergence, *structure d'ensemble*, variability, and within-stage sequences. However, we find Feldman's formulation of

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stages in terms of these issues to be neither coherent nor consistent. We address two reasons for this conclusion.

First, Feldman places Piaget's stages ''at the heart'' of his psychological theory, ignoring Piaget's protests to the contrary.

> Why does everyone speak of stages? … One tries to construct stages because this is an indispensable instrument for the analysis of formative processes. Genetic psychology attempts to envisage the construction of mental functions, and stages are a necessary instrument for the analysis of these formative processes. But I must vigorously insist on the fact that stages do not constitute an aim in their own right. I would compare them to zoological or botanical classification in biology, which is an instrument that must precede analysis (Piaget, 1977, p. 817).

We argue that placing stages at the center of Piaget's developmental theory undermines its coherence by displacing the central theoretical constructs that give rise to a concept of stages. Stages should be a vehicle for analysis, not a core process at the heart of the theory of development.

Second, Feldman constructs a theory of stages that has virtually no empirical basis and ignores a vast body of neo-Piagetian research on stages and stage-like development. By overlooking the large body of neo- and post-Piagetian research that has accumulated during the last 50 years, Feldman provides an account that is inconsistent with current knowledge.

Obviously, improving upon Piagetian stage theory is an ambitious undertaking, one that has occupied the careers of numerous scholars. We argue that the large bodies of research produced by these scholars are part of the ''normal process of differentiation'' that Piaget hoped would generate competing hypotheses to ultimately provide support for his general framework, including refinement of his analysis of stages. Oddly, Feldman essentially ignores this work despite its fundamental relation to Piaget's secret desire. Instead of building on the contributions of these many scholars, including Piaget himself in his later years, Feldman disregards them and distances himself from research and data. In this way, he loses the methodological and empirical grounding that Piaget saw as essential to his theory and that make Piaget's theoretical work so compelling and valuable. Feldman thus loses the nuanced relation between theoretical breadth and empirical rigor that lay at the core of Piaget's efforts in both psychology and epistemology.

> We need to ask whether great innovators have not been great precisely because they have based themselves on *results* … and not *only* on ideas, however, necessary the latter may be (Piaget, 1971a, p. 46)

1. The central constructs of piagetian theory: equilibration, reflective abstraction, figurative and operative knowledge

Feldman firmly places Piaget's four-stage model of cognitive development at the center of the theory. As investigators of stage-like processes in cognitive

development, we certainly value Piaget's stage theory. However, we strongly question whether his stages can justifiably be placed at the center of his theory. In fact, Feldman himself briefly acknowledges that some Piagetian scholars consider stages of cognitive development to be ancillary to Piaget's central theoretical claims. However, he fails to adequately consider their justifications for taking this position, neglecting even Piaget's own claim that his stages were a heuristic device rather than a central component of his theory. At the center of his theory Piaget clearly placed the process of *equilibration*, which he saw as the "central problem of intellectual development" (Piaget, 1985), and at the center of his theoretical model he placed *reflective abstraction*,[1] a component of *equilibration* in which a person reflects and builds on earlier structures to create new, qualitatively distinct, structures (Piaget, 1970a, 2000) at the center of his theoretical model. The concept of stage emerges from these deeper generative theoretical principles, which supply the basis for Piaget's several *different* articulations of the stage model for different purposes (Piaget, 1971b; Piaget, 1977; Piaget & Garcia, 1989).

Reflective abstraction is the process by which a person reprocesses the knowledge produced through the coordinations in an existing (or less complex) structure by using it within the coordinations of a new (or more complex) structure (Piaget, 1970b). The output of one structure becomes the input for the subsequent structure, "reflecting" upon the former. This deceptively simple idea not only conceptualizes the relations between structures in a nested hierarchy of increasingly powerful intellectual capabilities, but also reveals the generative process behind the construction of unprecedented structures (i.e., emergence). Piaget held that the development of knowledge takes the "form of *an uninterrupted sequence of reflective abstractions*" and thus a developmental sequence (Piaget, 1972). He understood *reflective abstraction* as central in the cognitive process that generates the structures of intelligence (Campbell, 2001).

The concepts that Feldman emphasizes of *taking of consciousness* and *figurative and operative knowing* are central to Piaget's description of the process of reflective abstraction. *Taking of consciousness* is part of *reflected* abstraction—that moment in the process of *reflective* abstraction when the knower becomes conscious[2] of or sees the necessity of newly formed structures (Piaget, 2000). We are unclear why Feldman chooses to divorce the taking of consciousness from the process of reflective abstraction and to define the latter as the midpoint of each developmental stage. There are two problems that arise from this separation and definition. The first is the assumption that all acts of reflected abstraction occur during a period when the structures of a stage are being consolidated. Piaget specified that these acts occur at a number of levels (Piaget, 1985), and he reported many relevant observations supporting this claim (Piaget, 1976). Studies of microdevelopmental processes,

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[1]We employ this term to indicate the process of abstraction Piaget refers to as "an uninterrupted alternation of projections→reflections→projections, and or contents→forms→re-elaborated contents→new forms, and so forth, in ever-broadening domains, without end" (Piaget, 2000, pp. 305–306).

[2]This consciousness can take many forms. At the sensorimotor level it may manifest simply as evidence of recognition or anticipation (Piaget, 2000).

particularly their fractal properties, also support it (Fischer & Granott, 1995; Granott & Parziale, 2002).The second problem is especially mysterious: Feldman employs the concept of taking of consciousness to support sweeping generalizations about children's social behavior that appear unconnected to Piaget's original meaning for the term. For example, claims connecting taking of consciousness with moral attitude (p. 43) require justification, including empirical support. How exactly does an attitude of moral superiority connect with reflected abstraction?

Feldman describes *figurative* and *operative* knowing as "two basic forms of motivation [which] arise from two equally powerful desires to know; one which is driven primarily by the desire to know the world exactly as it is (figurative knowledge); the other to make sense of, to interpret the world using existing mental-structures of analysis (operative knowledge)." He goes on to explain that neither of these two forms function independently and that they interact constantly, although one may be more important in a given situation. He cites mediation and action as examples of figurative knowledge, and pure mathematics and logic as examples of operative understanding.

In contrast, Piaget explicated the *figurative* and *operative* functions less in terms of domains and more in terms of process: Figurative aspects involve unreflective states of knowing that are simply taken to be real, as in perceiving, mental imaging, and imitating. Operative aspects involve the dynamic transformation of what is given and the construction and coordination of knowledge, as in actions and the internalized coordination of actions. For example, in mathematics—which Feldman identifies as an example of purely operative knowing—numbers would be given as figurative to the pre-operational child, while arithmetic operations such as adding, subtracting, and multiplying would be operative. Figurative aspects of cognition focus on a given set of entities apprehended in the world, while operative aspects apprehend the world by coordinating these entities (which often results in the disclosing of new entities).

The dialectic between the figurative and operative knowledge is described in Piaget's (2000) explication of reflective abstraction, a process that derives knowledge not from entities, but from the *coordination* of entities. The construction of more encompassing and powerful cognitive abilities requires the interplay of figurative and operative engagements with the world, resulting in the hierarchical emergence of new knowledge via reflective abstraction.

Figurative and operative also contrast content and form, a distinction Piaget maintained in his descriptions of the stages, which are defined primarily in terms of actions or operations (as logical structures). Feldman's stage definitions blur this distinction, while other current theories of cognitive development pursue an ever clearer distinction between content and form (Case, 1991; Commons, Trudeau, Stein, Richards, & Krause, 1998; Dawson, Xie, & Wilson, 2003; Fischer, 1980; Fischer & Bidell, 1998).

2. Transitions/emergence

Feldman seeks to preserve Piaget's major tenet of *equilibration* by making it responsible for the emergence of the qualitatively distinct stages of cognitive

development. He aims to silence critics of Piaget who claim that his ideas of emergence posit some "miraculous" creativity as responsible for the genesis of new structures. The ideas Feldman brings to the table in order to deal with the concept of *emergence* are promising—notions from the sciences of complexity, artificial intelligence, artificial life, evolutionary robotics, and philosophy. The exposition of these concepts, however, is fundamentally confused—a verbal flourish of complex jargon that is supposed to de-mystify emergence but that actually mystified us despite our sympathy with the concepts. Make no mistake: There are valuable insights that can be gleaned from these fields and applied to the study of cognitive development (Fischer & Bidell, 1998; Schultz, 2003; van der Maas & Molenaar, 1992; van Geert, 1998), but the analysis presented here makes no progress in this direction.

For example, Feldman explicates two different kinds of emergent phenomena as vaguely metaphorical explanations without clarifying the important differences between them or the connection with cognitive development. Without such explication, we can conclude only that both kinds of emergence are different from the kind in cognitive development. How is it helpful to compare cognitive emergence with *wetness* as an emergent property of H_2O? The analogy with an emerging stage is at best obscure. The second metaphor is with the emergent properties of a whirlpool in comparison to the properties of the water molecules that give rise to it under certain complex conditions. This metaphor seems more promising, but still we find it too distant from biological adaptation and therefore unconvincing. The two metaphors exemplify two meanings that can justifiably be given to the word *emergence*: The first specifies emergence as involving a kind of paralleling, irreducible property that accompanies certain material states. The second defines it as qualitative restructuring that takes place when certain material systems reach critical degrees of complexity under certain kinds of conditions. However, neither of these definitions can be simply transferred to explain cognitive developmental stage transitions.

Stage transitions in cognitive development are more comparable to the type of qualitative emergence seen in biological evolution, in which activity leads to a new relatively stable state. In this kind of emergence—which Piaget invoked—the agency of an organism, coupled with the contingencies of the environment, pushes the biological system toward transcending one self-state to create a new state with new adaptive capacities (often more complex). According to Piaget (2000), cognitive novelties arise in this way out of "the necessity of an equilibration between assimilation [existing internal structures] and accommodation [restructuring in response to input]."

Piaget himself explicitly stated the general mechanism of emergence, but Feldman does not clarify or elaborate that position. His attempt to enlist the help of diverse perspectives involving complexity and computers to de-mystify stage transitions ends up as a vague reference rather than a grounded explanation.

3. *Structure d'ensemble* and variability

Feldman considers that a stage is "an overall general operating system functioning at a deep level" (p. 5). This definition does capture one aspect of Piaget's conception

of *structure d'ensemble*. Each of Piaget's (1971b) major stages is defined by a set of formal properties that constitute a *structure d'ensemble,* defined in terms of specific mathematically defined groups or groupings. However, as a scientist grounded in observations, Piaget recognized that these structures do not manifest homogeneously in a psychological subject (a person). ''I have nowhere seen structural unity, at any stage of development of the child'' (Piaget, 1977). Indeed, Piaget (1985) hypothesized that the décalage caused by different development in cognitive subsystems is precisely what makes equilibration necessary.

Considerable research has been done on this question, finding repeatedly that in different domains the logical structures of a given stage typically do not develop in close parallel and sometimes differ widely (Biggs & Collis, 1982; Case, 1985; Demetriou & Efklides, 1994; Fischer, 1980; Fischer & Bidell, 1998; Flavell, 1982; Keil, 1981). For example, Feldman references accounts of four- to six-year-olds' adherence to illogical explanations rather than the large body of research showing that four-year-olds can respond logically in many situations—such as coordinating perspectives to evidence a theory of mind (Bartsch & Wellman, 1995; Bretherton & Beeghly, 1982; Lewis, 1994; Watson & Fischer, 1980) or to tell a coherent story about social roles in human interactions (Fischer, Hand, Watson, van Parys, & Tucker, 1984). In light of these findings, it is unclear why Feldman would posit a global s*tructure d'ensemble* to emphasize consistency in stage of behavior, whether referring to the beginning or end of a stage.

4. Within-stage sequences

Feldman divides each of his stages into two phases—first the acquisition of new structures and second the taking of consciousness and consolidation of those structures. While there are probably developmental changes that can justifiably be divided in this coarse way, the proposed division ignores the extensive research that demarcates detailed orderings of developing activities in diverse domains, with rigorous methods and careful scaling. Once again, the concepts proposed in Feldman's model of developmental stages are not grounded in the research findings of developmental science.

The study of cognitive development is better served by methods and concepts that make it possible to observe developmental events at a fine grain. Research employing diverse methods for assessing such sequences (of which Feldman seems unaware) suggests that a consensus may be emerging regarding the developmental levels of childhood, adolescence, and adulthood, of which Feldman seems unaware. Although he briefly mentions the work of Case, Commons, Fischer, and their colleagues, he dismisses their models, treating the recursively defined levels of these theorists as though they have emerged from a process of armchair theorizing. In fact, they have been developed and refined though years of careful empirical research and have provided the basis for developmental assessment systems that make it possible accurately and reliably to order behaviors by developmental level (Case, 1985; Commons et al., 1998; Dawson, 2004b; Fischer, 1980; Fischer & Bidell, 1998),

opening many new avenues of research. In dismissing these theorists, he also fails to acknowledge empirically verified correspondences between their developmental sequences and those of other developmental researchers (Dawson, 2002, 2004a; Dawson & Gabrielian, 2003; Fischer & Bidell, 1998; Kitchener & Fischer, 1990).

5. An alternative view of stages

If equilibration and reflective abstraction are the central constructs of Piagetian theory, what of the stages? We agree with Piaget—that stages are an excellent heuristic or tool for the study of cognitive developmental processes. Along with several other neo- and post-Piagetian scholars, we have operationalized stages as a series of *hierarchical integrations* (Armon, 1984; Case, 1985; Commons et al., 1998; Cook-Greuter, 1990; Dawson, in press; Demetriou & Efklides, 1994; Fischer, 1980; Kitchener & King, 1990; Kohlberg, 1994). Hierarchical integration, which results from the process of reflective abstraction, refers to the integration of previously existing intellectual activities into new forms (Piaget, 1985). Whereas reflective abstraction is a hypothesized psychological process posited to be responsible for the development of knowledge, hierarchical integration is a construct used to aid in the description and understanding of behavior. Because at least some of the products of hierarchical integration are observable in behavior, this concept has become central to much neo- and post-Piagetian research on cognitive development. The concept of hierarchical integration has permitted researchers to operationalize one of Piaget's most fundamental theoretical constructs, making it possible to explore a wide variety of developmental questions, including those taken on by Feldman in his attempt to resurrect Piagetian stages.

We do not think that developmental stages should be the centerpiece of a developmental theory. At the center of such a theory, we seek fundamental principles that can explain and predict developmental phenomena, not simply describe them. Stages are descriptions of phenomena. Even when stage definitions are highly abstract, they must point to observables. That is their value. They allow researchers to make structured observations of behavior, and in doing so, provide the possibility of deeper insights into the functioning of the mind. Feldman's loosely structured and un-operationalized account of stages is not a step forward for Piagetian theory. In fact, it is distinctly un-Piagetian.

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