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ABSTRACT

Previous research on adult cognition has focused mainly on the distance that separates the adult from the "formal standard" and on the factors that interact with formal operations whether they are moderators of competence or a hypothetical fifth step. Results of new clinical research on adults can be used to argue for a new constructivism of adult intelligence where equilibrium processes and structuralization of intelligence operate differently from children. This new constructivism is called "adaptability" and accounts for four characteristics of adult intellectual evaluation: stability, flexibility, generalizability, and organizability of operations. The model of adaptability can be derived from Piaget's theory when one departs from the idea that formal operations are the essential component of adult intelligence. This suggests that intellectual evaluation of adults could be made more appropriate if it would concern itself more with adult adaptability and concentrate less on adult formal ability. (Author/YLB)

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The Evaluation of Adult Intelligence: A New Constructivism

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Summary

Previous research on adult cognition has focused mainly on the distance which separates the adult from the "formal standard" and on the factors that interact with formal operations whether they are moderators of competence or an hypothetical fifth stage. Following the results of new clinical research on adults, this paper argues for a new constructivism of adult intelligence where equilibration processes and structuralization of intelligence operate differently from children. This new constructivism is called "adaptability" and accounts for four characteristics of adult intellectual evaluation: stability, flexibility, generalizability and organizability of operations. The model of adaptability can be derived from Piaget's theory once we depart from the idea that formal operations form the essential of adult intelligence. It is suggested that intellectual evaluation of adults could be made more appropriate if it concerned itself more with adult adaptability rather than concentrating on adult formal ability uniquely.

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(1) Introduction

The cognitive psychology of Jean Piaget has had very little impact on the domain of adult education and adult training so far. The theory itself is not explicit about the intellectual processes of the adult, and the scientific community has been reluctant to generalize to the adults a system of explanations that has first been developed through the observation of children. Moreover, the business community is more preoccupied with problems of personnel selection which are dealt with mainly through standardized I.Q. tests than with problems of personnel training which may become increasingly important as a greater part of the population gets older. There is no reason, however, why the piagetian conception of intellectual development, which is based on how a subject builds his own structures of knowledge through the interaction of his own activities with his environment, could not contribute to the study of adult intelligence and help to solve some of the problems associated with adult training.

The shortcomings of Piaget's theory about adult intelligence may be traced back to Piaget's main concern with epistemological questions. Paradoxically, in order to study the achievement of an adult form of intelligence, Piaget did not study the intelligence of adults but rather he studied the intelligence of adolescents. This has left us with a

conceptual ambiguity, since many have considered, including Piaget himself, that the epistemologically most mature form of intelligence could be equated with the intelligence of the most mature (adults). This has led him to speculate that formal operations could be available as a potential to everybody and could be developed by any healthy adult. This speculation, based on no empirical evidence, has started a lot of research concerned mainly with the study of adult intelligence through the study of formal operations.

This does not mean, however, that the study of formal operations and Piaget's theory are inappropriate to the study of adult intelligence. It implies, however, that important adaptations must be made concerning the genetic and epistemological aspects of the theory when it is applied to individuals who have achieved most of their intellectual development.

Some researchers (Arlin, 1975; Riegel, 1973) have challenged the idea that formal operations provide for an adequate description of the final stage of human intellectual development. Though some of their considerations have merit, they do not contribute significantly to the understanding of adult intelligence. A hypothetical fifth stage, if we assume there is one, would only move the problem one stage further. We would still have to explain intra- as well as interindividual differences in cognitive development. We would need to describe the structure of that stage, and with more difficulty, how this structure integrates formal operations and not only adds them up. We would still have to explain, at some point or another, a relative reduction, if not an almost

complete interruption, in the development of the instruments of knowledge and explain, as Piaget has hypothesized, how the development of contents of knowledge still continues afterward. Till now, nothing of this kind has been done, and with or without a fifth stage, the problem remains. A final stage, different from all previous stages, will always be in a permanent consolidation state. For example, we can consider that concrete operations are well consolidated when formal operations have been achieved. Nothing similar occurs for a final stage of development, which makes it, from an epistemological point of view, a permanently transitional stage.

The study of adults' intelligence is different and similar to the study of children's intelligence in some aspects. When a child goes from one solution to a better one, this improvement may be attributed, at least in part, to ontogenetic development. This cannot be the case for adults. Despite this difference, adult intellectual processes closely parallel those of the child in many instances. This allows us to consider that adult strategies can be interpreted through functional invariants of intellectual adaptation such as accommodation and assimilation, as Piaget has defined them.

(2) Piagetian research on adults

The main objective of this paper is to demonstrate how using functional invariants for the study of adult intellectual processes may contribute to stimulating research on adults and also help to reconsider actual data gathered on adult intelligence, in a new constructivist perspective.

So far, there have been three kinds of piagetian research on adults:

(a) the "adult-formal" research: in this category are included the research whose main objectives are to measure the distance which separates the adult from the "formal" standard. It also includes those research which are preoccupied mainly with intra- and interindividual differences in the reaching of that standard. This research has had the merit of raising concern on the lack of universality of formal operations, but have contributed marginally to the understanding of adults' cognitive processes. A great part of this research would be most appropriately classified as psychometric rather than piagetian (Higèle, 1978; Long and McCrary, 1979).

(b) the "competence-performance" adult research: in this category are put together all the research that compare adult performance with children performance and all those which test the impact of moderator variables such as sex, socio-economical level, procedures of testing and others on adult actualization of competence (Sinnott, 1975; Sinnott & Guttmann, 1978). Though this research has contributed a great deal in improving our methods of testing with adults as well as our understanding of how these variables interact with intellectual operations, it has not raised appreciably our comprehension of adults' cognitive processes. Furthermore, it may be assumed that most of the variables that are known to affect adult performance do affect children performance as well, though to a different extent. For example, vitality is known to affect adult performance. But there is no doubt as to whether it influences

children results as well. Since the probability of finding a higher degree of vitality among children is higher than among adults, it makes testing without any time limit more equitable for adults (Labouliere-Vief, 1977).

(c) The clinical research: under this category are grouped the piagetian research interested in how the adult solves problems and how he reaches a form of equilibrium through mental operations. This research is mainly carried out through individual interviews with adults, using Piaget's clinical method or adaptation of it. This kind of research has the merit of addressing the problem of adult cognitive processes directly. It is most recent, so its contribution to the knowledge of adult intelligence is still difficult to assess.

(3) Defining adult intelligence within the piagetian framework

Questions concerning adult intelligence are crucial and have been neglected so far. Piaget was more interested in epistemological problems and structural convergences than in interindividual differences. However, these interindividual differences must be reintegrated into the field of developmental psychology in order to increase the validity of Piaget's theory for adults. Otherwise, how could we differentiate two adults functioning at the same epistemological level? Answers to this problem are theoretically important. To summarize, they concern: (a) the significance of formal operations for the comprehension of what is adult intelligence and adaptation, (b) the synchrony of development in regard to the attainment and the continuation of formal operations, (c)

the interaction of formal abilities with those developed at previous stages and (d) the structures of adults' cognitions.

(a) The significance of formal operations for adult intelligence:

According to Vermersch (1979), it is inappropriate to talk about stages when adult intelligence is concerned. The notion of stages is related to an invariant sequence of steps and age categories that cannot be transposed upon the adult. Vermersch prefers to talk about "registres cognitifs" or "cognitive files". Since the adult has already gone through different steps of mental structure constructions, he has access to a wide variety of cognitive functioning files. Piaget has never used such a concept but he has acknowledged that there is a double process of evolution: one which is associated with the integration of ancient structures into new ones; the other which is associated with the continuation of the ancient structures separately from the new ones. For epistemological reasons, Piaget did not concern himself with the second case. As an example, as soon as the observation of the coordination of sensori-motor schemes led him to the observation of the use of symbolic representation, he stopped his concern with the sensori-motor period.

This does not mean that sensori-motor development ceases at the same time that symbolic development begins. In fact, sensori-motor goes on and develops itself in its own range of abilities: bike riding is an example of such a development that occurs well after two years.

Vermersch (1979) explains the adult's evolution in problem-solving as a "microgenesis". He associates the equilibration processes that occur in the adult to the same transitions that occur during the child's

acquisition of an operation. Many authors have underlined the similarities that exist between the errors that are made by children and those made by adults. Unfortunately, these errors have often been considered only in their negative aspects, not as necessary steps in the discovery of a solution. The adult cannot be considered to be at the same level as a child, since he does not actually build the structures he uses but simply recognizes them in the problem's organization. Furthermore, adult and children have different cognitive instruments: the similarities in performance are not to be found in the instruments themselves but rather in the way they are used. The study of adults' strategies must explain why some operational schemes (which are available) are activated in some situations and not in others.

It is often assumed that formal operations are the most adapted form of reasoning. In fact, "more advanced in development" cannot be equated with "more adapted". Depending on the situations, simpler forms of thoughts may help reach a solution as well if not better. This is the case when one uses excessively complex strategies for a relatively simple problem. Though formal operations may be considered the most adaptable form of reasoning, they are not necessarily the most adapted. This distinction is of crucial importance for the study of adult intelligence. Adults may choose among many forms of adaptations. Some forms are emphasized more than others. In some instances, we may find that formal operations do not lead to adaptation. Regardless of the cultural content and milieu, formal operations have intrinsic inconveniences: 1. they are time-consuming; 2. they are less economical

in concrete situations; 3. being the most objective, they are also the less subjective form of knowledge. Formal operations cannot account for the emotional, aesthetical dimensions of the adult experience.

In the same line of reasoning, being formal cannot be made equivalent to being clever. Being clever or intelligent is more a matter of mobility among different forms of reasoning than reaching a peak in a very limited sphere. It is often ignored that concrete operations, transductive and teleological reasoning, are not only integrated but are also conserved as a part of a formal subject's potential. What would be the poet's metaphors without some transductive reasonings? Would soap companies sell more soap or detergent while appealing to the adult consumer's logical or intuitive reasoning? In clinical evaluations, psychologists prefer a somewhat lower but well-balanced WISC profile. The same is true of the development of operations. Better adaptation means increased mobility between different forms of reasoning rather than an excessive rigidity in a few modes of thinking.

(b) The synchrony of development of formal operations:

The study of formal operations among adults immediately raises the questions of how synchronous is the development of formal operations and what are the causes of the temporal "décalage" observed in the mastery of these operations. Theoretically, such "décalages" at the level of concrete operations are explained by the fact that intelligence is still dependent on the manipulation of objects. However, if such asynchronisms are observed in the development of formal operations, one cannot use this argument since, by definition, formal operations bear on the domain of

propositions not on the real. Moreover, such asynchronisms cannot be attributed to a lack of development since formal operations represent the achievement of development. Thus, problems that are formally equivalent may not be psychologically equivalent as well. Formal operations are themselves a development of concrete operations and, in that sense, access to more abstract forms of thoughts may depend on factors such as specialization and professionalization (Piaget, 1972). The way these factors intervene in the asynchronous development of formal operations needs to be studied further.

Leonard (1979) assumes that the similarities between adults and children reasoning are not to be found in the adult's "cognitive files" but rather in the functional analogy between equilibration processes of both the child and the adult. Leonard (1979a, 1979b) has found that the equilibration process of the adult may be characterized sometimes by a persistence of an erroneous response that cannot be accounted for neither by the equilibration process - which Piaget considers only leads to a better state of equilibrium - nor by the lack of time, background knowledge or cognitive organization. He suggests that a phenomenon of closure intervenes in the equilibration processes of the adult every time a partial state of equilibrium comes to stabilize a cognitive organization. This closure phenomenon has three important characteristics:

- (1) there is a complete stop of the equilibration process;
- (2) the equilibration process is in a state of partial equilibrium;

(3) the subsequent organizational structure is fairly stable.

According to Leonard, this closure phenomenon possesses a very strong local coherence which is associated to the rejection of every element that is not taken into consideration by the local organization. Leonard admits however that the "closure" phenomenon does not explain how such an interruption in the equilibration process occurs. This interruption can hardly be interpreted within Piaget's theory as it is, since, from an epistemological perspective, the equilibration process never stops and may only lead to better states of equilibrium. Leonard (1979) suggests that the effects of context and the subject's past experience might help understand the persistence of the adult subject's erroneous response.

(c) Interactions of formal operations with abilities developed at previous stages:

The great variety of adult cognitive experiences suggest that there are interactions of formal operations with previous levels of development. As pointed out previously, the structuralization of concrete operations and some factors such as professionalization and specialization may help to explain asynchronisms in the development of formal operations. Intuition may be found to interact with formal operations. Piaget uses "intuition" as a metaphor to describe "four-to-seven year olds' certainty about their knowledge, on one hand, and the almost complete lack of awareness about how they know what they know on the other" (in Cowan, 1979). In the teaching of physics and mathematics, the teacher has to overcome strong intuitions. For example,

in teaching that a force is proportional to acceleration (change in speed), he has to fight an already well-established intuition that force is proportional to speed (Viennot, 1976). In the Orange Juice test of proportion developed by Noelting (1980a, 1980b), there is a similar difficulty. Before he uses the appropriate operation, the subject must first push aside the intuition that a mixture of juice and water is an additive ratio. For example, the adults will spontaneously consider that a 2:3 ratio of juice and water tastes the same as a 3:4 ratio because in both cases there is one more glass of water in the mixture. If one starts from a wrong intuition concerning the problem to be solved, the answer will be false from the start, even if it can be demonstrated that the subject does possess the appropriate operations to solve the problem: in this case, the common factor are algorithm. This underlines only the interfering aspect of intuitions in the development of operations. Their role may also be beneficent, as long as the intuition corresponds to some form of reality.

(d) The structures of adult cognitions:

To this point, it has been assumed that the structuralization of intelligence is made up of only one kind of structure. This assumption may be wrong. Manilovski (in Stepanova and Granovskaya, 1982) distinguishes two types of structures: "The first type consists of rigid structures in which stable relationships among components exist and a change in one of them causes a change in the other part of the system. The second type is a discrete or corpuscular type of structure, which is less stable and where the individual components are related to one

another through mediation. Each of these structures gives the system a greater degree of organization; they are more economical. On the other hand, they change less readily and are easily disorganized when even just one link in the system fails. Discrete or corpuscular structures give the components of the system a greater degree of freedom, which makes possible the set of combinations and adaptations". Stepanova and Granovskaya (1982) conclude by saying that: "An intellectual system in all probability has the properties of both a rigid and a corpuscular structure, and is organized hierarchically".

According to the previous definitions, a corpuscular structure of intelligence could account for the closure phenomenon reported by Leonard (1979). A rigid structure could not remain stable for long, specially at a state of partial equilibrium. It would have to accommodate itself by changing all of its elements. In a rigid structure, this would result in a transformation of the whole structure. Such a local accommodation, however, would not require a discrete structure to transform all of its elements. Such a structure would thus be most appropriate to describe the persistence of erroneous responses among adults. Furthermore, it may be assumed that such a kind of structure would play an increasingly important role in development, as intellectual evolution bears more and more on discrete contents of knowledge and intellectual functioning comes to a stage of increased integration and differentiation.

Stepanova and Granovskaya (1982) do provide some empirical evidence for such a hypothesis. According to the results of their study on the intellectual structure of the 18 to 35 years old, "the

intellectual system of the age group 34-35 was distinguished, on the one hand, by a rather high degree of integration and, on the other, by considerable independence of the components of that system".

Adult intelligence deserves to be studied in its own right. It should be studied in its own context, that is one where intellectual evolution takes new forms and new dimensions. These forms and dimensions must be assessed. The equilibration processes as well as the structuralization of intelligence appear to operate differently. As a result, more caution is required in our interpretation of adult performances. Otherwise, by considering adult evolution using the same parameters as for children or adolescents we would do adults the same wrong that was done to the study of children a century ago when their form of intelligence was considered merely as a simplification of that of adults.

The significance of formal operations as the final stage of development raises another question. According to Piaget, formal operations are the ultimate development in instruments of knowledge. According to him, this does not mean, however, that the development of contents of knowledge is completed as well. New contents will continue to be accumulated by the adult all through his life.

(4) The Model of adaptability

Thus, adult intellectual evaluation should take into account not only the organizational level of the abilities, but also their generalizability and their flexibility in different contexts. As defined by Piaget, intelligence is an extension of the human biological

adaptation. Intellectual evaluation of adults would be more appropriate if it concerned itself with the adult adaptability instead of adult formal ability uniquely. Adaptability may be considered to be made of four dimensions:

- (1) stability: this is the ability of the adult to conserve what has already been acquired in similar contexts;
- (2) generalizability: this is the capacity of the adult to extend abilities to new contents requiring the same tasks at the same organizational level;
- (3) flexibility: this is the capacity of the adult to perform different tasks on the same content at the same level of organization;
- (4) organizability: this is the capacity to organize ancient abilities into new ones at a higher level of complexity, effectiveness and adaptation.

Each of these dimensions of adaptability could be evaluated through an appropriate sampling of tasks, contents and organizational levels of problems to solve. This methodology is specially important in the case of adult cognitive evaluation since it is assumed that their development is more related to the development of new contents of knowledge.

Guttman's facet theory (in Berk, 1978) could be helpful in defining and specifying different domains of items or different universe of content.

For example, in order to measure the development of the operation of proportionality, one could imagine two kinds of facets: one facet dealing with the figurative representation of proportions: first, as

"sharing" a number "x" of cookies among a number "y" of individuals and second, as a mixture of a number "a" of glasses of orange juice with a number "b" of glasses of water. Another facet could deal specifically with the kind of task: one would consist in comparing two fractions of cookies or two mixtures of orange juice solution; the other would consist in finding how much water or how many people are required to make equivalent mixtures or equivalent shares. Four kinds of problem would be generated in this way allowing to measure formally equivalent operations in different contexts that could be meaningful in assessing the extent of the adult cognitive adaptability.

These four dimensions of adaptability introduce the properties of assimilation and accommodation in the study of the cognitive processes of adults. Dimensions 1 and 2 are closely related to the properties of assimilation which is in essence repetitive (stability) and generalizable (generalizability). Dimension 3 is related to local accommodation which is specificative and differentiative. Dimension 4 is related to equilibration which is associated with a new organization and structuralization of previous schemes.

(5) Conclusion

The study of adaptability is thus an efficient way to study the horizontal "décalages" which occur in adults' intra-individual performances and helps to make sense of these differences in performance.

A new constructivism of adult intelligence framed by piagetian epistemology can be useful for adult education and adult training. The model of adaptability that is suggested here can be derived from Piaget's

theory once we depart from the idea that formal operations form the essential of adult intelligence. Here are some of the implications of a new constructivism of adult intelligence for adult education and training in general: (1) the model of adaptability may be used to help differentiate individuals at the same stage or organizational level; (2) the model of adaptability may be used to build general use criterion-referenced tests of intellectual abilities "à la Piaget" (Gray, 1978); (3) the model of adaptability may be used to diagnose specific problems that occur in learning such as those related to mental representation of a problem (generalizability of content) or the understanding of different tasks (flexibility).

As the need for adult training becomes more essential because the population of North-America grows older, it will become necessary to rely on accurate diagnostic instruments which can be used in a formative perspective. These kinds of instruments can be developed within the piagetian framework and could eventually replace IQ tests, which for many reasons have been found biased and inappropriate to the needs of adult education.

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