Commentary [Commentary on the article "Reconciling stage and specificity in neo-Piagetian theory: Self-organizing conceptual structures" by M.D. Lewis]

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Lewis' article is a timely one in addressing an issue long neglected in developmental psychology, that of individual diversity. His main argument is that the construct of central conceptual structure (CCS), proposed by Case [1992a] as an effort to provide a compromise between universality and specificity of cognitive functioning, is not sufficient. Like the original Piagetian definition of general structures, a CCS cannot account for, let alone predict, the large inter- and intra-individual variability that is more often the rule than the exception in cognitive development. The solution proposed by Lewis is to resort to self-organizing or nonlinear dynamic systems.

Case's approach is representative of a number of recent neo-Piagetian approaches to cognitive development. They attest to the resurgence of structuralist approaches, after a relatively long period during which emphasis was placed, at least among North American developmentalists, on domain-specific approaches [Case, 1992b; Dagen and de Ribaupierre, 1987; de Ribaupierre, 1993]. Case's approach in addition attempts to take into account the numerous observations of asynchrony in development. According to Case, a CCS is general in that it applies to a broad range of situations; as such it is subject to system-wide processing constraints (although these are not very clearly spelled out) and is central to cognitive development. Neverthe-
ecessary that a theory be compatible with such variability (as most neo-Piagetian models are), the theory must also explain it [Lautrey et al., 1981; Reuchlin, 1981]. Lewis provides numerous examples of such variability, most of them from the interpersonal domain. His argument is that there should be more room for diversity in conceptual content than provided by the CCS and that CCSs alone cannot embody such diversity.

Recognizing with Lewis the potential usefulness of such structures, I would like to point to two further limits. Children’s productions are often stripped of their richness by the scoring systems employed by Case and his co-workers. This is of course a counterpart of a structuralist approach that seeks to define general invariants across a number of situations. Analyses of children’s drawings [Bleiker and Meiru, 1993] or narratives [McKeough, 1993] by Case’s collaborators illustrate this impoverishment. As a result, the productions of children of different cultural background are considered similar, although, at least at first glance, they seem very different [Case et al., 1993b]. As a second problem, if a CCS is deemed necessary for the acquisition of a given concept, one can hardly understand why certain children can acquire the concept without at the same time demonstrating mastery of the allegedly necessary CCS [Okamoto, 1993].

Lewis recommends adding a systemic approach to Case’s structuralist perspective. A systems approach is not incompatible with Case’s theory, and it is able to explain the emergence of CCSs and their diversity. An explicit link is thus achieved between Case’s approach and current dynamic systemic approaches. Lewis suggests that the CCS be regarded as a self-organizing system emerging from organism-environment interactions. Such systems are individual because they evolve in response to an accumulation of specific, individual constraints. Yet, they also obey general constraints, such as those imposed by maturation and culture. These two factors are considered to be ‘soft’ in that they do not totally determine (in this sense, they ‘underdetermine’) the actual development of a given child. This conception connects with our suggestion, developed elsewhere [Rieber et al., 1990], to adopt a minimally structuralist approach. Structural constraints are necessary, but not sufficient, to account for cognitive functioning.

In sum, Lewis’ main argument, based on contemporary systemic perspectives on both ontogeny and phylogeny, is that CCSs represent ‘self-organizing pathways’ that adjust to constraints of culture, neural structure, and maturation in variable and possibly suboptimal ways. Coherence across conceptual domains is accounted for by horizontal and vertical interactions, or couplings, among different types of concepts. Which particular elements will be coupled first remains individual, or idiosyncratic.

Lewis’ proposal is very persuasive. I can only applaud his attempt to account for individual diversity. However, a number of issues need to be raised. I consider two here. First, there is a clear risk of proceeding too readily from overgeneralized universality to idiosyncracy, and I will argue that there is an appropriate middle ground. Second, Lewis’ approach may be unidimensional to an undesirable degree. Before addressing these issues, however, I would like to comment on the striking similarity of both Case’s and Lewis’ proposals to Piagetian theory. The two approaches combined seem to me to qualify as an enriched return to a truly Piagetian perspective. Although Lewis mentions the fact that Piaget’s theory incorporates systemic principles, this fact has perhaps not been underscored sufficiently in his article. The similarity seems worth stressing, since theoretical
advances in psychology are often based on opposition rather than continuity between successive models. Furthermore, it is the structuralist facet of Piaget’s theory, rather than the functionalist one, that has been adopted by North American researchers. Not only, as Lewis remarks, does the ‘basic architecture of Case’s theory descend directly from Piaget’, but the proposal of the CCS [Case, 1992a; Case and Griffin, 1990] is indeed much closer to Piaget’s theory than was Case’s [1985] original proposition of executive structures (which was more directly inspired by information-processing theory).

As already noted, CCSs are more restricted than Piagetian structures, and they are defined on a semantic basis, rather than a logical or formal one. Although the content changes across broad classes of domains, the form assigned to the structures remains constant, and is even given in a common figural representation [Case, 1992a; Case et al., 1993a]. Thus, the semantic definitions restrict the knowledge domain to which a structure applies, but structures remain formally identical across domains. Development of these structures is isomorphic in the sense that the different units assemble in a common manner. While the semantic aspect explains heterogeneity or asynchrony, it is the formal relation that explains generality. Implicit in the model is the Piagetian construct of reflective abstraction, to account for the transition from one major stage to the next.

Lewis’ proposal amounts to an attempt to reintegrate into Case’s structuralist approach a systemic view advocated by Piaget (although not used to account for individual diversity) and long neglected in developmental psychology. At least three aspects of Lewis’ proposal are very close to Piaget’s ideas – the concept of organized systems, the type of coactions or interactions described, and the emphasis placed on viability as opposed to optimality. From the very beginning of his work, Piaget was interested in the functional mechanisms that account for the emergence of organized, increasingly adaptive systems. Although he pursued this objective throughout his career, a rather long period was devoted to the study of structures. He again adopted a more functional perspective in the late 1960s. In *Biologie et Connaissance (Biology and Knowledge)* [1967], for instance, Piaget borrowed a number of concepts from Waddington that are very close to some of Lewis’ proposals, as well as to contemporary systemic views of development. In particular, he referred to the concept of *creeds* as necessary paths relatively independent of each other, that are more or less well canalized [Gottlieb, 1983]. Deviations from creeds were considered by Piaget as even more frequent in the mental domain than in the biological one, and more easily compensated for by cognitive regulations. Regulation of creeds obeys the process of *homeorhesis*, which Piaget equated with the process of equilibration. Development entails trying to reach a state of equilibration, or *homeostasis*, constantly threatened by new sources of disequilibrium. The organism is an open system that conserves its form during the course of a continuous stream of exchanges with the environment.

A second dimension of similarity between Lewis’ approach and Piaget’s is identifiable in Piaget’s later account of equilibration [Piaget, 1975; Chapman, 1988, 1992; Vuyk, 1981]. Piaget described three types of equilibration, or interactions among elements: (a) equilibration between action schemes and external objects by means of assimilation and accommodation, (b) equilibration between the different subsystems by reciprocal assimilation and accommodation of the schemes to one another, and (c) equilibration between the subsystems and the total system, by means of differentiation and integration. The latter two are very
close to the horizontal and vertical couplings, or coactions, described by Lewis.

A third respect in which Lewis follows Piaget is in the distinction between optimality and viability, with only the latter concept allowing for individual diversity. Viability is defined as the establishment of a functional relationship with the environment, which seems very close to what Piaget meant by adaptation. Optimality inevitably would lead to identical endpoints for all. In this connection, Lewis attributes to Piaget a view of the child as organized toward prespecified developmental goals and claims this view to be incongruous with growth as self-organization. Recall, however, that Piaget's objective was not to explain ontogenetic development as such, but to understand the development of knowledge, including, for example, the development of modern logic. Consequently, he did not ascribe a particular developmental goal to the child, but remained at a much more global level. His interest lay in the relationship between successive, increasingly complex types of organization, whether from primitive physiological structures to the most advanced cognitive ones, or between different types of cognitive structures through history, or even throughout evolution.

Piaget [1967] preferred speaking of vection than of progress, to avoid a judgment of value. The criterion of hierarchy among different types of organization is one of increasing openness, that is, of an increase in the possibilities of the organism to act on its environment. The vection in which Piaget was interested is a union between two apparently antithetical and yet intimately related aspects—increasing autonomy from the environment and increasing openness in the possibilities of action on the environment, leading to an anchoring in increasingly extensive environments [Piaget, 1967, p. 408]. A related product is the progressive dissociation of form and content. In contrast to organic forms, hypothetical operations were defined by Piaget as an organizational structure applicable to any content [p. 410]. It does not follow that these operations will apply to the same content for all individuals. However, as a consequence of his interest in the epistemic subject, Piaget accorded much more importance to general aspects of development than to specific ones, which explains why he was so little interested in the development of particular children. Piaget's theory becomes very ambiguous when applied to the psychological individual; it can easily be understood as meaning that all individuals develop in exactly the same way. Piaget did nothing to resolve this ambiguity, except in paying occasional lip service to the large inter- and intra-individual variability to be found in cognitive organizations [Chapman, 1988; de Ribauipierre, 1993].

I now turn to the two issues mentioned earlier that are raised by Lewis' proposal. The first is the clear risk of equating individual diversity with idiosyncracy. Lewis, for example, regards individual trajectories as 'unique adaptations to particular experiences'. This is a trap many psychologists fall into when considering the problem of individual differences. Most often, individual differences have been regarded as mere noise hiding general, universal laws [Lautrey et al., 1981; de Ribauipierre et al., 1985]. This is not what Lewis suggests. However, if individual trajectories are truly unique, they become totally unpredictable, and no longer very different from sheer noise. Lewis alludes to this problem in stating that 'each outcome of the child's evolving epistemic history constrains subsequent cognitive outcomes, and each interacts with the general constraints of maturation and culture in unpredictable ways as development progresses'.

Following propositions by the French differentialist Reuchlin [1969, 1981], I want to
argue that there is a middle ground, namely that individual differences are governed by a limited number of general laws that we should try to uncover. Throughout his article, Lewis has some difficulty grappling with both generality and specificity. The reason may be that he does not distinguish between individual diversity and idiosyncracy, on the one hand, and between underlying mechanisms and products of these mechanisms, on the other. A limited number of similar processes may operate in different individuals, explaining why behavior tends to take the same form; yet their relative importance or the way in which they interact may vary from individual to individual. As a consequence, the products—that is, the mental representations or schemes built by the individual—might differ almost endlessly. Case's CCSs, just like Piagetian schemes, can be viewed as products of the application of underlying mechanisms. Consistent with Lewis' proposal, they are then likely to vary widely in content, as well as in the order in which they apply to different domains. Incidentally, one point that Lewis does not make very clear is whether children construct truly different structures or whether structures differ only in terms of content and order of emergence.

The second problem with Lewis' proposal is that it remains within a basically unidimensional framework. As indicated earlier, Lewis views maturation and culture as 'softly' determining cognitive development, in the sense that they represent general constraints to which there are individual adaptations. Therefore, only one organismic mechanism is postulated, namely maturation (or psychologically unspecified neural structure), which interacts with environment, or, more particularly, with culture. Individual differences are thus due to different types of interactions between maturation and environmental constraints. In contrast, we have recommended elsewhere [Lautrey, 1993; de Ribaupierre, 1993; de Ribaupierre et al., 1991; Rieben et al., 1990] adoption of a pluralistic approach, in which cognitive development is viewed as overdetermined by a number of organismic processes. Individual differences accordingly result from variable types of interactions, not only between processes and environment or between different structures, but also among the underlying processes.

These processes should be considered vicarious [Reuchlin, 1978; Reuchlin and Bacher, 1989] or optional; that is, they are assumed to coexist in all subjects and to offer alternative ways to approach tasks. On the one hand, they are linked to situations; that is, tasks differentially call for one process or another. On the other hand, their accessibility is different for different types of subjects, probably because subjects develop a preference for, or bias toward, one or several processes over others. An interaction therefore exists between types of situations and types of subjects. A research program conducted conjointly with Rieben and Lautrey [de Ribaupierre et al., 1985, 1991] has led us to the suggestion that two different modes of processing—propositional and analogical modes—could be applied in a number of Piagetian tasks. Individual differences in the predominance of these modes may account for the different types of intra-individual decalages observed and for different developmental pathways.

Pascual-Leone's [1969, 1987, 1989] theory is another example of a model postulating a number of underlying, organismic variables that may function vicariously with respect to one another. This model clearly differentiates two levels within the individual, consistent with the recommendation made earlier that mechanisms be better differentiated from products. There are a limited number of so-called 'silent' operators or organismic, content-free mechanisms whose function is to
activate different schemes or build new schemes. These operators are construed as both developmental and differential; they are at work in each individual, although their relative strength may vary across individuals. Depending on which operators are called into action, as well as their strength and the type of interactions among them, multiple schemes can be activated and built. Individual differences in performance thus may originate in the weight and interactions among the mechanisms and/or in the schemes called into action. Case’s CCSs are probably to be considered at this latter level. Because of severe developmental constraints, the form of conceptual structures is presumably common to a broad range of situations; however, their content is susceptible to large individual and cultural variation. 

A final comment pertains to the relationship between the CCS and working memory, which is not clearly spelled out in Case’s recent proposals. Lewis correctly asserts that Case has gradually deemphasized the role of working memory in his shift to CCSs. However, one construct does not replace the other. CCS is a descriptive concept, reflecting the fact that behavior tends to be similar across situations. Working memory, in contrast, was intended in Case’s [1985] earlier model, or in Pascual-Leone’s theory [1987], to play a causal role, by placing upper limits on the complexity that is attainable and accounting for the types of structures that can be built at a given level. Working-memory limits (rather than the CCS) as a criterion for general stages may accommodate more easily to the individual and/or cultural diversity to which Lewis calls our attention, because such limits less rigidly constrain the form that behavior can take. Yet, the main difficulty is to assess the complexity of the schemes or units of content that are being assembled, since not only their type but also their relative size is experience- and content-dependent. Moreover, as Lautrey [1993] has emphasized, most current task analyses, including Case’s and Pascual-Leone’s, have privileged a propositional mode of processing, in which independent units are combined by rules or operations. It has not yet been shown that complexity can also be analyzed when other modes of processing are being used.

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References


